



Cisco Catalyst Center User Guide, Release 2.3.7.x

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CHAPTER 1

New and Changed Information

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New and Changed Information

The following table summarizes the new and changed features in Catalyst Center 2.3.7.5 and tells you where they are documented.

Table 1: New and Changed Features in Catalyst Center, Release 2.3.7.5

Feature	Description
Enhancements to the AP Refresh Workflow	<p>The Access Point Refresh workflow now supports the following:</p> <ul style="list-style-type: none">• The Assurance use case where the new AP isn't provisioned after AP refresh and only the old configuration is copied to the new AP.• A toggle button to enable the automatic detection of the new APs using SwitchPort. <p>Note If the new AP is onboarded through Plug and Play (PnP), automatic detection isn't supported.</p> <p>See AP Refresh Workflow, on page 843.</p>
Enhancements to Configuring Global Device Credentials	<p>On the Device Credentials window, you can now only assign and unassign device credentials to and from sites. On the Manage Credentials slide-in pane, you can manage your device credentials using the Focus drop-down list. Depending on which focus you choose (Current site or System), you can perform specific actions.</p> <p>See Configure Global Device Credentials, on page 235.</p>

New and Changed Information

Feature	Description
Enhancements to Custom AP Groups and Flex Groups for Cisco AireOS Wireless Controller	<p>Instead of configuring and applying the newly added custom groups to the APs during wireless controller provisioning, Catalyst Center now configures and applies them during AP provisioning.</p> <p>Effective with this release, you can use the same AP groups and flex groups across multiple sites for Cisco AireOS Wireless Controller.</p> <p>Note</p> <ul style="list-style-type: none"> • You can't use the same AP group on multiple sites with different SSIDs, RF profile, and SSID overrides. • You can't use the same flex group on multiple sites with different native VLAN or AAA override VLAN. <p>See Overview of AP Groups, Flex Groups, Site Tags, and Policy Tags, on page 343 and Custom AP Group and Flex Group Reuse Examples, on page 347.</p>
Enhancements to Device Onboarding and the Discovery Workflow	<p>The Add Device option in the Catalyst Center Inventory is enhanced to include options for adding both new and existing devices.</p> <p>The discovery workflow includes enhancements, such as:</p> <ul style="list-style-type: none"> • The Provide Credentials window now includes the option to configure advance settings along with the CLI and SNMP credentials. • The Schedule Job window combines site assignment and scheduling of the discovery job. <p>See:</p> <ul style="list-style-type: none"> • Add Devices to the Catalyst Center Inventory, on page 86. • Use a CSV File to Import and Export Device Configurations, on page 126. • Import Device Configurations from a CSV File, on page 127. • Discover Devices, on page 841. • Discover Your Network Using CDP, on page 53. • Discover Your Network Using an IP Address Range or CIDR, on page 55. • Discover Your Network Using LLDP, on page 57.

Feature	Description
Enhancement to Device Resynchronization	<p>Prior to this release, restarting the inventory service would trigger resynchronization for all devices in the inventory. With this release, device resynchronization is triggered after the inventory service restart under the following circumstances only:</p> <ul style="list-style-type: none"> • After Catalyst Center upgrade. • If the device's synchronization is in terminated or delayed state after the service restart. • If the device's last synchronization time has crossed the configured cutoff time. <p>See About Inventory, on page 62.</p>
Enhancements to Device Upgrade Readiness Check	<ul style="list-style-type: none"> • Flash Check: Calculates the space required for upgrading to golden image with add-on and performs flash clean up proactively before image distribution. • Weak Crypto Check: Checks whether the device is configured with weak crypto and blocks image upgrade. This readiness check is applicable only for devices with software image version 17.14 and later. • File Transfer Check for FQDN Setup: Checks whether the name server associated with the device is reachable and displays an error message. <p>See List of Device Upgrade Readiness Prechecks, on page 420.</p>
Enhancements to Editing LAN Automated Devices	<p>In the Edit Devices window, you can now edit the hostname for the devices that are discovered through LAN automation.</p> <p>See LAN Automation, on page 549 and Edit Hostname and Loopback IP Address of LAN Automated Devices, on page 558.</p>
Enhancements to Port Configuration Within Fabric Sites	<p>The Port Assignment tab for a fabric site now displays the authentication template configured for each port. If you don't configure the authentication template for an individual port, the port inherits these settings from the global authentication template configuration. Inherited settings are displayed with an inherit icon next to the setting.</p> <p>See Configure Ports Within the Fabric Site, on page 595.</p>

New and Changed Information

Feature	Description
Progress Bar Support for Network Devices Provisioning	<p>The Task Progress bar on Activities > Tasks window, displays the progress of the ongoing provisioning task for your network devices.</p> <p>See Provision a Cisco Sensor SSID for Nonfabric Deployment, on page 320, Provision a Cisco AireOS Controller, on page 478, Provision a Cisco AP—Day 1 AP Provisioning, on page 486, Provision Cisco AireOS Controllers in the Existing Deployment, on page 491, Configure N+1 High Availability from Catalyst Center, on page 506, Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516, Configure Cisco Wireless Controllers on the Existing Infrastructure, on page 519, Provision Embedded Wireless on Cisco Catalyst 9000 Series Switches, on page 529, Provision a Meraki Device, on page 536, Provision a Router, on page 543, Complete the Provisioning Process, on page 466, and Visibility and Control of Device Configurations, on page 132.</p>
SD-Access Compatibility Check	<p>A device is added to the SD-Access fabric only if the device runs a software release that is compatible with the Catalyst Center release.</p> <p>See Add a Device to a Fabric, on page 578, Add a Device as a Border Node, on page 582, Steps to Configure an Extended Node, on page 619.</p>
SD-Access Application Health Check	<p>The health of SD-Access application is checked periodically and the status is displayed on the System Health page.</p> <p>See Fabric Health Check, on page 570.</p>
Support for Displaying IOS CLI in Configuration Preview for Cisco Catalyst 9800 Series Wireless Controller	<p>For Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.13.1 or later, you can generate IOS CLI from YANG configuration in the configuration preview.</p> <p>See Visibility and Control of Wireless Device Configurations, on page 470.</p>
Support for Standard Power Service	<p>For APs with the standard power capability, compliance with FCC regulations requires the activation of Automatic Frequency Coordination (AFC). The Standard Power Service toggle button in the Create Wireless Radio Frequency Profile and Create AI Radio Frequency Profile window enables you to activate AFC for the 6-GHz band within an RF profile.</p> <p>Note This feature is applicable only for Cisco Catalyst 9800 Series Wireless Controllers.</p> <p>When you provision the corresponding APs, the Summary window displays the standard power service configuration details.</p> <p>See Create a Wireless Radio Frequency Profile, on page 277 and Create an AI Radio Frequency Profile, on page 288.</p>
Support for the Workflow Progression View in Visibility- and Control-Enabled Provisioning Workflows	<p>If a visibility- and control-enabled provisioning workflow supports the workflow progression view, the Preparing Devices and Configuration Models window displays the steps the system takes to prepare a listed device.</p> <p>See Visibility and Control of Device Configurations, on page 132, Visibility and Control of Wireless Device Configurations, on page 470, and Visibility and Control of Fabric Configurations, on page 571.</p>

Feature	Description
Support for Third-Generation Catalyst Center Appliances	<p>Catalyst Center now supports the following third-generation appliances, which are based on the Cisco UCS C220 and C240 M6 servers:</p> <ul style="list-style-type: none"> • 32-core appliance: Cisco part number DN3-HW-APL • 32-core promotional appliance: Cisco part number DN3-HW-APL-U • 56-core appliance: Cisco part number DN3-HW-APL-L • 56-core promotional appliance: Cisco part number DN3-HW-APL-L-U • 80-core appliance: Cisco part number DN3-HW-APL-XL • 80-core promotional appliance: Cisco part number DN3-HW-APL-XL-U <p>For more information, see the Cisco Catalyst Center Third-Generation Appliance Installation Guide, Release 2.3.7.x.</p>
Support for Viewing and Editing Layer 2 Configurations of a Device	<p>You can view and edit the Layer 2 configurations of a device in the Catalyst Center inventory.</p> <p>Note This feature is in beta.</p> <p>See Display Information About a Device, on page 68, View Layer 2 Configuration of a Device, on page 76, and Edit Layer 2 Configuration of a Device, on page 78.</p>
Third-Party Devices Support	<p>Catalyst Center allows third-party devices to populate SNMP MIB-II values. See, Add a Third-Party Device, on page 103.</p>
Weak Crypto Check	<p>To ensure a secure network connection Catalyst Center performs weak crypto check to evaluate the device configuration, and blocks the device provisioning/upgrade/site assignment for devices that are configured only with MD5 authentication for SNMP credentials. This is applicable only for devices with software image version or golden tagged image version 17.14.1 and later.</p> <p>See Discovery Credentials, on page 45, Add a Network Device, on page 87, Update Network Device Credentials, on page 92, Add a Compute Device, on page 96, Add a Third-Party Device, on page 103, Add a Device to a Site, on page 108, Add Global SNMPv3 Credentials, on page 237, Provision a Switch or Router Device, on page 460, Provision a Wireless or Sensor Device, on page 464 and Complete the Provisioning Process, on page 466.</p>

The following table summarizes the new and changed features in Catalyst Center 2.3.7.4 and tells you where they are documented.

New and Changed Information

Table 2: New and Changed Features in Catalyst Center, Release 2.3.7.4

Feature	Description
Name Change to Catalyst Center	<p>As part of our vision to converge our products around an integrated platform, we are changing the name of Cisco DNA Center to Catalyst Center in this release. The capability and functionality of Catalyst Center remains the same as Cisco DNA Center.</p> <p>This name change is part of our simplified branding for the Catalyst Center Stack. Cisco is now connecting the power and flexibility of the Catalyst brand across the entire enterprise networking stack with Catalyst Center (formerly Cisco DNA Center), Catalyst Software and Licensing (formerly Cisco DNA Software and Licensing), Catalyst Wireless, Catalyst Switching, Catalyst Routing, and Catalyst SD-WAN (formerly Cisco SD-WAN or Viptela SD-WAN).</p>
Enhancements to AP Provisioning for N+1 High Availability	<p>Effective with this release, if you are using N+1 High Availability (HA) and modify any nonflex SSIDs that are already provisioned on the primary and secondary controllers to flex SSIDs (or conversely), ensure that the states of WLANs are consistent across both the primary and secondary controllers on the corresponding site.</p> <p>See Provision a Cisco AP—Day 1 AP Provisioning, on page 486.</p>
Enhancements to Custom Flex Profile Creation	<p>A custom flex profile is created during Cisco Wireless Controller provisioning (with model configurations) or during AP provisioning (without model configurations). In both scenarios, the custom profile is configured with settings that are similar to the default flex profile except for the Catalyst Center intent configurations.</p> <p>Catalyst Center also provides an option to autogenerate a flex profile name.</p> <p>See Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353.</p>
Enhancements to Default AP Profiles During Upgrade	<p>In earlier releases, the default AP profile was pushed to the wireless controller during upgrade.</p> <p>When you upgrade to this release from an earlier version, by default, Catalyst Center doesn't push the default AP profile to the wireless controller. To update the default AP profile on the wireless controller, you must explicitly save it on the Design > Network Settings > Wireless > AP Profiles window. After you save the default AP profile, if there is a difference between the current wireless controller configuration and the AP profile configuration saved on Catalyst Center, the default AP profile is pushed to the wireless controller during subsequent reprovisioning.</p> <p>See AP Profiles, on page 309.</p>

Feature	Description
Enhancements to the Embedded Wireless Controller Image Installation for Switches	<p>Following are the enhancements to the embedded wireless controller image installation process for switches:</p> <ul style="list-style-type: none"> • The Activate image on device option is removed. • During the image import, you can exit the window, and view the progress of the import and schedule the installation later using the Close option. • After the image is imported, you can install it immediately or schedule the image installation for a later date or time. • You can check the status of image installation on the Activities > Tasks window. <p>See Add a Device to a Fabric, on page 578 and Provision Embedded Wireless on Cisco Catalyst 9000 Series Switches, on page 529.</p>
Enhancements to Preauthentication ACLs	<p>Preauthentication Access Control Lists (ACLs) have the following enhancements:</p> <ul style="list-style-type: none"> • The Include auto rules toggle button lets you enable or disable pushing the Catalyst Center-generated rules to the applicable SSIDs. • For Walled Garden URLs, a valid URL must have at least one period. Cisco AireOS Wireless Controllers don't support other special characters. Cisco Catalyst 9800 Series Wireless Controllers support the special characters . * - _. <p>See Create Preauthentication Access Control Lists, on page 262.</p>
Enhancements to the Provisioning of Wireless Changes on Fabric Devices	<p>If the wireless capability is enabled for a fabric device in the SD-Access device slide-in pane and there are changes in the wireless settings, you must click Configure in the slide-in pane to push the changes to the device.</p> <p>Note These enhancements are also applicable for the N+1 configurations.</p> <p>See Add a Device to a Fabric, on page 578.</p>
Enhancements to the Catalyst Center Home Page	<p>The Catalyst Center home page displays a new welcome message and displays license and release banner messages relevant to Catalyst Center. The Tools area is removed and is accessible from the menu in the top-left corner.</p> <p>See Default Home Page, on page 19.</p>

New and Changed Information

Feature	Description
Enhancements to the Menus	<p>To streamline workflows and standard nomenclature, we changed several menu option names, moved several submenu options, and added a secondary launch point for Interactive Help.</p> <p>The menu option changes include:</p> <ul style="list-style-type: none"> • Design > Network Settings > Network is now Design > Network Hierarchy > Servers. • Design > Network Settings > SP Profiles is now Design > Service Provider Profiles. • Provision > Stealthwatch Security Analytics is now Provision > Stealthwatch Security. • Tools > Template Hub is now Design > CLI Templates. • Tools > Model Config Editor is now Design > Feature Templates. • The Activities menu option now lists two submenu options: Audit Logs and Tasks. • System > System Health is now System > System 360 > System Health. • System > Settings > Telemetry Collection is now System > Settings > Product Telemetry. • The Help icon lists the new secondary launch point for Interactive Help.
Enhancements to the Configure AI-Enhanced RRM Workflow	<p>You can configure an AI-enabled radio frequency profile without device provisioning.</p> <p>See Configure AI-Enhanced RRM, on page 298.</p>
Enhancements to VLAN ID Configuration for Wireless Interfaces	<p>In earlier releases, the valid range for VLAN ID for wireless interfaces was from 0 through 4094.</p> <p>Effective with this release, the valid range for VLAN ID for wireless interfaces is from 1 through 4094.</p> <p>Note</p> <ul style="list-style-type: none"> • For Cisco AireOS Wireless Controller, the valid range is from 1 through 4094. • For Cisco Catalyst 9800 Series Wireless Controllers, the valid range is from 2 through 4094. <p>See Create a Wireless Interface, on page 276 and Configure Additional Interfaces for a Network Profile, on page 355.</p>

Feature	Description
Device Compliance and Pending Operation Prechecks for a Seamless Deployment	<p>To ensure a seamless deployment, Catalyst Center performs a set of prechecks to ensure that any pending operations that conflict with the current task and any device compliance issues are addressed.</p> <p>See Network Provisioning Prechecks, on page 137.</p>
Log Collection for a Device	<p>When a resync is done for a specific device, the debug log is enabled automatically for that device, and XDE and device pack logs are collected.</p> <p>See Resynchronize Device Information, on page 124.</p>
Reconfiguration of a Fabric for IP Address Pool Changes	<p>When you modify the IP address pools that are used in a fabric, you must reconfigure the fabric.</p> <p>Note The IP address pool changes are not provisioned automatically.</p> <p>See Edit IP Address Pools, on page 249 and Reconfigure a Fabric, on page 588.</p>
Software Image Compatibility Check for Fabric Devices	<p>To ensure the network devices (before and after a fabric deployment) are compatible with the recommended or supported software image versions based on the Catalyst Center package version, Catalyst Center performs an Image Compatibility check to evaluate the network devices.</p> <p>See Fabric Readiness, Image Compatibility, and Compliance Checks, on page 569 and Types of Compliance, on page 426.</p>
Unsupported SD-Access Configuration Detection on Fabric Devices	<p>You can detect any unsupported SD-Access configurations on fabric devices using the SD-Access Unsupported Configuration compliance check.</p> <p>Note This feature is in beta.</p> <p>See Types of Compliance, on page 426 and View Compliance Summary, on page 432.</p>
Usability Enhancements to Previewing Configurations in Visibility- and Control-Enabled Workflows	<p>When previewing configurations in a visibility- and control-enabled workflow, you can display the device configurations in a side-by-side comparison view.</p> <p>Note The side-by-side comparison view doesn't support viewing YANG configurations.</p> <p>See Visibility and Control of Device Configurations, on page 132, Visibility and Control of Wireless Device Configurations, on page 470, and Visibility and Control of Fabric Configurations, on page 571.</p>

New and Changed Information

Feature	Description
Usability Enhancements to Support Service	<p>Support Service has the following enhancements:</p> <ul style="list-style-type: none"> • When creating a remote support authorization, you must first accept the Access Permission Agreement. • "SR" is replaced with "case number." • The Past Authorizations table is searchable and contains a column for the case number. <p>See View the Remote Support Authorization Dashboard, on page 24, Configure SSH Credentials, on page 25, and Create a Remote Support Authorization, on page 872.</p>
Visibility and Control of AI RF Profile Configurations	<p>With the Visibility and Control of Configurations feature, you can preview AI RF profile configurations and send those configurations to IT Service Management (ITSM) for approval before deploying them.</p> <p>See Configure AI-Enhanced RRM, on page 298, Assign a Location to an Existing AI RF Profile, on page 300, and Unassign a Location from an Existing AI RF Profile, on page 302.</p>



PART I

Get Started

- [Get Started with Catalyst Center, on page 13](#)
- [Configure Telemetry, on page 31](#)



CHAPTER 2

Get Started with Catalyst Center

- [Catalyst Center Overview](#), on page 13
- [Log In](#), on page 13
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Catalyst Center Overview

Catalyst Center offers centralized, intuitive management that makes it fast and easy to design, provision, and apply policies across your network environment. The Catalyst Center GUI provides end-to-end network visibility and uses network insights to optimize network performance and deliver the best user and application experience.

Log In

Access Catalyst Center by entering its network IP address in your browser. For compatible browsers, see the *Cisco Catalyst Center Release Notes*. This IP address connects to the external network and is configured during the Catalyst Center installation. For more information about installing and configuring Catalyst Center, see the *Cisco Catalyst Center Installation Guide*.

Idle session timeout is an admin configurable option. For information on how to configure idle session timeout, see "Account Lockout" in the *Cisco Catalyst Center Administrator Guide*.

-
- Step 1** Enter an address in your web browser's address bar in the following format. Here, *server-ip* is the IP address (or the hostname) of the server on which you have installed Catalyst Center:

Complete the Quick Start Workflow

`https://server-ip`

Example: `https://192.0.2.1`

Depending on your network configuration, you might have to update your browser to trust the Catalyst Center server security certificate. Doing so will help ensure the security of the connection between your client and Catalyst Center.

Step 2 Enter the Catalyst Center username and password assigned to you by the system administrator. Catalyst Center displays its home page.

If your user ID has the SUPER-ADMIN-ROLE and no other user with the same role has logged in before, you will see a first-time setup wizard instead of the home page.

Step 3 To log out, from the top-right corner, click your displayed username and choose **Log Out**.

Complete the Quick Start Workflow

After you have installed and configured the Catalyst Center appliance, you can log in to its GUI. Use a compatible, HTTPS-enabled browser when accessing Catalyst Center.

When you log in for the first time as the admin superuser (with the username `admin` and the SUPER-ADMIN-ROLE assigned), the Quick Start workflow automatically starts. Complete this workflow to discover the devices that Catalyst Center will manage and enable the collection of telemetry from those devices.

Before you begin

To log in to Catalyst Center and complete the Quick Start workflow, you will need:

- The `admin` superuser username and password that you specified while completing one of the following procedures in the *Catalyst Center Second-Generation Appliance Installation Guide*:
 - Configure the Primary Node Using the Maglev Wizard
 - Configure an Appliance Using the Install Configuration Wizard (44- or 56-core appliance)
 - Configure an Appliance Using the Install Configuration Wizard (112-core appliance)
 - Configure the Primary Node Using the Advanced Install Configuration Wizard (44- or 56-core appliance)
 - Configure the Primary Node Using the Advanced Install Configuration Wizard (112-core appliance)
- The information described in the installation guide's Required First-Time Setup Information topic.

Step 1 After the Catalyst Center appliance reboot is completed, launch your browser.

Step 2 Enter the host IP address to access the Catalyst Center GUI, using `HTTPS://` and the IP address of the Catalyst Center GUI that was displayed at the end of the configuration process.

After entering the IP address, one of the following messages is displayed (depending on the browser you are using):

- Google Chrome: Your connection is not private

- Mozilla Firefox: Warning: Potential Security Risk Ahead

Step 3 Ignore the message and click **Advanced**.

One of the following messages is displayed:

- Google Chrome:

This server could not prove that it is *GUI-IP-address*; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.

- Mozilla Firefox:

Someone could be trying to impersonate the site and you should not continue. Websites prove their identity via certificates. Firefox does not trust *GUI-IP-address* because its certificate issuer is unknown, the certificate is self-signed, or the server is not sending the correct intermediate certificates.

These messages are displayed because the controller uses a self-signed certificate. For information on how Catalyst Center uses certificates, see the "Certificate and Private Key Support" section in the [Cisco Catalyst Center Administrator Guide](#).

Step 4 Ignore the message and do one of the following:

- Google Chrome: Click the **Proceed to GUI-IP-address (unsafe)** link.
- Mozilla Firefox: Click **Accept the Risk and Continue**.

The Catalyst Center login window opens.

Step 5 Do one of the following and then click **Log In**:

- If you completed the Maglev configuration wizard and chose the **Start using pre manufactured cluster** option, enter the admin's username (**admin**) and password (**maglev1@3**).
- If you completed the Maglev configuration wizard and chose the **Start configuration in advanced mode** option, enter the admin's username (**admin**) and password that you set when you configured your Catalyst Center appliance.
- If you completed the Install configuration wizard, enter the admin's username (**admin**) and paste the password (**maglev1@3**) that you copied from the wizard's final window.
- If you completed the Advanced Install configuration wizard, enter the admin's username (**admin**) and password that you set when you configured your Catalyst Center appliance.

In the next window, you are prompted to specify a new admin password (as a security measure).

Step 6 Do one of the following:

- If you don't want to change the admin password at this time, click **Skip**.
- To set a new admin password:
 - a. Enter the same password that you specified in Step 5.
 - b. Enter and confirm a new admin password.
 - c. Click **Next**.

Complete the Quick Start Workflow

Step 7 Enter your cisco.com username and password (which are used to register software downloads and receive system communications) and then click **Next**.

Note If you don't want to enter these credentials at this time, click **Skip** instead.

The **Terms & Conditions** window opens, providing links to the software End User License Agreement (EULA) and any supplemental terms that are currently available.

Step 8 After reviewing these documents, click **Next** to accept the EULA.

The **Quick Start Overview** slider opens. Click **>** to view a description of the tasks that the Quick Start workflow will help you complete in order to start using Catalyst Center.

Step 9 Complete the Quick Start workflow:

- Click **Let's Do it**.
- In the **Discover Devices: Provide IP Ranges** window, enter the following information and then click **Next**:

- The name for the device Discovery job.
- The IP address ranges of the devices you want to discover. Click **+** to enter additional ranges.
- Specify whether you want to designate your appliance's loopback address as its preferred management IP address. For more information, see the "Preferred Management IP Address" topic in the *Catalyst Center User Guide*.

- In the **Discover Devices: Provide Credentials** window, enter the information described in the following table for the type of credentials you want to configure and then click **Next**:

Field	Description
CLI (SSH) Credentials	
Username	Username used to log in to the CLI of the devices in your network.
Password	Password used to log in to the CLI of the devices in your network. The password you enter must be at least eight characters long.
Name/Description	Name or description of the CLI credentials.
Enable Password	Password used to enable a higher privilege level in the CLI. Configure this password only if your network devices require it.

SNMP Credentials: SNMPv2c Read tab

Note Catalyst Center does not support SNMPv2c credentials when FIPS mode is enabled. You'll need to enter SNMPv3 credentials instead. For more information about FIPS mode, see the "Configure the Primary Node Using the Maglev Wizard" topic in the *Catalyst Center Second-Generation Appliance Installation Guide*.

Name/Description	Name or description of the SNMPv2c read community string.
Community String	Read-only community string password used only to view SNMP information on the device.

SNMP Credentials: SNMPv2c Write tab

Name/Description	Name or description of the SNMPv2c write community string.
Community String	Write community string used to make changes to the SNMP information on the device.

Field	Description
SNMP Credentials: SNMPv3	
Name/Description	Name or description of the SNMPv3 credentials.
Username	Username associated with the SNMPv3 credentials.
Mode	<p>Security level that SNMP messages require:</p> <ul style="list-style-type: none"> • No Authentication, No Privacy (noAuthnoPriv): Does not provide authentication or encryption. • Authentication, No Privacy (authNoPriv): Provides authentication, but does not provide encryption. • Authentication and Privacy (authPriv): Provides both authentication and encryption. <p>Note When FIPS mode is enabled, Catalyst Center only supports Authentication and Privacy mode.</p>
Authentication Password	<p>Password required to gain access to information from devices that use SNMPv3. The password must be at least eight characters in length. Note the following points:</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Authentication Type	<p>Hash-based Message Authentication Code (HMAC) type used when either Authentication and Privacy or Authentication, No Privacy is set as the authentication mode:</p> <ul style="list-style-type: none"> • SHA: HMAC-SHA authentication. • MD5: HMAC-MD5 authentication. <p>Note Catalyst Center does not support this authentication type when FIPS mode is enabled.</p>
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • CISCOAES192: 192-bit CBC mode AES for encryption on Cisco devices. • CISCOAES256: 256-bit CBC mode AES for encryption on Cisco devices.

Complete the Quick Start Workflow

Field	Description
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages are exchanged with devices supported with AES128, AES192, and AES256 encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note the following points:</p> <ul style="list-style-type: none"> Some wireless controllers require that passwords be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. Passwords are encrypted for security reasons and are not displayed in the configuration.
NETCONF	
Port	The NETCONF port that Catalyst Center should use in order to discover wireless controllers that run Cisco IOS-XE.

- d) In the **Create Site** window, group the devices you are going to discover into one site in order to facilitate telemetry and then click **Next**.

You can enter the site's information manually or click the location you want to use in the provided map.

- e) In the **Enable Telemetry** window, check the network components that you want Catalyst Center to collect telemetry for and then click **Next**.

Note If both the **Enable Telemetry** and **Disable Telemetry** options are grayed out, this indicates that either devices are not capable of supporting telemetry or devices are running an OS version that does not support telemetry enablement.

- f) In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

- If you're happy with the settings, click **Start Discovery and Telemetry**. Catalyst Center validates your settings to ensure that they will not result in any issues. After validation is complete, the window updates.

Catalyst Center begins the process of discovering your network's devices and enabling telemetry for the network components you selected. The process will take a minimum of 30 minutes (more for larger networks).

A message is displayed at the top of the homepage to indicate when the Quick Start workflow has completed.

- g) Do one of the following:

- Click **View Discovery** to open the **Discovery** window and confirm that the devices in your network have been discovered.
- Click the **Go to Network Settings** link to open the **Device Credentials** window. From here, you can verify that the credentials you entered previously have been configured for your site.
- Click the **View Activity Page** link to open the **Tasks** window and view any tasks (such as a weekly scan of the network for security advisories) that Catalyst Center has already scheduled to run.
- Click the **Workflow Home** link to access guided workflows that will help you set up and maintain your network.

User Profile Roles and Permissions

Catalyst Center supports role-based access control (RBAC). The roles assigned to a user profile define the capabilities that a user has permission to perform. Catalyst Center has three main default user roles:

- SUPER-ADMIN-ROLE
- NETWORK-ADMIN-ROLE
- OBSERVER-ROLE

The SUPER-ADMIN-ROLE gives users broad capabilities and permits them to perform all actions in the Catalyst Center GUI, including creating custom roles and assigning them to user profiles. The NETWORK-ADMIN-ROLE and the OBSERVER-ROLE have more limited and restricted capabilities in the Catalyst Center GUI.

If you're unable to perform an action in Catalyst Center, the reason might be that your user profile is assigned a role that doesn't permit it. For more information, check with your system administrator or see the [Cisco Catalyst Center Administrator Guide](#).

Default Home Page

After you log in, Catalyst Center displays its home page. The home page has the following main areas: **Assurance Summary** and **Network Snapshot**.

Assurance Summary

This area includes:

- **Health:** Provides the health score of your overall enterprise, which includes network devices, wired clients, and wireless clients. Clicking **View Details** takes you to the **Overall Health** window.
- **Critical Issues:** Provides the count of P1 and P2 issues. Clicking **View Details** takes you to the **Open Issues** window.
 - **P1:** Critical issues that need immediate attention before they cause a wider impact on network operations.
 - **P2:** Major issues that can potentially impact multiple devices or clients.
- **Trends and Insights:** Provides insights about the performance of your network. Clicking **View Details** takes you to the **Trends and Insights** window.

Network Snapshot

This area includes:

- **Sites:** Provides the number of sites discovered on your network along with the number of DNS and NTP servers. Clicking **Add Sites** takes you to the **Network Hierarchy** window.

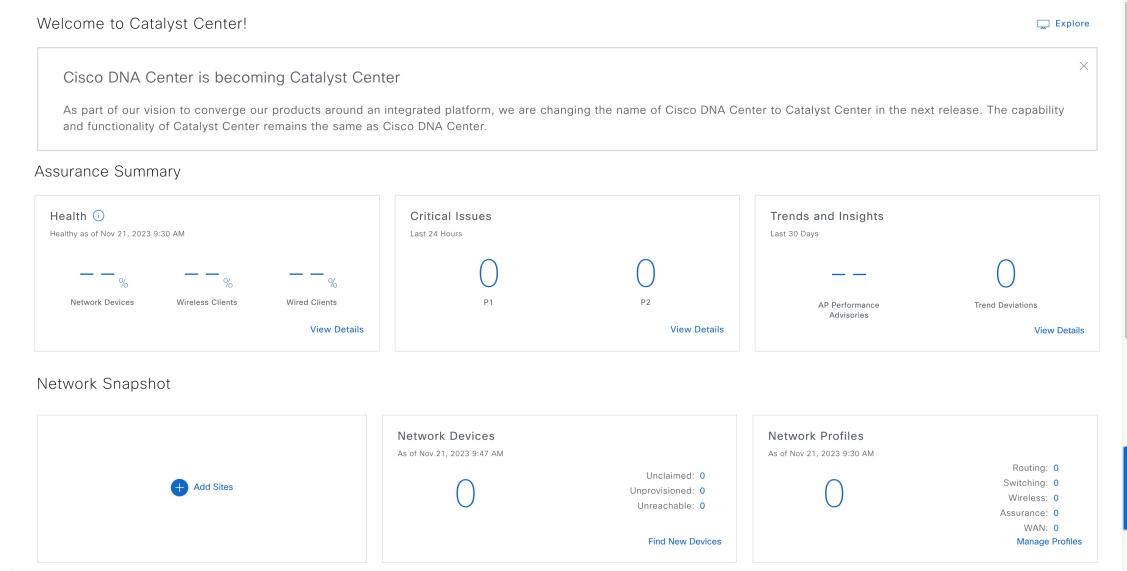
- **Network Devices:** Provides the number of network devices discovered on your network along with the number of unclaimed, unprovisioned, and unreachable devices. Clicking **Find New Devices** takes you to the **Discover Devices** window.
- **Network Profiles:** Provides the number of profiles discovered on your network. Clicking **Manage Profiles** takes you to the **Network Profiles** window.
- **Application Policies:** Provides the number of application policies discovered on your network along with the number of successful and errored deployments. Clicking **Add New Policy** takes you to the **Application Policies** window.
- **Import Images/SMUs:** Provides the number of images discovered on your network along with the number of untagged and unverified images. Clicking **Import Images/SMUs** takes you to the **Image Repository** window.
- **Software Image Updates:** Provides the status of software image updates. Clicking **Update Devices** takes you to the Image Update workflow.
- **Licensed Devices:** Provides the number of devices that have a Catalyst Center license along with the number of switches, routers, and wireless devices. Clicking **Manage Licenses** takes you to the **License Manager** window.
- **EoX Status:** Provides the number of devices scanned and EoX alerts discovered on your network. Clicking **Authorize Consent to Connect** opens the **Consent to Connect** dialog box. Review the information, check the check box confirming you have read the conditions, and click **Authorize** to scan the network for EoX alerts.
- **Field Notices:** Provides the number of hardware and software field notices that affect devices in the network. Clicking the displayed number takes you to the **Field Notices** window.
- **AI Endpoint Analytics:** Provides information about the endpoints that are connected to your network, including profiled endpoints, trust score alerts, and AI rules. (If Cisco AI Endpoint Analytics isn't installed, click **Setup AI Endpoint Analytics**.) Clicking **View Details** takes you to the **Policy > AI Endpoint Analytics > Overview** window.
 - *Fully profiled endpoints* have the following entries in the **Endpoint Inventory** window: Endpoint Type, OS Type, Hardware Model, and Hardware Manufacturer.
 - *Partially profiled endpoints* are missing at least one of the following entries: Endpoint Type, OS Type, Hardware Model, Hardware Manufacturer.
 - *Unprofiled endpoints* are missing the preceding entries.

Different Views of the Home Page

The home page can vary depending on factors such as the different stages of Catalyst Center and what role is used to log in.

For example, the day-zero view of the Catalyst Center home page displays when there are no devices in the system or if you skipped the getting started workflow.

Figure 1: The Day-Zero View of the Catalyst Center Home Page



Menu Bar

From the top-left corner, click the menu icon (≡) to access the menu items.

Icons

Click the icons at the right of the menu bar to perform common tasks:

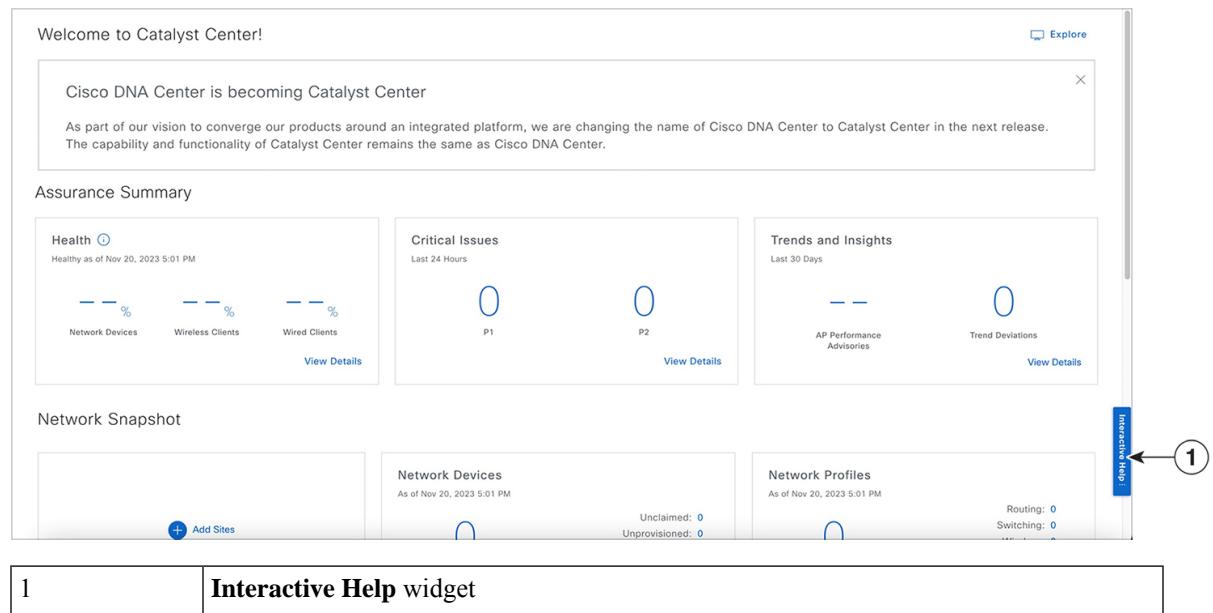
Icon	Description
🔍	Search: Search for devices, users, hosts, menus, and other items that are stored anywhere in the Catalyst Center database.
⭐	Favorite: You can add any window on Catalyst Center to My Favorites, so you can navigate to it more easily and quickly. For more information, see Add a Window to My Favorites, on page 29 .

Icon	Description
	<p>Help</p> <ul style="list-style-type: none"> • About: Displays the current Catalyst Center software version. Click Release Notes to launch the release notes in a separate browser tab. Click Packages to view the system and application package versions. Click Serial number to view the serial number of the Catalyst Center appliance. Click Member ID to view the member ID. • API Reference: Open the Catalyst Center platform API documentation in Cisco DevNet. • Developer Resources: Open Cisco DevNet, where you can access developer tools. • Contact Support: Open a support case with the Cisco Technical Assistance Center (TAC). • Remote Support Authorization: Grant remote access to a Cisco specialist to access Catalyst Center for troubleshooting your network. For more information, see View the Remote Support Authorization Dashboard, on page 24. • Help: Launch context-sensitive online help in a separate browser tab. • Cisco CX Cloud Success Tracks: Access the Cisco CX cloud success tracks website in a new window. • Keyboard Shortcuts: Display the keyboard shortcut names, shortcut keys, and shortcut key combinations for shortcut groups. • Make a Wish: Submit your comments and suggestions to the Catalyst Center product team.
	<p>Software Updates: See a list of available software updates. Click the Go to Software Updates link to view system and application updates.</p>
	<p>Notifications: View event notifications and set notification preferences. A red circle by the notification icon indicates that there are new notifications.</p>

Interactive Help

Interactive Help contains walkthroughs for specific tasks in Catalyst Center. The walkthroughs provide onscreen guidance to help you complete the task.

You can open **Interactive Help** by either clicking the Help icon and choosing **Interactive Help** or clicking the **Interactive Help** widget displayed by default in the bottom-right corner of the Catalyst Center window. You can also move the **Interactive Help** widget from the default location to other locations. Drag and drop the widget to the possible locations, which are indicated by green dotted-line rectangles.

Figure 2: Interactive Help Widget

Catalyst Center Journey Map

The Catalyst Center journey map shows various capabilities provided by Catalyst Center and its usage.

Step 1 To launch the Catalyst Center journey map, do any one of the following:

- From the top-left corner, click the menu icon and choose **Explore**.
- In the Catalyst Center home page, click **Begin Your Journey**.
- In the Catalyst Center home page, click **Explore**.

In the Catalyst Center journey map, the various features (capabilities) provided by Catalyst Center are grouped into the following tabs—**AIOps**, **NetOps**, **DevOps**, and **SecOps**. Hover your cursor over the ⓘ icon to view details about each tab.

Step 2 Click the ⓘ icon to view the journey map in a pie chart

The pie chart shows the details of the chosen tab. A number next to a step (for example, ⓘ 1) indicates the suggested order of the recommended steps within a segment for your journey map. You can perform the following actions in the pie chart:

- Hover your cursor over the features displayed in the pie chart to view a brief description about the feature and its status.
- If a feature is installed or in use, click the feature name in your journey map to view its configuration or settings page.
- To view the details about a segment, click the segment name in the pie chart. To return to the previous view containing all the segments, click the segment name again.

View the Remote Support Authorization Dashboard

Step 3 Click the  icon to view the journey map in a table format.

The table shows the details of the chosen tab. Hover your cursor over the feature name to view a brief description about the feature and its status.

Step 4 Check the **Completed** check box to view information about the completed and incomplete steps in the journey map.

- If you click **Completed**, the completed steps are highlighted with green borders.
- If you click **Incomplete**, the incomplete steps are highlighted with orange borders.

View the Remote Support Authorization Dashboard

Remote support authorization allows you to grant remote access to a Cisco specialist to access Catalyst Center and troubleshoot your network.



Note The Catalyst Center remote support authorization is supported only with RADKit version 1.2.1 and later.

Step 1 From the top-right corner, click the help icon  and choose **Remote Support Authorization**.

In the **Remote Support Authorization** dashboard, the **SUMMARY** area shows the total, current, and past remote support authorizations.

Step 2 In the **Create New Authorization** tab, click **Create a Remote Support Authorization** to create a new authorization. For more information, see [Create a Remote Support Authorization, on page 872](#).

Step 3 Click the **Current Authorizations** tab to view the current remote support authorization tiles with the following possible statuses:

- **All**: Displays all the scheduled and active remote support authorizations.
- **Scheduled**: Displays the scheduled remote support authorizations.
- **Active**: Displays the active remote support authorizations.

For troubleshooting purposes, the support authorization tile shows the schedule and duration of the Cisco specialist's access to Catalyst Center.

Step 4 To revoke an authorization, click **Revoke Authorization** in the respective support authorization tile.

Step 5 Click the **Past Authorizations** tab to view the past authorizations.

The **Past Authorizations** table shows the support authorization based on **Case Number**, **Date**, **Session Status**, **Cisco Specialist**, and **Log** and lists the following statuses for past authorizations:

- **All**: Lists all the expired and revoked remote support authorizations.
- **Expired**: Lists all the expired remote support authorizations.
- **Revoked**: Lists all the revoked remote support authorizations.

Using the search bar, you can search for past authorizations by case number.

Step 6 To view the remote support authorization logs, click **View Logs** for the desired authorization.

The **Audit Logs** window is displayed. For more information, see "View Audit Logs" in the *Cisco Catalyst Center Administrator Guide*.

Step 7 Click the **Manage SSH Credentials** tab to establish the SSH connection to Catalyst Center. For more information, see [Configure SSH Credentials, on page 25](#).

- Note**
- The number of nodes in the deployment determines the maximum number of SSH credentials.
 - SSH credentials only need to be created once if all the nodes use the same password.

In the **Remote Support Authorization** dashboard, the Remote Support Cloud service connectivity status is shown:

- A green check mark in the top-right corner indicates that the remote support authorization is connected to the Remote Support Cloud service.
- An exclamation point in the top-right corner indicates that the remote support authorization is not connected to the Remote Support Cloud service.

Configure SSH Credentials

SSH credentials allow a Cisco specialist to access your Catalyst Center setup for troubleshooting.

Step 1 From the top-right corner, click the help icon (ⓘ) and choose **Remote Support Authorization**.

Step 2 Click the **Manage SSH Credentials** tab and then click + **Add New SSH Credentials**.

Step 3 In the **Add New SSH Credentials** slide-in pane, do the following:

- a. In the **Password** field, enter a password.
- b. In the **Name/Description** field, enter a name or description to identify the password.

Step 4 Click **Add SSH Credential**.

- Note**
- The number of nodes in the deployment determines the maximum number of SSH credentials.
 - SSH credentials only need to be created once if all the nodes use the same password.

Step 5 To edit an SSH credential, do the following:

- a. In the **Existing SSH Credentials** area, click **Edit**.
- b. In the **Edit SSH Credentials** slide-in pane, make your changes and click **Save**.

Step 6 To delete an SSH credential, do the following:

- a. In the **Existing SSH Credentials** area, click **Delete**.

- b. In the confirmation window, click **Confirm**.
-

Use Global Search

Use the global Search function to find items in the following categories anywhere in Catalyst Center:

- **Activities**: Search for Catalyst Center menu items, workflows, and features by name.
- **Applications**: Search for them by name.
- **Application Groups**: Search for them by name.
- **Authentication template**: Search for them by name or type.
- **Devices**: Search for them by collection status, reachability status, location, or tag.
- **Fabric**: Search by fabric name.
- **Help**: Search for topics that include your search string.
- **Hosts and Endpoints**: Search for them by name, IP address, or MAC address.
- **IP Pools**: Search for them by name or IP address.
- **Model Configurations**: Search for them by model configuration design name or parameter name.
- **Network Devices**: Search for them by name, IP address, serial number, software version, platform, product family, or MAC address.
- **Network Profiles**: Search by profile name.
- **Network Settings**
 - **Device Credentials**: Search by name.
 - **IP Address Pools**: Search for them by group name or pool CIDR.
 - **Service Provider Profiles**: Search for them by profile name, WAN provider, or model.
 - **Wireless Network Settings**: Search for them by wireless network settings name or parameter name.
- **Policy**: Search for them by name or description.
- **Sites**: Search for them by name.
- **Traffic copy**: Search for them by name and description.
- **Transits**: Search by transit name.
- **Users**: Search for the system settings and users by username. Case-insensitivity and substring search are not supported for usernames.
- **Workflows**: Search for them by task name or parameter name.
- Other items, as new versions of Catalyst Center are released.

To start a global Search, click the Search icon (Q) in the top-right corner of any Catalyst Center window. Catalyst Center displays a global search window, with a Search field where you can begin entering identifying information about an item.

You can enter all or part of the item's name, address, serial number, or other identifying information. The Search field is case-insensitive and can contain any character or combination of characters.

As you begin entering your search string, Catalyst Center displays a list of possible search targets that match your entry. If more than one category of item matches your search string, Catalyst Center sorts them by category, with a maximum of five items in each category. The first item in the first category is selected automatically, and summary information for that item is displayed in the summary panel on the right.

You can scroll the list as needed, and click any of the suggested search targets to see information for that item in the summary panel. If there are more than five items in a category, click **View All** next to the category name. To return to the categorized list from the complete list of search targets, click **Go Back**.

As you add more characters to the search string, global Search automatically narrows the displayed list.

Catalyst Center allows you to search for a device using its entire IPv6 address or any abbreviated form of the IPv6 address.

For example, to search for *2001:0db8:85a3:0000:0000:8a2e:0370:7334*, you can use the following search entries:

- **2001:0db8:85a3:0000:0000:8a2e:0370:7334** (using the full IPv6 address)
- **2001:db8:85a3:0:0:8a2e:0:7334** (truncating leading zeros)
- **2001:db8:85a3::8a2e:0:7334** (compressing consecutive zeros with a double colon)
- **2001:db8:85a3** (using a portion of the IPv6 address)

Catalyst Center allows you to search for an IPv6 address by using the double colon in the IPv6 address with prefix, postfix, or any combination.

For example, to search for *2001:db8:85a3::8a2e:0:7334*, you can use the following search entries:

- :: (using double colon alone)
- **85a3::8a2e** (using prefix and postfix with double colon)
- **85a3::** (using prefix with double colon)
- **::8a2e** (using postfix with double colon)

You can search for devices in Catalyst Center by entering their MAC addresses in any format (with a hyphen or colon).

When you are finished, click  to close the window.

Global search can display five results per category at a time.

Apply Light or Dark Appearance in Catalyst Center

You can view Catalyst Center in light (default) or dark appearance.

Step 1

From the top-right corner, click your displayed username and choose **My Profile and Settings > Display Settings**.

Step 2

In the **Set Appearance** area, click **Light** or **Dark** to view Catalyst Center in light appearance or dark appearance.

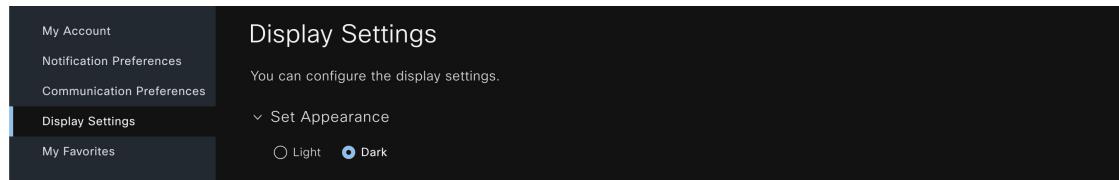
Step 3

Click **Save**.

Catalyst Center caches the appearance you choose in the browser storage. Therefore, in the following scenarios where the browser cache that stores the appearance is not available, the Catalyst Center GUI is displayed in light appearance for several seconds:

- You log in to Catalyst Center from a different browser.
- In a three-node cluster, you log in to the second or third Catalyst Center node for the first time after dark appearance is applied in a primary node.

When dark appearance is enabled, the Catalyst Center GUI displays the following appearance:



Enable Localization

You can view the Catalyst Center GUI windows in English (the default), Chinese, Japanese, or Korean.

To change the default language, perform the following task:

Step 1

In your browser, change the locale to one of the supported languages: Chinese, Japanese, or Korean.

- From Google Chrome, do the following:
 - a. Click the  icon in the top-right corner, and then choose **Settings**.
 - b. Click **Languages**.
 - c. Click **Add languages**.
 - d. In the **Add languages** dialog box, choose **Chinese, Japanese, or Korean**, and then click **Add**.
- From Mozilla Firefox, do the following:
 - a. Click the  icon in the top-right corner, and then choose **Settings**.
 - b. From the **Language and Appearance > Language** area, click **Choose**.
 - c. From the **Select a language to add** drop-down list, choose **Chinese, Japanese, or Korean**.
 - d. Click **OK**.

Step 2 Log in to Catalyst Center.

The GUI is shown in the selected language.

Add a Window to My Favorites

You can add any window on Catalyst Center to My Favorites (the list of your favorited windows). With My Favorites, you can navigate to favorited windows more easily and quickly.

You can also add different views of the same window to My Favorites if the view has a unique URL. For example, on the **Tasks** window, you can add this window to My Favorites when it's filtering tasks or work items with the **Success** status and, separately, when it's filtering tasks or work items with the Last Updated **24 hours** status.

Step 1 Navigate to the window that you want to add to My Favorites.**Step 2** On the window, in the top-right corner, click the star icon () to add the window to My Favorites.**Step 3** On the **THIS WINDOW IS FAVORITED** dialog box, in the **Name** field, you can either:

- Keep the autopopulated name as the title of your favorited window.
- Delete the autopopulated name and type a new name.

Step 4 (Optional) To view the list of your favorited windows, click **View My Favorites**.

The **My Favorites** slide-in pane displays all your favorited windows.

Tip To quickly display the **My Favorites** slide-in pane from any window on Catalyst Center, use the keyboard shortcut **q + f**.

Step 5 Click **Done** to save any edits to the favorited window name and to close the dialog box.**Step 6** (Optional) To remove a window from My Favorites, you can either remove it from the **THIS WINDOW IS FAVORITED** dialog box or the **My Favorites** window.

- Navigate to the favorited window that you want to remove, and then click the star icon () In the **THIS WINDOW IS FAVORITED** dialog box, click **Remove**.
 - To remove a window from the **My Favorites** window, see [Manage My Favorites, on page 29](#).
-

Manage My Favorites

You can manage your favorited windows on the **My Favorites** window. For information about adding a window to My Favorites, see [Add a Window to My Favorites, on page 29](#).

Step 1 From the top-right corner, click your displayed username and choose **My Profile and Settings > My Favorites**.

The **My Favorites** window displays the list of your favorited windows.

Step 2 (Optional) To remove a favorited window, do the following:

Subscribe to Catalyst Center Insights

- a) Locate the window you want to remove from the list.
- b) Deselect the window's adjacent star icon (★) to remove it from My Favorites.

Step 3

(Optional) To go to a favorited window, do the following:

- a) Locate the favorited window that you want to go to.
- b) Under the favorited window, click its hyperlinked pathway.

Subscribe to Catalyst Center Insights

You can subscribe to *Catalyst Center Insights*, which contains product announcements, network highlights, information about your network performance, and more. The Catalyst Center Insights publication is sent in PDF format to the email address that you specify.



Note

If your Catalyst Center appliance is deployed in a secure, air-gapped network, certain metrics are omitted from Catalyst Center Insights. To view the complete Catalyst Center Insights, you must have internet and telemetry connectivity, which aren't available in air-gapped environments.

Before you begin

- Under **System > Settings > Integration Settings**, enter your callback URL hostname or IP address. For more information, see "Configure Integration Settings" in the *Cisco Catalyst Center Administrator Guide*.
- Under **System > Settings > External Services > Destinations > Email**, configure the SMTP servers that you will use to receive the publication.

Step 1

From the top-right corner, click your displayed username and choose **My Profile and Settings > Communication Preferences**.

Step 2

Click the **Subscription Off** toggle button to **Subscription On**.

Step 3

Enter the email address where you want to receive Catalyst Center Insights, and click **Save**.

Insights are archived for up to one year. You can read past publications by choosing **Actions > Download PDF** for the desired date range.

Step 4

(Optional) To change the email address, click the pencil icon.

Step 5

(Optional) To unsubscribe from Catalyst Center Insights, click the **Subscription On** toggle button to **Subscription Off**.



CHAPTER 3

Configure Telemetry

- [Application Telemetry Overview, on page 31](#)
- [Configure Syslog, SNMP Traps, NetFlow Collector Servers, and Wired Client Data Collection Using Telemetry, on page 31](#)
- [Criteria for Enabling Application Telemetry on Devices, on page 32](#)
- [Provision Application Telemetry Settings, on page 34](#)
- [Enable Application Telemetry for Wireless Controllers, on page 35](#)
- [Update Telemetry Settings to Use a New Cluster Virtual IP Address, on page 36](#)
- [Update Device Configuration Using Telemetry, on page 37](#)

Application Telemetry Overview

Application telemetry allows you to configure global network settings on devices for monitoring and assessing their health.

Configure Syslog, SNMP Traps, NetFlow Collector Servers, and Wired Client Data Collection Using Telemetry

With Catalyst Center, you can configure global network settings when devices are assigned to a specific site. Telemetry polls network devices and collects telemetry data according to the settings in the SNMP server, syslog server, NetFlow Collector, or wired client.

Before you begin

Create a site and assign a device to the site. See [Create, Edit and Delete a Site, on page 167](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Telemetry**.

Step 2 In the **SNMP Traps** area, do one of the following:

- Check the **Use Catalyst Center as SNMP trap server** check box.
- Check the **Add an external SNMP trap server** check box and enter the IP address of the external SNMP trap server. The selected server collects SNMP traps and messages from the network devices.

Step 3 In the **Syslogs** area, do one of the following:

- Check the **Use Catalyst Center as syslog server** check box.
- Check the **Add an external syslog server** check box and enter the IP address of the external syslog server.

Step 4

In the **Application Visibility** area, check the **Enable by default on wired access devices** check box to enable Application Telemetry and Controller-Based Application Recognition (CBAR) by default upon the network device site assignment.

Do one of the following:

- Click the **Use Catalyst Center as NetFlow collector** radio button. The NetFlow configuration on the device interfaces is completed only when you enable application telemetry on the device. Select the NetFlow collector at the site level to configure the NetFlow destination server to the device.
- Click the **Add Cisco Telemetry Broker (CTB)** radio button and add the IP address and port number of the Cisco Telemetry Broker. The Cisco Telemetry Broker collects NetFlow records from the device and sends the information to the destination.

Note Catalyst Center must be configured as a destination in Cisco Telemetry Broker to receive NetFlow records. If Catalyst Center is not configured as a destination, the Application Experience does not work.

Step 5

In the **Wired Endpoint Data Collection** area, click the **Enable Catalyst Center Wired Endpoint Data Collection At This Site** radio button to turn on IP Device Tracking (IPDT) on the access devices of the site.

If you don't want to enable IPDT for the site, click the **Disable Catalyst Center Wired Endpoint Data Collection At This Site** radio button (the default).

Note You must enable IPDT to preview the CLI configuration. When provisioning a device, you can preview the CLI configuration before deploying it on the device.

Step 6

In the **Wireless Controller, Access Point and Wireless Clients Health** area, check the **Enable Wireless Telemetry** check box to monitor the health of the wireless controllers, APs, and wireless clients in your network.

Step 7

Click **Save**.

Criteria for Enabling Application Telemetry on Devices

Catalyst Center automatically enables application telemetry on all applicable interfaces or WLANs that are selected based on the new automatic interfaces or WLAN selection algorithm.

**Note**

- The conventional tagging-based algorithm is supported and has precedence over the newer automatic interfaces or WLAN selection algorithm.
- If you want to switch over from the automatic selection algorithm to the tagging-based algorithm, you must disable telemetry before provisioning the tagged SSIDs to the devices.

The following table provides the criteria for selecting interfaces and WLANs based on the conventional tagging-based algorithm (with **lan** keyword) and the new automatic selection algorithm for all the supported platforms:

Platform	Conventional Tagging-Based Algorithm	Automatic Selection Algorithm
Router	<ul style="list-style-type: none"> Interface description has the lan keyword.¹² Interface has an IP address other than the management IP address. 	<ul style="list-style-type: none"> Interface has an IP address other than the management IP address. Interface is not any of the following: <ul style="list-style-type: none"> WAN <p>Note An interface is treated as a WAN-facing interface if it has a public IP address, and if there is a route rule with a public IP address that routes through the interface.</p> <p>In this context, a public IP address is not in a private range (for example, not in 192.168.x.x, 172.16.y.y, 10.z.z.z), or is an IP address that is not in the system's IP pools.</p> <p>Route rules can be dynamically learned. In this context, the show ip route command does not show a route to a public IP address that goes through this interface.</p> <ul style="list-style-type: none"> Loopback. Management interface: GIGABITETHERNET0, GIGABITETHERNET0/0, MGMT0, FASTETHERNET0, or FASTETHERNET1.
Switch	<ul style="list-style-type: none"> Interface description has the lan keyword.^{1,2} Switch port is configured as an access port. Switch port is configured with the switch-mode access command. 	<ul style="list-style-type: none"> Interface is a physical interface. Access port does not have neighbors. Interface is not any of the following: <ul style="list-style-type: none"> Management interface: FASTETHERNET0, FASTETHERNET1, GIGABITETHERNET0/0, or MGMT0 LOOPBACK0, Bluetooth, App Gigabit, WPAN, Cellular, or Async VSL interface.

Platform	Conventional Tagging-Based Algorithm	Automatic Selection Algorithm
Cisco AireOS Controller	WLAN profile name is tagged with the lan keyword. ^{1, 2}	If the SSIDs are mixed, that is Local mode, Flex mode, and Fabric mode, Wireless Service Assurance (WSA) processing is enabled. If all the SSIDs are in Local mode, NetFlow is enabled.
Cisco Catalyst 9800 Series Wireless Controller with Optimized Application Performance Monitoring (APM) profile and IOS 16.12.1 and later.	WLAN profile name is tagged with the lan keyword. ^{1, 2}	If the SSIDs are mixed—that is, central switching, Flex mode, and Fabric mode—the Cisco Application Visibility and Control (AVC) basic record is configured. If all the SSIDs use central switching, the Optimized APM record is configured. For Cisco Catalyst 9800 Series Wireless Controllers with IOS 17.10 and later, Catalyst Center pushes the APM profile, not the AVC basic profile, for flex and fabric SSIDs.
Catalyst Center Traffic Telemetry Appliance with Optimized APM profile and IOS 17.3 and later.	<ul style="list-style-type: none"> • Interface description has the lan keyword.^{1, 2} • Interface is a physical interface. 	<ul style="list-style-type: none"> • Interface is a physical interface. • Interface is not a management interface: GIGABITETHERNET0, GIGABITETHERNET0/0, MGMT0, FASTETHERNET0, and FASTETHERNET1.

¹ The **lan** keyword is case insensitive and can be separated by a space, hyphen, or underscore.

² Resynchronize the network device to read the **lan** interface description.

Provision Application Telemetry Settings

Configure global telemetry settings as described in [Configure Syslog, SNMP Traps, NetFlow Collector Servers, and Wired Client Data Collection Using Telemetry, on page 31](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The Inventory window displays the device information gathered during the discovery process. To view devices available in a particular site, expand the Global site in the left pane and select the site, building, or floor.

Step 2 Choose the devices that you want to provision.

Step 3 From the **Actions** drop-down list, choose **Telemetry** and do one of the following:

Note The **Enable Application Telemetry** and **Disable Application Telemetry** options are enabled only when the device supports application telemetry from Catalyst Center.

- Enable Application Telemetry:** To configure application telemetry for the selected devices.
- Disable Application Telemetry:** To remove the application telemetry configuration from the chosen devices.

Step 4 Click **Apply**.

The **Application Telemetry** column shows the telemetry configuration status. If you don't see the **Application Telemetry** column in the default column setting, click the ellipsis icon (⋮) at the right end of the column headings and check the **Application Telemetry** check box.

Enable Application Telemetry for Wireless Controllers

You can enable application telemetry for new and existing devices.



Note You can also enable Application Telemetry from the **Application Visibility** window. For more information, see [Enable/Disable Application Telemetry, on page 647](#).

Before you begin

To enable application telemetry, devices must have a Catalyst Center Advantage license.



Note Before enabling application telemetry in Catalyst Center, ensure to delete any existing flow monitors configured manually from **Configuration > Services > Application Visibility > Flow Monitors** through the Cisco Catalyst 9800 Series Wireless Controller GUI.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

Step 2 To view devices available in a particular site, expand the **Global** site in the left pane, and choose the site, building, or floor.

Step 3 In the **Inventory** window, choose the device. You can choose multiple devices at a time.

Step 4 From the Action drop-down list, choose **Telemetry > Enable Application Telemetry**.

Step 5 In the **Enable Telemetry** slide-in pane, complete the following settings:

- AP mode: Check the **Flex/Fabric** or **Local** check box. You can also choose both options.
- To enable telemetry for guest SSIDs, check the **Include Guest SSID** check box.

Note If an SSID name contains the **guest** keyword, to enable telemetry for the SSID, you must check the **Include Guest SSID** check box even if the is SSID for an enterprise wireless network.

c) **Telemetry Source:**

- Embedded Wireless Controllers - NetFlow
- AireOS wireless controller (Local mode) - NetFlow
- AireOS wireless controller (Flex/Fabric mode) - Wireless Service Assurance (WSA)

- d) To apply the same settings for all wireless controllers, check **Apply this selection to all wireless controllers**.

Step 6 Click **Enable**.

Step 7

In the **Application Telemetry** window, click **ok**.

To skip this screen in the future, check **Don't show again**.

The telemetry status is displayed in the **Application Telemetry** column in the **Inventory** window.

Update Telemetry Settings to Use a New Cluster Virtual IP Address

If you are using the Catalyst Center application telemetry to monitor device data, and you need to change the Catalyst Center cluster virtual IP address (VIP), complete the following steps to change the VIP and to ensure that node telemetry data is sent to the new VIP.

Before you begin

- Determine the version of Catalyst Center that you are using. You can check this by logging in to the Catalyst Center GUI and using the **About** option to view the Catalyst Center version number.
- Obtain SSH client software.
- Identify the VIP address that was configured for the 10-GB interface facing the enterprise network on the Catalyst Center primary node. Log in to the appliance using this address, on port 2222. To identify this port, see the rear-panel figure in the "Front and Rear Panels" section in the *Cisco Catalyst Center Installation Guide*.
- Obtain the Linux username (**maglev**) and password configured on the primary node.
- Identify the cluster VIP that you want to assign. The cluster VIP must conform to the requirements explained in the "Required IP Addresses and Subnets" section in the *Cisco Catalyst Center Installation Guide*.

Step 1

Access the Catalyst Center GUI and disable Application Telemetry at all the sites, as follows:

- a) From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The Inventory window displays the device information gathered during the discovery process. To view devices available in a particular site, expand the Global site in the left pane, and select the site, building, or floor.

- b) Choose all the sites and devices currently being monitored.
- c) From the **Actions** drop-down list, choose **Telemetry > Disable Application Telemetry**.
- d) Wait for the sites and devices to show that telemetry has been disabled.

Step 2

Use the appliance Configuration wizard to change the cluster VIP, as follows:

- a) Using an SSH client, log in to the VIP address that was configured for the 10-GB interface facing the enterprise network on the Catalyst Center primary node. Be sure to log in on port 2222.
- b) When prompted, enter the Linux username and password.
- c) Enter the following command to access the Configuration wizard on the primary node:

```
$ sudo maglev-config update
```

If you are prompted for the Linux password, enter it again.

- d) Click [Next] until the screen prompting you for the cluster virtual IP appears. Enter the new cluster VIP, then click [Next] to proceed through the remaining screens of the wizard.

You must configure one virtual IP per configured interface. We recommend that you enter the `sudo maglev-config update` command so that the wizard prompts you to provide one VIP per configured interface.

When you reach the final screen, a message appears, stating that the wizard is ready to apply your changes.

- e) Click [proceed] to apply the cluster VIP change.

At the end of the configuration process, a success message appears and the SSH prompt reappears.

Step 3 Restart the necessary Catalyst Center services by entering the following series of commands at the SSH prompt:

```
magctl service restart -d collector-netflow
magctl service restart -d collector-syslog
magctl service restart -d collector-trap
magctl service restart -d wirelesscollector
```

Step 4 Wait for all the services to restart. You can monitor the progress of the restarts by entering the following command, substituting service names as needed for the release train appropriate for your Catalyst Center version.

```
magctl appstack status | grep -i -e collector-netflow -e collector-syslog -e collector-trap -e wirelesscollector
```

When all the necessary services are running, you see command output similar to the following, with a Running status for each service that has restarted successfully:

```
assurance-backend wirelesscollector-123-bc99s 1/1   Running   0   25d   <IP>   <IP>
ndp    collector-netflow-456-lxvlx  1/1   Running   0   1d    <IP>   <IP>
ndp    collector-syslog-789-r0rr1  1/1   Running   0   25d   <IP>   <IP>
ndp    collector-trap-101112-3ppllm 1/1   Running   0   25d   <IP>   <IP>
```

Step 5 Access the Catalyst Center GUI and **Enable Application Telemetry** to all nodes as follows:

- From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Choose all the sites and devices that you want to monitor.
- From the **Actions** drop-down list, choose **Telemetry > Enable Application Telemetry**.
- Wait for the sites and devices to show that telemetry has been enabled.

Update Device Configuration Using Telemetry

You can push configuration changes to a device regardless of whether device controllability is enabled or disabled.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process. To view devices available in a particular site, expand the **Global** site in the left pane, and select the site, building, or floor.

Step 2 Choose the devices on which you want to update the configuration changes.

Step 3 From the **Actions** drop-down list, choose **Telemetry > Update Telemetry Settings**.

The **Update Telemetry Settings** slide-in pane opens.

- Step 4** (Optional) Check the **Force Configuration Push** check box to push the configuration changes to the device. If there is no change in the configuration settings, the existing configuration is pushed again to the device.
- Step 5** Click **Next**.
- Step 6** In the **Update Telemetry Settings** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option:
- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
- If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Step 7** In the **Task Name** field, enter a task name.
- Step 8** Do the following:
- If you chose **Now** or **Later**, click **Apply**.
 - If you chose **Generate configuration preview**, click **Preview**.
- Step 9** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
- If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.
- For more information, see [Network Provisioning Prechecks, on page 137](#).
- If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.
- Step 10** If you chose **Generate configuration preview**, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:
- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
 - b. On the **Preview Configuration** window, review the device configurations.
- For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Note During configuration preview, the PKCS12 certificate isn't generated as the certificate must be used within 15 minutes. The **Preview Configuration** window only displays the relevant configuration commands. When you deploy the configuration after previewing it, the PKCS12 certificate is generated and pushed to the device.



PART **II**

Discover and Manage Network Inventory and Topology

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- [Manage Your Inventory, on page 61](#)
- [Display Your Network Topology, on page 147](#)



CHAPTER 4

Discover Your Network

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- [Discovery Dashboard, on page 44](#)
- [Discovery Prerequisites, on page 44](#)
- [Discovery Credentials, on page 45](#)
- [Preferred Management IP Address, on page 51](#)
- [Discovery Configuration Guidelines and Limitations, on page 51](#)
- [Perform Discovery, on page 52](#)
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Discovery Overview

The Discovery feature scans the devices in your network and sends the list of discovered devices to inventory.

The Discovery feature also works with the Device Controllability feature to configure the required network settings on devices, if these settings are not already present on the devices.

There are four ways for you to discover devices:

- Use Cisco Discovery Protocol (CDP) and provide a seed IP address.
- Specify a range of IP addresses. (A maximum range of 4096 devices is supported.)
- Use Link Layer Discovery Protocol (LLDP) and provide a seed IP address.
- Use Classless Inter-Domain Routing (CIDR) and provide a seed IP address.

When configuring the Discovery criteria, remember that there are settings that you can use to help reduce the amount of time it takes to discover your network:

- **CDP Level and LLDP Level:** If you use CDP or LLDP as the Discovery method, you can set the CDP or LLDP level to indicate the number of hops from the seed device that you want to scan. The default, level 16, might take a long time on a large network. So, if fewer devices have to be discovered, you can set the level to a lower value.
- **Prefix Length:** If you use **CIDR** as a discovery method, you can set the prefix length value ranging from 20 to 30. The default value is 30.
- **Subnet Filters:** If you use an IP address range, you can specify devices in specific IP subnets for Discovery to ignore.

- **Preferred Management IP:** Whether you use CDP, LLDP, CIDR, or an IP address range, you can specify whether you want Catalyst Center to add any of the device's IP addresses or only the device loopback address.



Note For Cisco SD-Access Fabric and Cisco Catalyst Assurance, we recommend that you specify the device loopback address.

Regardless of the method you use, you must be able to reach the device from Catalyst Center and configure specific credentials and protocols in Catalyst Center to discover your devices. These credentials can be configured and saved in the **Design > Network Settings > Device Credentials** window or on a per-job basis in the **Discovery** window.



Note If a device uses a first hop resolution protocol, such as Hot Standby Router Protocol (HSRP) or Virtual Router Redundancy Protocol (VRRP), the device might be discovered and added to the inventory along with its floating IP address. Later, if HSRP or VRRP fails, the IP address might be reassigned to a different device. This situation can cause issues with the data that Catalyst Center retrieves for analysis.

Discovery Dashboard

From the top-left corner, click the menu icon and choose **Tools > Discovery** to view the **Discovery Dashboard**. The **Discovery Dashboard** shows the inventory overview, latest discovery, discovery type, discovery status, and recent discoveries.

Discovery Prerequisites

Before you run Discovery, complete the following minimum prerequisites:

- Understand what devices will be discovered by Catalyst Center by viewing the [Cisco Catalyst Center Compatibility Matrix](#).
- Understand that the preferred network latency between Catalyst Center and devices is 100 ms round-trip time (RTT). (The maximum latency is 200 ms RTT.)
- Ensure that at least one SNMP credential is configured on your devices for use by Catalyst Center. At a minimum, this can be an SNMPv2C read credential. For more information, see [Discovery Credentials, on page 45](#).
- Configure SSH credentials on the devices you want Catalyst Center to discover and manage. Catalyst Center discovers and adds a device to its inventory if at least one of the following criteria is met:
 - The account that is being used by Catalyst Center to SSH into your devices has privileged EXEC mode (level 15).
 - You configure the device's enable password as part of the CLI credentials configured in the Discovery job. For more information, see [Discovery Configuration Guidelines and Limitations, on page 51](#).

Discovery Credentials

Discovery credentials are the CLI, SNMPv2c, SNMPv3, HTTP(S), and NETCONF configuration values for the devices that you want to discover. You must specify the credentials based on the types of devices you are trying to discover:

- Network devices: CLI and SNMP credentials.



Note For NETCONF-enabled devices such as embedded wireless controllers, you must specify SSH credentials with admin privilege and select the NETCONF port.

- Compute devices (NFVIS): CLI, SNMP, and HTTP(S) credentials.

Because the various devices in a network can have different sets of credentials, you can configure multiple sets of credentials in Catalyst Center. The discovery process iterates through all sets of credentials that are configured for the Discovery job until it finds a set that works for the device.

If you use the same credential values for the majority of devices in your network, you can configure and save them to reuse in multiple Discovery jobs. To discover devices with unique credentials, you can add job-specific Discovery credentials when you run Discovery jobs. You can configure up to 10 global credentials for each credential type and define any five of them. If you need to define a job-specific credential, you can define five global credentials and one job-specific credential for each credential type.

To define credentials for a Discovery, click the menu icon and choose **Tools > Discovery > Add Discovery**. To continue, use the following procedures and discovery credential information:

- [Discover Your Network Using CDP, on page 53](#)
- [Discover Your Network Using an IP Address Range or CIDR, on page 55](#)
- [Discover Your Network Using LLDP, on page 57](#)

Table 3: CLI Credentials

Field	Description
Name/Description	Name or phrase that describes the CLI credentials. If authentication fails for CLI, Catalyst Center retries the authentication process for 300 seconds (5 minutes).
Username	Name that is used to log in to the CLI of the devices in your network.
Password	Password that is used to log in to the CLI of the devices in your network. For security reasons, re-enter the password as confirmation. Note Passwords are encrypted for security reasons and are not displayed in the configuration.

Discovery Credentials

Field	Description
Enable Password	<p>Password used to move to a higher privilege level in the CLI. Configure this password only if your network devices require it.</p> <p>For security reasons, re-enter the enable password.</p> <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

Table 4: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

Table 5: SNMPv3 Credentials

Field	Description
Name/Description	Name or description of the SNMPv3 settings that you are adding.
Username	Name associated with the SNMPv3 settings.
Mode	<p>Security level that an SNMP message requires. Choose one of the following modes:</p> <ul style="list-style-type: none"> Authentication and Privacy: Provides both authentication and encryption. Authentication, No Privacy: Provides authentication, but does not provide encryption. No Authentication, No Privacy: Does not provide authentication or encryption.

Field	Description
Auth. Type	<p>Authentication type to be used. (Enabled if you select Authentication and Privacy or Authentication, No Privacy as Mode.) Choose one of the following authentication types:</p> <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA. • MD5 (not recommended): Authentication based on HMAC-MD5. <p>Note Catalyst Center does not support device discovery if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>
Auth. Password	<p>SNMPv3 password used for gaining access to information from devices that use SNMPv3. These passwords (or passphrases) must be at least eight characters in length.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • CISCOAES192: 192-bit CBC mode AES for encryption on Cisco devices. • CISCOAES256: 256-bit CBC mode AES for encryption on Cisco devices.
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.

Table 6: SNMP Properties

Field	Description
Retries	Number of times Catalyst Center tries to communicate with network devices using SNMP.
Timeout (in Seconds)	Amount of time, in seconds, between retries.

Table 7: HTTP(S) Credentials

Field	Description
Read	<p>You can configure up to 10 HTTPS read credentials:</p> <ul style="list-style-type: none"> Name/Description: Name or description of the HTTPS credentials that you are adding. Username: Name that is used to authenticate the HTTPS connection. Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).
Write	<p>You can configure up to 10 HTTPS write credentials:</p> <ul style="list-style-type: none"> Name/Description: Name or description of the HTTPS credentials that you are adding. Username: Name that is used to authenticate the HTTPS connection. Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).

Table 8: NETCONF Setting

Field	Description
Port	<p>Port on the device. You can use one of the following ports:</p> <ul style="list-style-type: none"> • Port 830 (default). • Any other port that is available on the device. • A custom port that Catalyst Center configures. (You can use a custom port only if Device Controllability is enabled. For more information, see the Device Controllability section in the Cisco Catalyst Center Administrator Guide.) <p>If authentication fails for NETCONF, Catalyst Center retries the authentication process for 300 seconds (5 minutes).</p> <p>Discovery accepts and validates multiple credentials and only adds devices with working credentials to your inventory. So, if a NETCONF connectivity failure occurs during the discovery process, Catalyst Center adds the device without a NETCONF port. However, if you add a device (that's not NETCONF enabled) manually to your inventory with the NETCONF credential, Catalyst Center displays the error “Managed: Netconf Connection Failure” if there’s no response to the RPC request on the NETCONF port. In both cases, if the device is added without the NETCONF port and if any application uses only NETCONF to collect data, Catalyst Center displays the missing NETCONF port error. If any application uses the CLI credentials when NETCONF is not configured, Catalyst Center displays the device in the managed state because the device is using the CLI credentials.</p>

Discovery Credentials and Cisco ISE

If you are using Cisco ISE as an authentication server, the Discovery feature authenticates devices using Cisco ISE as part of the discovery process. To make sure that your devices are discovered properly, follow these guidelines:

- Do not use Discovery credentials that have fewer than 4 alphanumeric characters. Although devices may have credentials with fewer than 4 alphanumeric characters, Cisco ISE allows 4 alphanumeric characters as the minimum username and password length. If the device credentials have fewer than 4 characters, Catalyst Center cannot collect the device’s inventory data, and the device will go into a partial collection state.
- Do not use credentials that have the same username, but different passwords (cisco/cisco123 and cisco/pw123). While Catalyst Center allows the discovery of devices with the same username but different passwords, Cisco ISE does not allow this. If a duplicate username is used, Catalyst Center cannot authenticate the device and collect its inventory data, and the device will go into a partial collection state.

For information on how to define Cisco ISE as a AAA server, see [Add Cisco ISE or Other AAA Servers, on page 233](#).

Guidelines and Limitations for Discovery Credentials

The following are the guidelines and limitations for the Catalyst Center Discovery credentials:

Discovery Credentials Example

- To change the device credentials used in a Discovery job, you need to edit the Discovery job and deselect the credentials that you no longer want to use. Then, you need to add the new credentials and start the discovery. For more information, see [Change Credentials in a Discovery Job, on page 59](#).
- If you change a device's credential after successfully discovering the device, subsequent polling cycles for that device fail. To correct this situation, use one of the following options:
 - Use the Discovery tool to:
 - Run a new Discovery job with job-specific credentials that match the device's new credential.
 - Edit the existing Discovery job and rerun the Discovery job.
 - Use the Design tool to:
 - Create a new global credential and run a new Discovery job using the correct global credential.
 - Edit an existing global credential and use Copy & Edit to recreate the Discovery job. Alternatively, create a new Discovery job.
- If an ongoing Discovery polling cycle fails because of a device authentication failure, you can correct the situation using one of following options:
 - Use the Discovery tool to:
 - Stop or delete the current Discovery job and run a new Discovery job with job-specific credentials that match the device's credential.
 - Stop or delete the current Discovery job, edit the existing Discovery job, and rerun the Discovery job.
 - Use the Design tool to:
 - Create a new global credential and run a new Discovery job using the correct global credential.
 - Edit an existing global credential and use Copy & Edit to recreate the Discovery job. Alternately, create a new Discovery job.
- Deleting a global credential does not affect previously discovered devices. The status of the previously discovered devices does not indicate an authentication failure. However, the next Discovery job that tries to use the deleted credential will fail. The Discovery job will fail *before* it tries to contact any devices.

Discovery Credentials Example

The devices that form a typical network can have widely varying Discovery requirements. Catalyst Center lets you create multiple Discovery jobs to support these varying requirements. For example, assume that a network has 200 devices that form a Cisco Discovery Protocol (CDP) neighborhood. In this network, 190 devices share a global credential (Credential 0) and the remaining devices each have their own unique credential (Credential-1 through Credential-10).

For FIPS mode deployment, the discovery password must contain at least 8 characters.

To discover all the devices in this network using Catalyst Center, perform the following task:

-
- Step 1** Configure the CLI global credentials as Credential-0.
- Step 2** Configure the SNMP (v2c or v3) global credentials.
- Step 3** Run a Discovery job using one of the 190 device IP addresses (190 devices that share the global credentials) and the global Credential-0.
- Step 4** Run 10 separate Discovery jobs for each of the remaining 10 devices using the appropriate job-specific credentials, such as Credential-1, Credential-2, Credential-3, and so on.
- Step 5** Review the results in the **Inventory** window.
-

Preferred Management IP Address

When Catalyst Center discovers a device, it uses one of the device's IP addresses as the preferred management IP address. The IP address can be that of a built-in management interface of the device, another physical interface, or a logical interface such as Loopback0. You can configure Catalyst Center to use the device's loopback IP address as the preferred management IP address, provided the IP address is reachable from Catalyst Center.

When you choose **Use Loopback IP** as the preferred management IP address, Catalyst Center determines the preferred management IP address as follows:

- If the device has one loopback interface, Catalyst Center uses that loopback interface IP address.
- If the device has multiple loopback interfaces, Catalyst Center uses the loopback interface with the highest IP address.
- If there are no loopback interfaces, Catalyst Center uses the Ethernet interface with the highest IP address. (Subinterface IP addresses are not considered.)
- If there are no Ethernet interfaces, Catalyst Center uses the serial interface with the highest IP address.

After a device is discovered, you can update the management IP address from the **Inventory** window. For more information, see [Update a Device's Management IP Address, on page 123](#).

Discovery Configuration Guidelines and Limitations

This section describes the limitations and guidelines of device discovery.

- The following are the guidelines and limitations for Catalyst Center to discover your Cisco Catalyst 3000 Series Switches and Catalyst 6000 Series Switches:
 - Configure the CLI username and password with privileged EXEC mode (level 15). These credentials are the same CLI username and password that you configure in Catalyst Center for the Discovery function. Catalyst Center requires the highest access level to the device.
 - Explicitly specify the transport protocols allowed on individual interfaces for both incoming and outgoing connections. Use the **transport input** and **transport output** commands for this configuration. For information about these commands, see the command reference document for the specific device type.

- Do not change the default login method for a device's console port and the VTY lines. If a device is already configured with a AAA (TACACS) login, make sure that the CLI credential defined in the Catalyst Center is the same as the TACACS credential defined in the TACACS server.
- The following are the guidelines and limitations for Catalyst Center to discover your wireless controllers and APs:
 - Cisco Wireless Controllers must be discovered using the management IP address instead of the service port IP address. If not, the related wireless controller 360 and AP 360 windows will not display any data.
 - After the wireless controllers are discovered, Catalyst Center displays the list of associated APs in the inventory. The listed APs are connected to the wireless controller during either the discovery or through inventory sync. To view any new APs that join the wireless controller after the inventory sync, you must perform a manual resync.



Note This limitation is applicable only for the devices that are not yet assigned to a site or provisioned in Catalyst Center.

- Third-party devices cannot be discovered with Catalyst Center discovery feature. You must add the third-party devices manually to your network. For more information, see [Add a Third-Party Device, on page 103](#).

Perform Discovery

You can discover devices using Link Layer Discovery Protocol (LLDP), CDP, CIDR, or an IP address range. Your devices must have the required device configurations, as described in [Discovery Prerequisites, on page 44](#).

- For IP address range discovery, only ping-reachable devices are included in the list of discovered devices. Ping-unreachable devices are ignored and aren't included in the list of discovered devices.
- For CDP-, CIDR- and LLDP-based discovery, because CDP, CIDR and LLDP protocols respond to even ping-unreachable IPs, ping-unreachable devices are included in the list of discovered devices.
- For CDP-, CIDR- and LLDP-based discovery, configure your network device's host IP address as the client IP address. (A host is an end-user device, such as a laptop computer or mobile device.)
- The Discovery function requires the correct SNMP read-only community string. If an SNMP read-only community string is not provided, as a *best effort*, the Discovery function uses the default SNMP read-only community string, public.
- During discovery, devices that are already discovered and associated with a site are skipped for site assignment.
- CLI credentials are not required to discover hosts; hosts are discovered through the network devices to which they are connected.
- During discovery using SNMPv3 credentials, Catalyst Center pushes the SNMPv3 credentials with the default SNMP user group to the devices ignoring the existing user group on the device.

Discover Your Network Using CDP

You can discover devices using Cisco Discovery Protocol (CDP), an IP address range, CIDR, or LLDP. This procedure shows you how to discover devices and hosts using CDP. For more information about the other discovery methods, see [Discover Your Network Using an IP Address Range or CIDR, on page 55](#) and [Discover Your Network Using LLDP, on page 57](#).

**Note**

- The Discovery function requires the correct SNMP Read Only (RO) community string. If an SNMP RO community string is not provided, as a *best effort*, the Discovery function uses the default SNMP RO community string, public.
- CLI credentials are not required to discover hosts; hosts are discovered through the network devices to which they are connected.

Before you begin

- Enable CDP on your network devices.
- Configure your network devices, as described in [Discovery Prerequisites, on page 44](#).
- Configure your network device's host IP address as the client IP address. (A host is an end-user device, such as a laptop computer or mobile device.)

Step 1 From the top-left corner, click the menu icon and choose **Tools > Discovery**.

Step 2 In the **Discovery** window, click **Add Discovery**.

Step 3 In the **Discover Devices** window, complete the following fields:

- a) Enter a name for the discovery job.
- b) Under **Discovery Type**, choose **CDP**.
- c) In the **IP Address** field, enter a seed IP address for Catalyst Center to start the Discovery scan.
- d) (Optional) In the **Subnet Filter** field, enter an IP address or subnet to exclude from the Discovery scan.

You can enter addresses either as an individual IP address (*x.x.x.x*) or as a classless inter-domain routing (CIDR) address (*x.x.x.x/y*), where *x.x.x.x* refers to the IP address and *y* refers to the subnet mask. The subnet mask can be a value from 0 to 32.

- e) Click

Repeat Step d and Step e to exclude multiple subnets from the Discovery job.

- f) (Optional) In the **CDP Level** field, enter the number of hops from the seed device that you want to scan.

Valid values are from 1 to 16. The default value is 16. For example, CDP level 3 means that CDP will scan up to three hops from the seed device.

- g) For **Preferred Management IP**, choose one of the following options:

- **None**: Allows the device to use any of its IP addresses.
- **Use Loopback IP**: Specify the device's loopback interface IP address.

Note If you choose **Use Loopback IP** and the device does not have a loopback interface, Catalyst Center chooses a management IP address using the logic described in [Preferred Management IP Address, on page 51](#).

Note To use the loopback interface IP address as the preferred management IP address, make sure that the CDP neighbor's IP address is reachable from Catalyst Center.

Step 4 In the **Provide Credentials** window, configure the discovery credentials and other settings as required.

Enter at least one CLI credential and one SNMP credential that Catalyst Center will configure for the devices it discovers. You can have a maximum of five global credentials and one task-specific credential for each type. For more details, see [Discovery Credentials, on page 45](#).

- a) In the left pane, click **CLI** to add CLI credentials.
- b) Expand **SNMP** to add SNMP credentials.
- c) Expand **Advanced Settings** and configure the following settings:

- **Protocol Order:** Choose **SSH** or **Telnet**. If you choose both, you can specify the order in which they are used by dragging the protocols up or down.
- **SNMP Polling Properties:** Use the global SNMP polling properties defined in the **Network Settings > Device Credentials** window or modify for this discovery instance.

Note You can configure other credentials such as, NETCONF and HTTP(S), if required.

Step 5 In the **Schedule Job** window, do the following:

- a) Click **Now** to start device discovery immediately or click **Later** to schedule device discovery at a specific time. If you choose the **Daily** or **Weekly** recurrence option, the **Discover new devices only** option is disabled.
- b) Click the toggle button to enable or disable the **Discover new devices only** option.
- c) Click the **Assign devices to an existing site** link.

The **Visibility and Control of Configurations** dialog box is displayed with information about the settings that will be enabled on the devices during site assignment. If Visibility of Configurations is enabled and a site is assigned during discovery, a configuration preview will not be generated.

During the discovery workflow, devices can be assigned to existing sites only, new site creation is not supported.

In the dialog box, choose any one of the following options:

- **Assign to site without Configuration Preview:** Use the **Search Hierarchy** search field or the filter icon to find a site, building, or area. For more details, see [Search the Network Hierarchy, on page 166](#).
- **Skip site assignment for now:** Use this option if you want the devices to be assigned to sites later from inventory.

Step 6 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 7 Click **Start Discovery**.

You can view the status of the task in the **Activities > Tasks** window.

What to do next

The **Device Discovery** window displays an option to view the discovered devices based on the site assignment. Use this option to view devices assigned to a site or a network or the unassigned devices in the inventory.

Discover Your Network Using an IP Address Range or CIDR

You can discover devices using an IP address range, CIDR, CDP, or LLDP. This procedure shows you how to discover devices and hosts using an IP address range, or CIDR. For more information about the other Discovery methods, see [Discover Your Network Using CDP, on page 53](#), and [Discover Your Network Using LLDP, on page 57](#).

Before you begin

Your devices must have the required device configurations, as described in [Discovery Prerequisites, on page 44](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Discovery**.

Step 2 In the **Discovery** window, click **Add Discovery**.

Step 3 In the **Discover Devices** window, complete the following fields:

- a) Enter a name for the discovery job.
- b) Under **Discovery Type**, choose **IP Address/Range**, or **CIDR**.
- c) If you choose **IP Address/Range** discovery type, do the following:
 1. In the **From** and **To** fields, enter the beginning and ending IP addresses (IP address range) for Catalyst Center to scan, and click .

You can enter a single IP address range or multiple IP addresses for the discovery scan.

Note Cisco Wireless Controllers must be discovered using the Management IP address instead of the Service Port IP address. If not, the related wireless controller 360 and AP 360 pages will not display any data.

2. (Optional) Repeat previous step to enter additional IP address ranges.
- d) If you choose **CIDR** discovery type, do the following:
 1. In the **IP Address** field, enter a seed IP address for Catalyst Center to start the Discovery scan.
 2. In the **Subnet Filter** field, enter an IP address or subnet to exclude from the Discovery scan.
3. Click .

(Optional) Repeat previous steps to exclude multiple subnets from the Discovery job.

4. In the **Prefix Length** field, enter the value of prefix length. The valid value ranges from 20 to 30.
- e) For **Preferred Management IP Address**, choose one of the following options:

Discover Your Network Using an IP Address Range or CIDR

- **None:** Allows the device to use any of its IP addresses.
- **Use Loopback IP:** Specify the device's loopback interface IP address.

Note If you choose **Use Loopback IP** and the device does not have a loopback interface, Catalyst Center chooses a management IP address using the logic described in [Preferred Management IP Address, on page 51](#).

Step 4

In the **Provide Credentials** window, configure the discovery credentials and other settings as required.

Enter at least one CLI credential and one SNMP credential that Catalyst Center will configure for the devices it discovers. You can have a maximum of five global credentials and one task-specific credential for each type. For more details, see [Discovery Credentials, on page 45](#).

- In the left pane, click **CLI** to add CLI credentials.
- Expand **SNMP** to add SNMP credentials.
- Expand **Advanced Settings** and configure the following settings:

- **Protocol Order:** Choose **SSH** or **Telnet**. If you choose both, you can specify the order in which they are used by dragging the protocols up or down.
- **SNMP Polling Properties:** Use the global SNMP polling properties defined in the **Network Settings > Device Credentials** window or modify for this discovery instance.

Note You can configure other credentials such as, NETCONF and HTTP(S), if required.

Step 5

In the **Schedule Job** window, do the following:

- Click **Now** to start device discovery immediately or click **Later** to schedule device discovery at a specific time. If you choose the **Daily** or **Weekly** recurrence option, the **Discover new devices only** option is disabled.
- Click the toggle button to enable or disable the **Discover new devices only** option.
- Click the **Assign devices to an existing site** link.

The **Visibility and Control of Configurations** dialog box is displayed with information about the settings that will be enabled on the devices during site assignment. If Visibility of Configurations is enabled and a site is assigned during discovery, a configuration preview will not be generated.

During the discovery workflow, devices can be assigned to existing sites only, new site creation is not supported.

In the dialog box, choose any one of the following options:

- **Assign to site without Configuration Preview:** Use the **Search Hierarchy** search field or the filter icon to find a site, building, or area. For more details, see [Search the Network Hierarchy, on page 166](#).
- **Skip site assignment for now:** Use this option if you want the devices to be assigned to sites later from inventory.

Step 6

In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 7

Click **Start Discovery**.

You can view the status of the task in the **Activities > Tasks** window.

What to do next

The **Device Discovery** window displays an option to view the discovered devices based on the site assignment. Use this option to view devices assigned to a site or a network or the unassigned devices in the inventory.

Discover Your Network Using LLDP

You can discover devices using Link Layer Discovery Protocol (LLDP), CDP, CIDR, or an IP address range. This procedure shows you how to discover devices and hosts using LLDP. For more information about the other discovery methods, see [Discover Your Network Using CDP, on page 53](#) and [Discover Your Network Using an IP Address Range or CIDR, on page 55](#).

**Note**

- The Discovery function requires the correct SNMP Read Only (RO) community string. If an SNMP RO community string is not provided, as a *best effort*, the Discovery function uses the default SNMP RO community string, public.
- CLI credentials are not required to discover hosts; hosts are discovered through the network devices to which they are connected.

Before you begin

- Enable LLDP on your network devices.
- Configure your network devices, as described in [Discovery Prerequisites, on page 44](#).
- Configure your network device's host IP address as the client IP address. (A host is an end-user device, such as a laptop computer or mobile device.)

Step 1 From the top-left corner, click the menu icon and choose **Tools > Discovery**.

Step 2 In the **Discovery** window, click **Add Discovery**.

Step 3 In the **Discover Devices** window, complete the following fields:

- a) Enter a name for the discovery job.
- b) Under **Discovery Type**, choose **LLDP**.
- c) In the **IP Address** field, enter a seed IP address for Catalyst Center to start the Discovery scan.
- d) (Optional) In the **Subnet Filter** field, enter an IP address or subnet to exclude from the Discovery scan.

You can enter addresses either as an individual IP address (*x.x.x.x*) or as a classless inter-domain routing (CIDR) address (*x.x.x.x/y*), where *x.x.x.x* refers to the IP address and *y* refers to the subnet mask. The subnet mask can be a value from 0 to 32.

- e) Click

Repeat Step c and Step d to exclude multiple subnets from the Discovery job.

- f) (Optional) In the **LLDP Level** field, enter the number of hops from the seed device that you want to scan.

Valid values are from 1 to 16. The default value is 16. For example, LLDP level 3 means that LLDP will scan up to three hops from the seed device.

g) For **Preferred Management IP**, choose one of the following options:

- **None**: Allows the device use any of its IP addresses.
- **Use Loopback IP**: Specify the device's loopback interface IP address.

Note If you choose this option and the device does not have a loopback interface, Catalyst Center chooses a management IP address using the logic described in [Preferred Management IP Address, on page 51](#).

Note To use the loopback interface IP address as the preferred management IP address, make sure that the LLDP neighbor's IP address is reachable from Catalyst Center.

Step 4

In the **Provide Credentials** window, configure the discovery credentials and other settings as required.

Enter at least one CLI credential and one SNMP credential that Catalyst Center will configure for the devices it discovers. You can have a maximum of five global credentials and one task-specific credential for each type. For more details, see [Discovery Credentials, on page 45](#).

- a) In the left pane, click **CLI** to add CLI credentials.
- b) Expand **SNMP** to add SNMP credentials.
- c) Expand **Advanced Settings** and configure the following settings:

- **Protocol Order**: Choose **SSH** or **Telnet**. If you choose both, you can specify the order in which they are used by dragging the protocols up or down.
- **SNMP Polling Properties**: Use the global SNMP polling properties defined in the **Network Settings > Device Credentials** window or modify for this discovery instance.

Note You can configure other credentials such as, NETCONF and HTTP(S), if required.

Step 5

In the **Schedule Job** window, do the following:

- a) Click **Now** to start device discovery immediately or click **Later** to schedule device discovery at a specific time.

If you choose the **Daily** or **Weekly** recurrence option, the **Discover new devices only** option is disabled.

- b) Click the toggle button to enable or disable the **Discover new devices only** option.
- c) Click the **Assign devices to an existing site** link.

The **Visibility and Control of Configurations** dialog box is displayed with information about the settings that will be enabled on the devices during site assignment. If Visibility of Configurations is enabled and a site is assigned during discovery, a configuration preview will not be generated.

During the discovery workflow, devices can be assigned to existing sites only, new site creation is not supported.

In the dialog box, choose any one of the following options:

- **Assign to site without Configuration Preview**: Use the **Search Hierarchy** search field or the filter icon to find a site, building, or area. For more details, see [Search the Network Hierarchy, on page 166](#).
- **Skip site assignment for now**: Use this option if you want the devices to be assigned to sites later from inventory.

Step 6

In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 7

Click **Start Discovery**.

You can view the status of the task in the **Activities > Tasks** window.

What to do next

The **Device Discovery** window displays an option to view the discovered devices based on the site assignment. Use this option to view devices assigned to a site or a network or the unassigned devices in the inventory.

Manage Discovery Jobs

The following sections provide information about how to manage the Discovery jobs.

Stop and Start a Discovery Job

Step 1 From the top-left corner, click the menu icon and choose **Tools > Discovery**.

Step 2 To stop an active Discovery job, hover your cursor over the ellipsis icon () in the **Actions** column and choose **Stop Discovery**.

Step 3 To restart an inactive Discovery job, hover your cursor over the ellipsis icon in the **Actions** column and choose **Re-discover**.

Change Credentials in a Discovery Job

You can change the credentials used in a Discovery job and then rerun the Discovery job.

Before you begin

You should have created at least one Discovery job.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Discovery**.

Step 2 To copy a Discovery job, hover your cursor over the ellipsis icon () in the **Actions** column and choose **Copy & Edit**.

Catalyst Center creates a copy of the Discovery job, named *Clone of Discovery_Job*.

Step 3 (Optional) To change the name of the Discovery job, replace the default name in the **Discovery Name** field with a new name.

Step 4 In the **New Discovery** window, expand the **Credentials** area and choose any of the global credentials that have already been created, or configure your own.

If you want to use existing credentials, make sure that to select them. If you don't want to use a credential, deselect it.

Step 5 To configure your own credentials, click **Add Credentials**.

You must configure CLI and SNMPv2c credentials. All other credentials are optional. For field information, see [Discovery Credentials, on page 45](#).

Clone a Discovery Job

To save credentials for *only* the current job, click **Save**. To save them for the current job and future jobs, check the **Save as global settings** check box and then click **Save**.

- Step 6** Click **Discover**.
-

Clone a Discovery Job

You can clone a Discovery job and retain all the information defined for that job.

Before you begin

Run at least one Discovery job.

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Discovery**.

- Step 2** To copy a Discovery job, hover your cursor over the ellipsis icon () in the **Actions** column and choose **Copy & Edit**.

Catalyst Center creates a copy of the Discovery job, named *Clone of Discovery_Job*.

- Step 3** (Optional) To change the name of the Discovery job, replace the default name in the **Discovery Name** field with a new name.

- Step 4** Define or update the parameters for the new Discovery job.
-

Delete a Discovery Job

You can delete a Discovery job whether it is active or inactive.

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Discovery**.

- Step 2** To delete a Discovery job, hover your cursor over the ellipsis icon () in the **Actions** column and choose **Delete**.

- Step 3** Click **OK** to confirm.
-



CHAPTER 5

Manage Your Inventory

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- [Inventory and Cisco ISE Authentication, on page 62](#)
- [Display Information About Your Inventory, on page 63](#)
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About Inventory

The Inventory function retrieves and saves details, such as host IP addresses, MAC addresses, and network attachment points about devices in its database.

The Inventory feature can also work with the Device Controllability feature to configure the required network settings on devices, if these settings are not already present on the device.

Inventory uses the following protocols, as required:

- Link Layer Discovery Protocol (LLDP).
- IP Device Tracking (IPDT) or Switch Integrated Security Features (SISF). (IPDT or SISF must be enabled on the device.)
- LLDP Media Endpoint Discovery. (This protocol is used to discover IP phones and some servers.)
- Network Configuration Protocol (NETCONF). For a list of devices, see [Discovery Prerequisites, on page 44](#).

After the initial discovery, Catalyst Center maintains the inventory by polling the devices at regular intervals. The default interval is every 24 hours. However, you can change this interval as required for your network environment. For more information, see [Update the Device Polling Interval, on page 123](#). Polling occurs for each device, link, host, and interface. Only the devices that have been active for less than one day are displayed. This prevents stale device data, if any, from being displayed. On average, polling 500 devices takes approximately 20 minutes. A configuration change in the device triggers an SNMP trap, which in turn triggers device resynchronization. Device resynchronization is also triggered after the inventory service restart under the following circumstances:

- If there is an upgrade (Catalyst Center upgrade) after the inventory service restart.
- If the device's synchronization is in terminated or delayed state after the service restart.
- If the **Last Sync** time for the device is more than 75 percent of the periodic resync interval configured on the device. For example, after the inventory service restart, if the **Last Sync** time for a device has crossed 18 hours and the configured periodic resync interval is 24 hours, the device will be resynchronized before the periodic resync interval. The percentage for the resync interval cutoff time may vary based on the value configured on the device.

Inventory and Cisco ISE Authentication

Cisco ISE has two different use cases in Catalyst Center:

- If your network uses Cisco ISE for device authentication, you need to configure the Cisco ISE settings in Catalyst Center. As a result, when provisioning devices, Catalyst Center configures the devices with the Cisco ISE server information that you defined. In addition, Catalyst Center configures the devices on the Cisco ISE server and propagates subsequent updates to the devices. For information about configuring Cisco ISE settings in Catalyst Center, see [Configure Global Network Servers, on page 234](#).



Note If you are using Cisco ISE for authenticating Cisco Catalyst 9800 series devices, you must configure Cisco ISE to provide privilege for NETCONF users.

If a device is not configured or updated on the Cisco ISE server as expected due to a network failure or the Cisco ISE server being down, Catalyst Center automatically retries the operation after a certain wait period. However, Catalyst Center does not retry the operation if the failure is due to a rejection from Cisco ISE, as an input validation error.

When Catalyst Center configures and updates devices in the Cisco ISE server, the transactions are captured in the Catalyst Center audit logs. You can use the audit logs to help troubleshoot issues related to the Catalyst Center and Cisco ISE inventories.

After you provision a device, Catalyst Center authenticates the device with Cisco ISE. If Cisco ISE is not reachable (no RADIUS response), the device uses the local login credentials. If Cisco ISE is reachable, but the device does not exist in Cisco ISE or its credentials do not match the credentials configured in Catalyst Center, the device does not fall back to use the local login credentials. Instead, it goes into a partial collection state.

To avoid this situation, make sure that before you provision devices using Catalyst Center, you have configured the devices in Cisco ISE with the same device credentials that you are using in Catalyst Center. Also, make sure that you configured valid discovery credentials. For more information, see [Discovery Credentials, on page 45](#).

- If required, you can use Cisco ISE to enforce access control to groups of devices.

Display Information About Your Inventory

You can display and filter for information about discovered devices in your inventory. You can also customize or change the information displayed in the **Devices** table.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Note For the devices that are added as Fully Qualified Domain Name (FQDN), hover your cursor over the **i** icon next to the device name in the **IP address** column to view the **Resolved IP Address**.

Step 2 (Optional) To change the Inventory view, use the toggle button () in the top-right corner. You can change your default view (the list layout) to other layouts, such as the topology or map layout.

Step 3 (Optional) To change the **Devices** table's focus views, from the **Focus** drop-down list, choose a view, such as **Default**, **Inventory**, or **Software Images**.

Note

- The displayed columns change depending on the chosen focus view.
- Selected devices persist in each new focus view.

- Step 4** (Optional) To filter for specific device details in the **Devices** table, you can do the following:
- To filter for a device family, choose one or more of the device family buttons at the top of the **Inventory** window. For example, you can click **Routers** to display only routers in the table.
 - To filter for device work items, in the left pane, check the check box of one or more work items. The table is immediately filtered for the work item. For example, you can check the **Unreachable** check box to display only unreachable devices in the table.
 - To filter for specific device details, click **Filter devices** and choose from the filter options: **Quick Filters**, **Advanced Filters**, or **Recent Filters**. Then click **Apply**. For more information, see [Filter Devices, on page 107](#).
- Step 5** (Optional) To take a guided tour of the **Inventory** window, click **Take a tour** in the top-right corner.
- Step 6** (Optional) To export all the data in the **Devices** table, click **Export** in the top-right corner.
- Step 7** (Optional) To customize the **Devices** table, click the settings icon (⚙) in the top-right corner, choose from the following options in the **Table Settings** slide-in pane, and then click **Apply**.
 - **Table Appearance:** Choose if you want the default or compact table view and table striping.
 - **Edit Table Columns:** Choose if you want to create a custom view and if you want to hide or display columns. Note that the column selection does not persist across sessions.

The following table provides key information relevant to certain table columns.

Column	Description
Device Name	Name of the device. Click the device name for more information about that device. Note A device name that is displayed in red means that inventory has not polled the device and updated its information for more than 30 minutes.

Column	Description
Support Type	<p>Shows the device support level:</p> <ul style="list-style-type: none"> • Supported: The device profile is tested for all applications on Catalyst Center. You can open a service request if any of the Catalyst Center functionalities for these devices do not work. • Limited: The device profile for legacy devices is tested only for the following features and tested only on a best-effort basis on Catalyst Center. <ul style="list-style-type: none"> • Discovery • Topology • Device Reachability • Config Change Audit • Inventory • Software Image Management (Software images may not be available for EOL devices on cisco.com. Not recommended for EOL devices.) • Template Provisioning (Applicable only for switches.) <p>For more information, see the Legacy Device Compatibility Matrix.</p> <ul style="list-style-type: none"> • Third Party: The device profile has been tested on Catalyst Center for third-party devices that are capable of populating SNMP MIB 2 values. Catalyst Center support limited base automation and assurance capabilities, such as Inventory and Topology as a best effort basis. <p>For more information, see the Cisco Catalyst Center Compatibility Matrix.</p> <ul style="list-style-type: none"> • Unsupported: All remaining Cisco and third-party devices that are not tested and certified on Catalyst Center. You can try out various functionalities on Catalyst Center for these devices, as a best effort. However, you cannot raise a service request or a bug if Catalyst Center features do not work as expected.
Reachability	<p>The following is a list of the various statuses:</p> <ul style="list-style-type: none"> • Reachable: The device is reachable by Catalyst Center using SNMP, HTTP(S), and NETCONF polling. • Ping Reachable: The device is reachable by Catalyst Center using ICMP polling and not reachable using SNMP, HTTP(S), and NETCONF polling. • Unreachable: The device is not reachable using SNMP, HTTP(S), NETCONF, or ICMP polling.

Display Information About Your Inventory

Column	Description
EoX Status	<p>Shows the EoX scan status:</p> <ul style="list-style-type: none"> Success: The device is scanned for EoX alerts successfully. Not Scanned: The device is not scanned for EoX alerts. Scan Failed: Catalyst Center is not able to scan the device for EoX alerts. Scanning: Catalyst Center is scanning the device for EoX alerts. <p>Hover your cursor over the i icon next to EoX Status, and click Click here to accept to initiate an EoX scan.</p> <p>For the devices that are scanned successfully, the EoX Status column shows the number of alerts, if any. Click the number of alerts to view the alerts in detail.</p> <p>In the slide-in pane, click the Hardware, Software, and Module tabs to view the hardware, software, and module EoX alerts.</p>
Manageability	<p>Shows the device status:</p> <ul style="list-style-type: none"> Managed with green tick icon: Device is reachable and is fully managed. Managed with orange error icon: Device is managed with some error, such as unreachable, authentication failure, missing NETCONF ports, internal error, and so on. Hover your cursor over the error message to view more details about the error and the impacted applications. Unmanaged: Device cannot be reached and no inventory information was collected because of device connectivity issues. <p>Note Click Last Sync Details to view the Last Sync Start Time and Reason(s) for Last Sync.</p>
Platform	Cisco product part number.
Device Role	<p>Role assigned to each discovered device during the scan process. The device role is used to identify and group devices according to their responsibilities and placement within the network. If Catalyst Center is unable to determine a device role, it sets the device role to Unknown.</p> <p>Note If you manually change the device role, the assignment remains static. Catalyst Center does not update the device role even if it detects a change during a subsequent device resynchronization.</p> <p>If required, you can use the drop-down list in this column to change the assigned device role.</p>
Site	The site to which the device is assigned. Click Assign if the device is not assigned to any site. Click Choose a Site , select a site from the hierarchy, and click Save . For more information, see Network Hierarchy Overview, on page 157 .
Last Updated	Most recent date and time on which Catalyst Center scanned the device and updated the database with new information about the device.
	<p>Note Click Last Sync Details to view the Last Sync Start Time and Reason(s) for Last Sync.</p>

Column	Description
Resync Interval	The polling interval for the device. Set the resync interval from the Inventory window by choosing Actions > Edit Device > Resync Interval . To set the resync type as Global , from the main menu, choose System > Settings . For more information, see the Cisco Catalyst Center Administrator Guide .
Provisioning Status	<p>Shows the status of the last provisioning operation attempted on a device. Click See Details to view the status of past provisioning operations.</p> <ul style="list-style-type: none"> • Success: The latest operation on the device was successful. • Success with a warning icon: The latest operation on the device was successful, but there are failures from past provisioning operations that may need user attention. • Failed: The latest operation on the device has failed. • Failed with a warning icon: The latest operation on the device has failed, and there are failures from past provisioning operations that may need user attention. • Configuring: The device is currently being configured. • Pending: The system is trying to determine if the device will be impacted by an ongoing provisioning operation. • Not Provisioned: The device has never been provisioned. • Out of Sync: The network settings or network profiles for a device have been modified after the last provisioning operation.
Credential Status	<p>Shows the device credential status:</p> <ul style="list-style-type: none"> • Not Applied: The device credential is not applied on the device. • Success: The device credential is applied on the device successfully. • Failed: The device credential failed on the device. <p>Click See Details to view the details about the credentials.</p> <p>The Credential Status slide-in pane shows the Type, Name/Description, Status, and Details of the credential.</p> <p>For a device whose status is Failed, hover your cursor over the ellipsis icon () in the Actions column and choose Retry or Clear.</p> <ul style="list-style-type: none"> • Retry: Applies the credential on the device. • Clear: Clears the device credential.
AP CDP Neighbors	Displays details about the switch and port connected to an AP in the Inventory window. This window displays information about AP CDP neighbors even if the connected access switch is managed by Catalyst Center.

- **Edit Custom Views:** First you must create a custom view in the **Edit Table Columns** tab, and then you can edit the custom view.
- **Reset All Settings:** Reset the table settings to the default settings.

Display Information About a Device

Step 8

(Optional) To manage your devices from the **Devices** table, you can use the following options:

Name	Description
Tag	You can click Tag to tag devices, edit and delete tags, or create port groups. For more information, see Manage Devices in Inventory, on page 108 .
Add Device	You can click Add Device to add a network or compute device, or integrate a Meraki dashboard or Firepower Management Center (FMC) with Catalyst Center. For more information, see Types of Devices in the Catalyst Center Inventory, on page 85 .
Actions drop-down list	You can use the Actions drop-down list to manage your devices, software images, telemetry, and more. To view more details about each action option, click the right-adjacent information icon (ⓘ).

Step 9

(Optional) In the **Devices** table, you can do the following:

- To sort the columns in either ascending or descending order, click the column header.
- To view more details about a device, click the device name and then click **View Device Details**.
- To view a device's compliance details, click either **Non-Compliant** or **Compliant** under the **Compliance** column.
- To assign a site to a device, click **Assign** under the **Site** column.
- To change a device role, click the edit icon under the **Device Role** column and then choose from the options, such as **ACCESS** or **CORE**.
- To mark an image as Golden or view its needed updates, click **Mark Golden** or **Needs Update** under the **Software Image** column.
- To change the number of entries, scroll down to the bottom of the window, and from the **Show Records** drop-down list, choose the number of entries that you want displayed.

Note that if there are more than 25 entries in the table and you choose a different focus view, the same number of entries is displayed in each new view.

Note Each focus view displays different columns, and you can customize a table view to include columns, such as **Compliance**, **Site**, **Device Role**, and **Software Image**.

Display Information About a Device

You can display, filter, and search for information about a discovered device, its security, and its compliance.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.
- Step 2** In the **Devices** table, click the name of a device and more information about the device is displayed.
- Step 3** Click **View Device Details**.
The device details are displayed in the window.
- Step 4** Use the following table that describes the available information in this window to display, filter, and search for details about a device.

Name	Description
Run Commands	This link is only available for routers, wireless controllers, switches, and hubs. Launch the Command Runner application to run diagnostic CLI commands and view the resulting command output on a device. To launch Command Runner, you must have installed the Command Runner application. For more information, see the <i>Cisco Catalyst Center Administrator Guide</i> .
Learn WLC Config	This link is only available for wireless controllers. Click the link to open Learn Device Configuration window, where you can provision a wireless controller. To open this window, the wireless controller must be reachable and in a Managed state.
View 360	This link is available for all devices. Displays the Device 360 window for that device. To open this window, you must have installed the Assurance application.
Interfaces	This tab is available for all devices except APs. Displays information about the device's ports, such as its Ethernet ports, in a topology or table view. For more information about device interfaces, see Display Information About a Device's Interface, on page 73 .

Display Information About a Device

Name	Description
Layer 2 Configuration	<p>This tab is available only for Cisco Catalyst 9000 Series switches and Cisco IE switches running Cisco IOS-XE 17.3 or later. For a complete list of supported devices, see the Cisco Catalyst Center Compatibility Matrix.</p> <p>Note Classic IE switches are not supported.</p> <p>Displays information about the layer 2 configuration of a device such as VLAN, Discovery Protocols, STP, VTP, and so on.</p> <p>For more information about layer 2 configurations, see View Layer 2 Configuration of a Device, on page 76.</p> <p>This feature is in beta.</p>
Hardware & Software	<p>This tab is available on all devices.</p> <p>Displays the device's hardware and software details, such as its uptime and provision status, with an operational summary.</p>
Configuration	<p>This tab is only available for APs, routers, switches, and hubs.</p> <p>For routers, switches, and hubs, this tab displays detailed configuration information that is similar to what is displayed in the output of the show running-config command. You can hide line numbers, search for a command line or piece of text, or export the CLI output.</p> <p>For APs, this tab displays information about the AP configuration, 2.4-GHz radio configuration, and 5-GHz radio configuration.</p> <p>This feature is not supported for wireless controllers, so configuration data is not returned for this device type.</p>
Power	<p>This tab is only available for routers, switches, and hubs.</p> <p>Displays details about the device's power usage and supplies.</p> <p>To specify or narrow down the data in the Power Supplies table, you can either:</p> <ul style="list-style-type: none"> • Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. • Click the filter icon (▼) to display power supplies by any combination of values, such as values for the Name, Operational Status, and Serial Number fields.

Name	Description
Fans	<p>This tab is only available for routers, switches, and hubs.</p> <p>Displays details about fans.</p> <p>To specify or narrow down the data in the Fans table, you can either:</p> <ul style="list-style-type: none"> Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. Click the filter icon (▼) to display fans by any combination of values for the Name and Operational Status fields.
SFP Modules	<p>This tab is only available for routers, switches, and hubs.</p> <p>Displays details such as the manufacturer and the ports that Small Form-Factor Pluggable (SFP) modules are connected to.</p> <p>To specify or narrow down the data in the SFP Modules table, you can either:</p> <ul style="list-style-type: none"> Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. Click the filter icon (▼) to display SFP modules by any combination of values, such as values for the Name, Platform, and Serial Number fields.
User Defined Fields	<p>This tab is available for all devices.</p> <p>Displays the user-defined fields that are associated with the device.</p> <p>Click Manage User Defined Fields to display the Manage User Defined Fields slide-in pane. You can do the following:</p> <ul style="list-style-type: none"> Click Create New Fields to create a new field. Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. Click the filter icon (▼) to display user-defined fields by any combination of values, such as values for the Name, Description, and Action fields. <p>To add a user-defined field to a device, you first must create a user-defined field in the Manage User Defined Fields slide-in pane. For more information, see Create User-Defined Fields, on page 84.</p> <p>To display a user-defined field, you must assign it to a device and add a value to it. For more information, see Add User-Defined Fields to a Device, on page 84.</p>

Display Information About a Device

Name	Description
Config Drift	<p>This tab is available for all devices.</p> <p>Displays configuration changes on the device, including a change history, and compares two configuration versions. You can do the following:</p> <ul style="list-style-type: none"> • Label the configuration drift on the time line for future reference. For more information, see Label Configuration Drift, on page 132. • Pick any two versions of the same device and compare their running configuration data.
REP Rings	<p>This tab is available for all devices.</p> <p>Displays details about Resilient Ethernet Protocol (REP) rings, such as its name, ring size, first adjacent device, and so on.</p> <p>Click Create REP Ring and follow the workflow to create a REP ring.</p> <p>For more information, see Delete a Node from a REP Ring, on page 624 or Delete a REP Ring, on page 624.</p>
Wireless Info	<p>This tab is only available for wireless controllers.</p> <p>Displays details about managed sites, wireless, redundancy, health parameters, and more.</p> <p>In the Wireless Summary tab, in the SSIDs table, you can search for a specific value by clicking Search Table, manually entering a value, and then pressing the Enter key. The narrowed search results are displayed with the value highlighted throughout the table.</p>
Mobility	<p>This tab is only available for wireless controllers.</p> <p>Displays mobility details, such as the mobility group name, RF group name, and so on.</p> <p>The Mobility Peers table is displayed if mobility peers are configured on the device. If mobility peers are not configured, see Configure Mobility Group, on page 509.</p> <p>You can filter the table to display specific mobility peers by any combination of values, such as values for MAC address, Device Name, and IP Address fields.</p>

Name	Description
Advisories	<p>This tab is available for all devices.</p> <p>Displays a device's advisory details in the Advisories table. You can do the following:</p> <ul style="list-style-type: none"> Click Manage All to display the Security Advisories window to manage your devices and advisories. Click Filter to display advisories by any combination of values, such as values for the Advisory ID and Advisory Title fields. Then click Apply. Click an advisory ID to display more information about that advisory. In the Custom Match Pattern column, click Add match pattern to add or update a condition to match with devices in the CONDITIONS text box. Then you can save the match pattern and run a scan to check the number of devices that match with the match pattern.
Field Notices	Displays information about field notices for the device. See View Field Notices .
Potential Field Notices	Displays information about potential field notices for the device.
Summary	<p>This tab is available for all devices.</p> <p>Displays a device's compliance summary, such as when compliance last ran for the Startup vs Running configuration. You can do the following:</p> <ul style="list-style-type: none"> Click Run Compliance Check to check the device for compliance. Click View Preference for Acknowledged Violations to view the list of acknowledged violation attributes. You can unlist a violation to open it.

Display Information About a Device's Interface

For routers, wireless controllers, switches, or hubs, you can display, search, and filter for information about a device's interface. Depending on the device, certain information is available.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 In the **Devices** table, click the name of a device, and then click **View Device Details**.

Step 3 In the left pane, expand **Interfaces**.

Step 4 Use the following table that describes the **Interfaces** drop-down list options to display details about an interface.

Display Information About a Device's Interface

Name	Description
Ethernet Ports	<ul style="list-style-type: none"> This tab is available for all devices except APs. Displays Ethernet ports details in two views: topology and table. <ul style="list-style-type: none"> The topology view displays the Ethernet port topology of a device with a color-coded system of each port's connection status. The table view displays Ethernet ports details, such as the ports' operational status, admin status, and so on. For more information about the two views, see Display Information About Ethernet Ports, on page 75.
VLANs	<ul style="list-style-type: none"> This tab is only available for switches and hubs. Displays VLAN details, such as its operational status and admin status, in table format. The VLANs table displays the ID of the following types of VLANs: <ul style="list-style-type: none"> VLAN ID of the manufacturing-supplied default VLAN VLAN ID of the configured default VLAN VLAN ID of the configured VLAN <p>To specify or narrow down the data in the VLANs table, you can either:</p> <ul style="list-style-type: none"> Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. Click the filter icon () to display VLANs by any combination of values, such as values for the VLAN Name, VLAN ID, and Operational Status fields.
Virtual Ports	<ul style="list-style-type: none"> This tab is only available for wireless controllers and routers. Displays details about ports, such as its operational status, admin status, and so on. To specify or narrow down the data in the VLANs table, you can either: <ul style="list-style-type: none"> Click Search Table, manually enter a value, and then press the Enter key. The narrowed search results are displayed with the value highlighted throughout the table. Click the filter icon () to display virtual ports by any combination of values, such as values for the Port Name, Operational Status, and Admin Status fields.

Display Information About Ethernet Ports

In the **Ethernet Ports** tab, you can display, search, and filter for certain information about a port or ports through either the topology view or table view.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- Step 2** In the **Devices** table, click a device name, and then click **View Device Details**.
- Step 3** In the left pane, expand **Interfaces** and choose **Ethernet Ports**.
- Step 4** In the upper-right corner, click **Topology View** ( ) to view the Ethernet port topology if it's not already displayed. This view displays the Ethernet port topology of a device with a color-coded system of each port's connection status. Hover your cursor over a port for more details.
- Note** For Cisco Catalyst 4000 Series, 6000 Series, and 9000 Series Switches and Cisco ASR 1000 Series Aggregation Services Routers, this view displays line cards and supervisor cards details, such as the part number and serial number, if the cards are available.
- Step 5** In the topology view, you can do the following:
- To view the error reason for an error-disabled port, click the port.
 - To filter for a specific Ethernet port, use the **Color Code** drop-down list. The following table describes the available drop-down list options.

Table 9: Color Code Drop-Down List Options

Name	Description
Status	Displays the default view of the topology view.
Access VLANs	Displays the access VLAN assigned to a particular port. The Access VLANs view allows you to select a maximum of five access VLANs and lists only the access VLANs associated with the port. This option displays the access VLANs in the following color-coded system: Selected , Not Configured , Default , and VLAN .
Port Channels	Displays the top five port channels that are configured on the device. This option only displays the configured port channels on the device in the following color-coded system: Selected and Port-channel with a corresponding number.

- Step 6** In the upper-right corner, click **Table View** ( ) to view the **Ports** table. The **Ports** table displays Ethernet ports details, such as a ports' operational status, admin status, and so on.
- Step 7** (Optional) To specify or narrow down the data in the **Ports** table, you can:

View Layer 2 Configuration of a Device

- Click **Search Table**, manually enter a value, and then press the **Enter** key. The narrowed search results are displayed with the value highlighted throughout the table.
- Click the filter icon () to display ports by any combination of values, such as values for the **Tags**, **Port Name**, and **Type** fields. Enter the wanted values, and click **Search**.

Step 8 (Optional) In the table view, you can do the following:

- Click **Tag** to tag a port or ports, search for a tag, or manage tags.
For more information, see [Assign Tags to Ports, on page 117](#).
- Click **Export** to export the **Ports** table data.

View Layer 2 Configuration of a Device

You can view, filter, and search for the layer 2 configuration of a device.



Note This feature is in beta.

Before you begin

Make sure that you have devices in your inventory. If not, discover the devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 In the **Devices** table, click the device name, and then click **View Device Details**.

The device details and a summary of the device configurations is displayed. The **Layer 2 Configuration** area displays a summary of the layer 2 configurations on the device.

Step 3 Choose one of the following options to view the layer 2 configuration details:

- In the **Layer2 Configuration** area, click **View Layer 2 Details**.
- In the left pane, expand **Layer 2 Configuration**.

Step 4 Use the following table to view details of the layer 2 configurations.

Name	Description
VLAN	Displays the list of supported VLANs. Click on the VLAN ID to view the VLAN details.
Discovery Protocols	Displays details such as admin status, hold time, timer, and so on, for the discovery protocols.

Name	Description
STP	Displays the STP configurations such as the operational mode, STP port default fast mode, and other default configurations. It also displays a table that lists the supported STP VLANs.
VTP	Displays the VTP details such as VTP mode, VTP version, and other default configurations.
DHCP Snooping	Displays the DHCP Snooping details such as admin status, DHCP snooping on VLANS and other default configurations.
IGMP Snooping	Displays the IGMP Snooping details such as admin status, IGMP Snooping Querier, and other default configurations. It also displays a table that lists the supported IGMP Snooping VLANs.
MLD Snooping	Displays the MLD Snooping configurations and a table that lists the supported MLD Snooping VLANs.
Authentication	Displays the authentication details, such as the authentication status and configuration mode.
Cisco TrustSec	Displays the Cisco TrustSec details such as Device SGT, Authorization List Name, and so on.
Logical Ports	Displays the port channel configurations and the list of supported port channels. Click on the port channel name to view details.
Port Configuration	Displays the list of supported ports. Click on the port name to view the port configuration details.

To edit any of the configurations, click the **Edit** icon in the configuration details window. For more information, see [Edit Layer 2 Configuration of a Device, on page 78](#).

Use the following options to sort, filter, and export the table data displayed in the configuration details window:

- To sort the columns in either ascending or descending order, click the column header.
- Use the **Search Table** option to search for an item.
- Click the filter icon to display the table items by any combination of values.
- Click **Export** to export the table data.
- Click the settings icon to customize the table.

Edit Layer 2 Configuration of a Device

You can edit a device's layer 2 configurations such as, VLAN, Discovery Protocols, STP, and so on.



Note This feature is in beta.

Before you begin

Make sure that you have devices in your inventory. If not, discover the devices using the Discovery feature.

Ensure that the devices are in a reachable state.



Note You cannot edit configurations for devices that are part of a network or network zone or Cisco SD-Access fabric network.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2

In the **Devices** table, click the device name, and then click **View Device Details**.

The device details and a summary of the device configurations is displayed. The **Layer 2 Configuration** area displays a summary of the layer 2 configurations on the device.

Step 3

Choose one of the following options to view the layer 2 configuration details:

- In the **Layer2 Configuration** area, click **View Layer 2 Details**.
- In the left pane, expand **Layer 2 Configuration**.

Step 4

In the left pane, choose the required configuration to edit and click the **Edit** icon in the right pane.

The **Edit Device Configurations** window is displayed. In the left pane, you can choose the configuration to edit.

Step 5

Use the following table to edit the layer 2 configuration, as required.

You can use the following options available in the edit windows:

- **Reset** and **Set to Default** options to reset the settings or to restore the default settings.
- The **x** icon to remove a value from a field and the delete icon to remove a configuration.

Name	Description
VLAN	<p>Choose from the following options to add or edit a VLAN:</p> <ul style="list-style-type: none"> To add a new VLAN, click Add VLAN. Enter the VLAN ID, VLAN Name and add other configurations, if required. To edit a VLAN, check the check box next to the VLAN ID and click Edit. Edit the configurations and add other configurations, as required.
Discovery Protocols	Edit the configurations and add other configurations, as required.
STP	<p>Edit the configurations and add other configurations, as required.</p> <p>Use the Select VLAN option to add or remove VLANs from the STP VLAN table.</p> <p>To edit a VLAN, check the check box next to the VLAN ID and click Edit. Edit the configurations and add other configurations, as required.</p>
VTP	Edit the configurations and add other configurations, as required.
DHCP Snooping	Edit the configurations and add other configurations, as required.
IGMP Snooping	<p>Edit the configurations and add other configurations, as required.</p> <p>Use the Select VLAN option to add or remove VLANs from the IGMP Snooping VLAN table.</p> <p>To edit a VLAN, check the check box next to the VLAN ID and click Edit. Edit the configurations and add other configurations, as required.</p>
MLD Snooping	<p>Edit the configurations and add other configurations, as required.</p> <p>Use the Select VLAN option to add or remove VLANs from the MLD Snooping VLAN table.</p> <p>To edit a VLAN, check the check box next to the VLAN ID and click Edit. Edit the configurations and add other configurations, as required.</p>
Cisco TrustSec	Edit the configurations and add other configurations, as required.

Edit Layer 2 Configuration of a Device

Name	Description
Logical Port	<p>Edit the configurations and add other configurations, as required.</p> <p>In the Port Channel table, use the Add option to add port channels.</p> <ul style="list-style-type: none"> a. From the drop-down list, choose the Port Channel Protocol. b. Enter a Port Channel Name. c. Add other configurations, if required. d. Click Save. <p>To edit a port channel, check the check box next to the Port Channel Name and click Edit. Edit the configurations and add other configurations, as required.</p>
Port Configuration	<p>Check the check box next to the Port Name and click Edit. Edit the configurations and add other configurations, as required.</p>

Step 6 Click **Next**.

Step 7 In the **Schedule Provision** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 8 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

What to do next

After successful provisioning, you can view the updated configurations in the **Layer 2 Configuration** tab under device details in the inventory. If there's any failure, the device inventory displays the existing configurations.

Manage Port Details

You can manage and edit certain port details of a device.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 In the **Devices** table, click a device name, and then click **View Device Details**.

Step 3 In the left pane, expand **Interfaces** and choose **Ethernet Ports**.

Step 4 Click a port in the topology view (), or click a port name in the table view ().

Information about the port is displayed.

- Note**
- For Cisco Catalyst 2000, 3000, and 9000 Series Switches, port details include the port's maximum allocated power and power drawn.
 - This window displays the details of the CDP neighbor. If CDP is not present, the LLDP neighbor details displays. If both CDP and LLDP neighbors are not present, the **Neighbor Details** area is hidden from this window.

Step 5 (Optional) Click **Tag** to tag the port, search for a tag, manage tags, or create a new tag.

For more information, see [Assign Tags to Ports, on page 117](#).

Step 6 (Optional) To manage the port, click the **Port Actions** drop-down list and choose from the following options:

- To shut down the port and change the port's admin status to Down, choose **Port Shut**. Then click **Okay** to confirm. This option is only available when the port is open and the admin status is Up.
- To open the port and change the port's admin status to Up, choose **Port No Shut**. Then click **Okay** to confirm. This option is only available when the port is shut and the admin status is Down.
- To clear the port's MAC address, choose **Clear Mac Address**.
- To activate an error-disabled port, clear the MAC address and shut down the port.

- Note**
- The device software type must be Cisco IOS or Cisco IOS XE to clear the MAC address and shut down a port.
 - For wireless controllers, clearing the MAC address and shutting down the port are not supported.
 - Clearing the MAC address and shutting down the port are supported only on access ports.
 - Port shutdown disrupts the traffic on a port.

Step 7 To edit certain port details, such as the port description area, use the following table.

Name	Description
Access VLAN	Click the Edit icon. In the Edit Access VLAN dialog box, choose an access VLAN from the drop-down list, and then click Save to assign the access VLAN to the port. You cannot update the access VLAN for the ports that have two access VLANs preconfigured.
Voice VLAN	Click the Edit icon next to Voice VLAN . In the Edit Voice VLAN dialog box, choose a voice VLAN from the Select Value drop-down list, and then click Save to assign the voice VLAN to the port.
Port Description	Click the Edit icon next to PORT DESCRIPTION , enter a description, click Save , and then click Okay to add a description to the port. Click the delete icon to delete the description. In the Warning dialog box, click Okay .

- Note**
- The device software type must be Cisco IOS or Cisco IOS-XE to edit VLAN details and the port description.
 - Editing VLAN details is supported only on access ports.
 - For wireless controllers, editing VLAN details is not supported.
-

Inventory User Interface Enhancement

The enhanced Catalyst Center inventory user interface provides the existing inventory features while improving filters and layout for a better user experience.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The enhanced **Inventory** window appears by default and displays the device information gathered during the discovery process.
- Step 2** Click the location option in the top menu bar to select the site, building, or floor from the network hierarchy to manage your device.
- Step 3** Use the device families area appears at the top of the **Inventory** window to select one or more device families.
The available device families are: **Routers**, **Switches**, **Wireless Controllers**, **Access Points**, and **Sensors**.
- Step 4** Use the **Focus** drop-down list to filter the devices based on **Inventory**, **Default**, **Software Image**, **Provision**, **Security**, or **Device Replacement**.
- Step 5** Use the divider bar at the left corner of the **Device** table to collapse or expand the table width.
- Step 6** In the **DEVICE WORK ITEMS** area, select one or more filter criteria to narrow down the devices in the table.
- Step 7** Click **Add Device** to add a new device in the inventory. For more information, see [Add Devices to the Catalyst Center Inventory, on page 86](#).
- Step 8** Use **Tag** to tag a device. For more information, see [Manage Devices in Inventory, on page 108](#).
- Step 9** Use the **Action** drop-down list to perform the device actions on one or more devices.
- Step 10** Click the **i** icon to learn about the list of actions and their respective functionalities.
- Step 11** To edit or customize the inventory table, click the gear icon in the right corner at the top of the table and do the following:
 - a. Click **Table Appearance** to define the **Table Density** and **Table Striping**.
 - b. Click **Edit Table Columns** to select the device information that you want to include in the inventory table during the discovery process.
 - c. Click **Edit Custom Views** to customize your current view.
 - d. Click **Apply** to save the changes or click **Reset All Settings** to apply the default settings for the inventory table.
- Step 12** Use the **Filter Devices** option to apply the advanced filter in your device table. For more information, see [Filter Devices](#).

- Step 13** Click the toggle buttons at the top-right corner to switch between **Dashboard**, **Table**, **Topology**, and **Map** view.
- Step 14** Click **Go to old page** to navigate to old inventory window.
- Step 15** Use **Export** to export all data in the device table.
-

Manage User-Defined Fields

User-defined fields are custom labels that you can create and assign to any device in Catalyst Center. These labels allow you to display more details about the device. For a user-defined field to be displayed, you must assign it to a device and add a value to it.

Create User-Defined Fields

Catalyst Center allows you to create user-defined fields and assign them to any device.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.
- Step 2** In the **Devices** table, click the name of a device, and then click **View Device Details**.
- Step 3** In the left pane, click **User Defined Fields**.
- Step 4** Click **Manage User Defined Fields**.
- Step 5** In the **Manage User Defined Fields** slide-in pane, click **Create New Field**.
- Step 6** In the **Create New Field** dialog box, enter a field name and description.
- Note** You can add device details that are not already present in the **Device Details** window, such as customer IP address and customer device name, in user-defined fields.
- Step 7** Click **Save**.
To create more user-defined fields, click **Create New Field** again.
- Step 8** (Optional) To edit a user-defined field, click the corresponding edit icon, make the required changes, and click **Save**.
- Step 9** (Optional) To delete a user-defined field, click the corresponding delete icon and click **Yes** at the prompt.
-

Add User-Defined Fields to a Device

Before you begin

You must have created at least one user-defined field in the **Manage User Defined Fields** window. See [Create User-Defined Fields, on page 84](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Step 2** Click the name of the device for which you want to add user-defined fields, and then click **View Device Details**.

- Step 3** In the left pane, click **User Defined Fields**.
- Step 4** Click **Add User Defined field**.
- Step 5** From the **Field Name** drop-down list, choose a user-defined field and enter its value in the **Value** field.
For example, if you created a user-defined field for the customer IP address, choose it from the **Field Name** drop-down list, and enter the customer IP address in the **Value** field.
- Step 6** (Optional) To remove a user-defined field from the device, click the corresponding delete icon.
- Step 7** Click **Save**.

Launch Topology Map from Inventory

You can launch the Topology map for the discovered devices from the **Inventory** window.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- Step 2** Use the toggle button ( | ) to switch between the Topology map view and the Inventory view. The Topology map view displays the topology and the provisioning status of the device. Click each node to view the device details. See [About Topology, on page 147](#) for more information on the Topology map.

Note Click **Collapse All** or **Expand All** to collapse and expand the Topology map view.

Types of Devices in the Catalyst Center Inventory

Devices show up in the inventory in one of two ways: by being discovered or by being added manually. Catalyst Center Inventory supports the following types of devices:

- **Network Devices:** Supported network devices include Cisco routers, switches, and wireless devices such as wireless controllers and access points (APs).
- **Compute Devices:** Supported compute devices include the Cisco Unified Computing System (UCS), devices running Cisco Enterprise Network Functions Virtualization Infrastructure Software (NFVIS), and other data center devices.
- **Meraki Dashboard:** Dashboard to the Cisco cloud management platform for managing Cisco Meraki products.
- **Firepower Management Center (FMC):** Provides complete and unified management over Firepower Threat Defense (FTD) devices for managing Cisco network security solutions.
- **Third-Party Device:** Third-party devices are capable of populating SNMP MIB 2 values. Catalyst Center support limited base automation and assurance capabilities, such as Inventory and Topology as a best-effort basis.

For a complete list of supported devices, see the [Cisco Catalyst Center Compatibility Matrix](#).

Add Devices to the Catalyst Center Inventory

You can add new devices or existing devices to the Catalyst Center inventory.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Click **Add Device**.

The **Add Device** slide-in pane appears with options for adding new devices (using Plug and Play) and existing devices.

Step 3 Choose one of the following options to add existing devices to the inventory.

- To add devices using the discovery process, click **Discovery** and follow the workflow. For more information, see [Discover Devices, on page 841](#).
- To add a single device, click **Single Device**. Choose the type of device that you want to add.
 - To add a network device, see [Add a Network Device, on page 87](#).
 - To add a compute device, see [Add a Compute Device, on page 96](#).
 - To integrate the Meraki dashboard, see [Integrate the Meraki Dashboard, on page 100](#).
 - To integrate the Firepower Management Center, see [Integrate Firepower Management Center, on page 101](#).
 - To add a third-party device, see [Add a Third-Party Device, on page 103](#).
- To import device configuration from a CSV file, click **Import Inventory**. For more information, see [Import Device Configurations from a CSV File, on page 127](#).

Step 4 Choose one of the following options to add new devices to the inventory.

New devices are added using the Plug and Play process. You can choose to add a single device, multiple devices, or devices from a Smart Account. Clicking on any of the following tiles takes you to the corresponding options in the **Plug and Play** window.

- To add a single device, click **Single Device**. For more information, see [Add or Edit a Device, on page 455](#)
- To add devices in bulk from a CSV file, click **Bulk Devices**. For more information, see [Add Devices in Bulk, on page 456](#).
- To add devices from a Smart Account, click **Smart Account**. For more information, see [Add Devices from a Smart Account, on page 458](#).

What to do next

You can view and manage the devices in your inventory. For more information, see [Manage Devices in Inventory, on page 108](#). To manage the newly added devices from the **Plug and Play** window, see [View Devices, on page 452](#).

Manage Network Devices

Add a Network Device

You can add a network device to your inventory manually.

Before you begin

Make sure you configure your network device. For more information, see [Discovery Prerequisites, on page 44](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Click **Add Device**.

The **Add Device** slide-in pane appears with options to add devices.

Step 3 In the **Add Existing devices** area, click the **Single Device** tile.

Step 4 From the **Type** drop-down list, choose **Network Device**.

Step 5 In the **Device IP / DNS Name** field, enter the IP address or name of the device.

Note If the device uses the HSRP protocol, you must enter the primary IP address and not the virtual IP address.

Step 6 Expand the **CLI** area, if it is not already expanded, and do one of the following:

- To use global credentials, click the **Select global credential** radio button.

Note If no CLI global credentials are available, create the global CLI credentials in the **Network Settings > Device Credentials** window. See [Add Global CLI Credentials, on page 236](#).

- To configure credentials for the specific device, click the **Add device specific credential** radio button and configure the following fields:

Table 10: CLI Credentials

Field	Description
Name/Description	Name or phrase that describes the CLI credentials. If authentication fails for CLI, Catalyst Center retries the authentication process for 300 seconds (5 minutes).
Username	Name that is used to log in to the CLI of the devices in your network.
Password	Password that is used to log in to the CLI of the devices in your network. For security reasons, re-enter the password as confirmation. Note Passwords are encrypted for security reasons and are not displayed in the configuration.

Add a Network Device

Field	Description
Enable Password	<p>Password used to move to a higher privilege level in the CLI. Configure this password only if your network devices require it.</p> <p>For security reasons, re-enter the enable password.</p> <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

Step 7 Expand the **SNMP** area, if it is not already visible and do one of the following:

- To use global credentials, click the **Select global credential** radio button.

Note If no SNMP global credentials are available, create the global SNMP credentials in the **Network Settings > Device Credentials** window. See [Add Global SNMPv2c Credentials, on page 236](#) and [Add Global SNMPv3 Credentials, on page 237](#).

- Click the **Add device specific credential** radio button and do the following:

Step 8 From the **Version** drop-down list, choose **V2C** (SNMP Version 2c) or **V3** (SNMP Version 3).

If you choose **V2C**, configure the following fields:

Table 11: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

If you choose **V3**, configure the following fields:

Table 12: SNMPv3 Credentials

Field	Description
Name/Description	Name or description of the SNMPv3 settings that you are adding.
Username	Name associated with the SNMPv3 settings.

Field	Description
Mode	<p>Security level that an SNMP message requires. Choose one of the following modes:</p> <ul style="list-style-type: none"> • Authentication and Privacy: Provides both authentication and encryption. • Authentication, No Privacy: Provides authentication, but does not provide encryption. • No Authentication, No Privacy: Does not provide authentication or encryption.
Auth. Type	<p>Authentication type to be used. (Enabled if you select Authentication and Privacy or Authentication, No Privacy as Mode.) Choose one of the following authentication types:</p> <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA. • MD5 (not recommended): Authentication based on HMAC-MD5. <p>Note Catalyst Center does not support device discovery if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>
Auth. Password	<p>SNMPv3 password used for gaining access to information from devices that use SNMPv3. These passwords (or passphrases) must be at least eight characters in length.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • CISCOAES192: 192-bit CBC mode AES for encryption on Cisco devices. • CISCOAES256: 256-bit CBC mode AES for encryption on Cisco devices.

Field	Description
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note</p> <ul style="list-style-type: none"> Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 9 Expand the **SNMP RETRIES AND TIMEOUT** area, if it is not already expanded, and configure the following fields:

Table 13: SNMP Properties

Field	Description
Retries	Number of times Catalyst Center tries to communicate with network devices using SNMP.
Timeout (in Seconds)	Amount of time, in seconds, between retries.

Step 10 Expand the **HTTP(S)** area, if it is not already visible, and do one of the following:

- Click the **Select global credential** radio button if you want to use the global HTTP(S) credentials that have been already created.

Note If no HTTP(S) global credentials are available, create the global HTTP(S) credentials in the **Network Settings > Device Credentials** window. See [Add Global HTTPS Credentials](#).

- Click the **Add device specific credential** radio button and configure the following fields:

Table 14: HTTP(S) Credentials

Field	Description
Read	<p>You can configure up to 10 HTTPS read credentials:</p> <ul style="list-style-type: none"> Name/Description: Name or description of the HTTPS credentials that you are adding. Username: Name that is used to authenticate the HTTPS connection. Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).

Field	Description
Write	<p>You can configure up to 10 HTTPS write credentials:</p> <ul style="list-style-type: none"> • Name/Description: Name or description of the HTTPS credentials that you are adding. • Username: Name that is used to authenticate the HTTPS connection. • Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> • Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).

Step 11 Expand the **NETCONF** area, if it is not already expanded, and configure the **Port** field.

Note NETCONF requires that you configure SSH as the CLI protocol and define the SSH credentials.

Table 15: NETCONF Setting

Field	Description
Port	<p>Port on the device. You can use one of the following ports:</p> <ul style="list-style-type: none"> • Port 830 (default). • Any other port that is available on the device. • A custom port that Catalyst Center configures. (You can use a custom port only if Device Controllability is enabled. For more information, see the Device Controllability section in the Cisco Catalyst Center Administrator Guide.) <p>If authentication fails for NETCONF, Catalyst Center retries the authentication process for 300 seconds (5 minutes).</p> <p>Discovery accepts and validates multiple credentials and only adds devices with working credentials to your inventory. So, if a NETCONF connectivity failure occurs during the discovery process, Catalyst Center adds the device without a NETCONF port. However, if you add a device (that's not NETCONF enabled) manually to your inventory with the NETCONF credential, Catalyst Center displays the error “Managed: Netconf Connection Failure” if there’s no response to the RPC request on the NETCONF port. In both cases, if the device is added without the NETCONF port and if any application uses only NETCONF to collect data, Catalyst Center displays the missing NETCONF port error. If any application uses the CLI credentials when NETCONF is not configured, Catalyst Center displays the device in the managed state because the device is using the CLI credentials.</p>

Step 12 Select one of the network **Protocol** radio button that enables Catalyst Center to communicate with remote devices. Valid values are **SSH2** or **Telnet**.

Step 13 (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows valid credentials with a green tick mark and invalid credentials with a red cross mark.

Update Network Device Credentials

All the credentials will be validated except the SNMP Write credentials.

Step 14 Click **Add**.**Update Network Device Credentials**

You can update the discovery credentials of selected network devices. The updated settings override the global and job-specific settings for the selected devices.

**Note**

You cannot update credentials of a third-party device discovered by Catalyst Center.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

You must have either administrator (ROLE_ADMIN) or policy administrator (ROLE_POLICY_ADMIN) permissions and the appropriate RBAC scope to perform this procedure.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Select the network devices that you want to update.**Step 3** From the **Actions** drop-down list, choose **Inventory > Edit Device**.**Step 4** In the **Edit Device** dialog box, choose **Network Device** from the **Type** drop-down field, if it is not already selected.**Step 5** Expand the **CLI** area, if it is not already expanded, and do one of the following:

- If you want to use the global CLI credentials that have been already created, click the **Select global credential** radio button.

Note If no CLI global credentials are available, create them in the **Network Settings > Device Credentials** window. See [Add Global CLI Credentials](#).

- Click the **Edit device specific credential** radio button and configure the following fields:

Table 16: CLI Credentials

Field	Description
Username	Name that is used to log in to the CLI of the devices in your network.
Password	Password that is used to log in to the CLI of the devices in your network. For security reasons, re-enter the password as confirmation. Passwords are encrypted for security reasons and are not displayed in the configuration.
Enable Password	Password that is used to move to a higher privilege level in the CLI. For security reasons, re-enter the enable password. Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 6

Expand the **SNMP** area, if it is not already expanded, and do one of the following:

- If you want to use the global SNMP credentials that have been already created, click the **Select global credential** radio button.

Note If no SNMP global credentials are available, create them in the **Network Settings > Device Credentials** window. See [Add Global SNMPv2c Credentials](#) and [Add Global SNMPv3 Credentials](#).

- Click the **Edit device specific credential** radio button and do the following:

Step 7

From the **Version** drop-down list, choose **V2C** (SNMP Version 2c) or **V3** (SNMP Version 3).

If you chose **V2C**, configure the following fields:

Table 17: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> • Name/Description: Name or description of the SNMPv2c settings that you are adding. • Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> • Name/Description: Name or description of the SNMPv2c settings that you are adding. • Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

If you chose **V3**, configure the following fields:

Table 18: SNMPv3 Credentials

Field	Description
Name/Description	Name or description of the SNMPv3 settings that you are adding.
Username	Name associated with the SNMPv3 settings.
Mode	Security level that an SNMP message requires. Choose one of the following modes: <ul style="list-style-type: none"> • Authentication and Privacy: Provides both authentication and encryption. • Authentication, No Privacy: Provides authentication, but does not provide encryption. • No Authentication, No Privacy: Does not provide authentication or encryption.

Update Network Device Credentials

Field	Description
Auth. Type	<p>Authentication type to be used. (Enabled if you select Authentication and Privacy or Authentication, No Privacy as Mode.) Choose one of the following authentication types:</p> <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA. • MD5 (not recommended): Authentication based on HMAC-MD5. <p>Note Catalyst Center does not support device discovery if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>
Auth. Password	<p>SNMPv3 password used for gaining access to information from devices that use SNMPv3. These passwords (or passphrases) must be at least eight characters in length.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • CISCOAES192: 192-bit CBC mode AES for encryption on Cisco devices. • CISCOAES256: 256-bit CBC mode AES for encryption on Cisco devices.
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 8 Expand the **SNMP RETRIES AND TIMEOUT** area, if it is not already expanded, and configure the following fields.

Table 19: SNMP Properties

Field	Description
Retries	Number of attempts allowed to connect to the device. Valid values are from 1 to 3. The default is 3.
Timeout	Number of seconds Catalyst Center waits when trying to establish a connection with a device before timing out. Valid values are from 1 to 300 seconds in intervals of 5 seconds. The default is 5 seconds.

Step 9 Expand the **HTTP(S)** area, if it is not already expanded, and do one of the following:

- a) If you want to use the global HTTP(S) credentials that have been already created, click the **Select global credential** radio button.

Note If no HTTP(S) global credentials are available, create them in the **Network Settings > Device Credentials** window. See [Add Global HTTPS Credentials](#).

- b) Click the **Edit device specific credential** radio button and configure the following fields:

Table 20: HTTP(S)

Field	Description
Username	Name that is used to log in to the HTTP(S) of the devices in your network.
Password	Password that is used to log in to the HTTP(S) of the devices in your network. For security reasons, re-enter the password as confirmation. Passwords are encrypted for security reasons and are not displayed in the configuration.
Port	Specify the required HTTP(s) port number.

Step 10 Expand the **NETCONF** area, if it is not already expanded, and configure the **Port** field.

NETCONF requires that you configure SSH as the CLI protocol and define the SSH credentials.

Step 11 Select one of the network **Protocol** radio buttons that enables Catalyst Center to communicate with remote devices. Valid values are **SSH2** or **Telnet**.

Step 12 (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows the valid credentials with green tick mark and invalid credentials with red cross mark.

If you have chosen more than one device for updating the credentials, the **Validation** button will be disabled.

Step 13 Click **Update**.

Security Focus for Network Devices

The Catalyst Center security focus allows you to view the results of the trustworthy checks on your devices.

Few security checks are performed to ensure that your Cisco devices are authentic and are not compromised or altered physically.

View the Integrity Verification Status of a Device

As a part of device identity verification, following checks are performed:

- Verification of Secure Unique Device Identifier (SUDI) certificate chain.
- Signature verification of SUDI certificate response of the device.
- Product ID verification with the SUDI certificate.
- Serial number verification with the SUDI certificate.

These checks are triggered under the following circumstances:

- Every time Inventory gets collected in the Catalyst Center.
- When you make any configuration changes on your devices.
- When you make any image upgrades in your devices.

The following CLI command is used to perform device identity verification check:

```
show platform sudi certificate sign nonce ${randomNonceValue}
```

View the Integrity Verification Status of a Device

This procedure explains how to view the status of the integrity verification check.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 From the **Focus** drop-down menu, choose **Security**.

Step 3 In the **Devices** table, if the **Integrity Verification** column for your device displays **Failed** as the status, click the information icon (ⓘ) to display the reason.

Note If the **Integrity Verification** column is not displayed, see [Display Information About Your Inventory, on page 63](#).

Manage Compute Devices

Add a Compute Device

You can add a compute device to your inventory manually. A compute device includes devices such as the Cisco Unified Computing System (UCS), devices running Cisco Enterprise Network Functions Virtualization Infrastructure Software (NFVIS), and other data center devices.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Click **Add Device**.

The **Add Device** slide-in pane appears with options to add devices.

- Step 3** In the **Add Existing devices** area, click the **Single Device** tile.
- Step 4** From the **Type** drop-down list, choose **Compute Device**.
- Step 5** In the **Device IP / DNS Name** field, enter the IP address or name of the device.
- Step 6** Expand the **HTTP(S)** area, if it is not already expanded, and do one of the following:
- If you want to use the global HTTP(S) credentials that have been already created, click the **Select global credential** radio button.
- Note** If no HTTP(S) global credentials are available, create them in the **Network Settings > Device Credentials** window. See [Add Global HTTPS Credentials, on page 240](#).
- Click the **Add device specific credential** radio button and configure the following fields:

Table 21: HTTP(S)

Field	Description
Username	Name used to authenticate the HTTPS connection.
Password	Password used to authenticate the HTTPS connection.
Port	Number of the TCP/UDP port used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).

- Step 7** Expand the **CLI** area, if it is not already expanded, and do one of the following:
- If you want to use the global CLI credentials that have been already created, click the **Select global credential** radio button.
- Note** If no CLI global credentials are available, create them in the **Network Settings > Device Credentials** window. See [Add Global CLI Credentials, on page 236](#).
- Click the **Add device specific credential** radio button and configure the following fields:

Table 22: CLI Credentials

Field	Description
Username	Name that is used to log in to the CLI of the devices in your network.
Password	Password that is used to log in to the CLI of the devices in your network. For security reasons, re-enter the password as confirmation. Passwords are encrypted for security reasons and are not displayed in the configuration.
Enable Password	Password that is used to move to a higher privilege level in the CLI. For security reasons, re-enter the enable password. Passwords are encrypted for security reasons and are not displayed in the configuration.

- Step 8** Expand the **SNMP** area, if it is not already expanded, and do one of the following:

Add a Compute Device

- a) If you want to use the global SNMP credentials that have been already created, click the **Select global credential** radio button.

Note If no SNMP global credentials are available, create them in the **Network Settings > Device Credentials** page. See [Add Global SNMPv2c Credentials, on page 236](#) and [Add Global SNMPv3 Credentials, on page 237](#).

- b) Click the **Add device specific credential** radio button and do the following:

Step 9 From the **Version** drop-down list, choose **V2C** (SNMP Version 2c) or **V3** (SNMP Version 3).

If you chose **V2C**, configure the following fields:

Table 23: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> Name/Description: Name or description of the SNMPv2c settings that you are adding. Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

If you chose **V3**, configure the following fields:

Table 24: SNMPv3 Credentials

Field	Description
Name/Description	Name or description of the SNMPv3 settings that you are adding.
Username	Name associated with the SNMPv3 settings.
Mode	Security level that an SNMP message requires. Choose one of the following modes: <ul style="list-style-type: none"> Authentication and Privacy: Provides both authentication and encryption. Authentication, No Privacy: Provides authentication, but does not provide encryption. No Authentication, No Privacy: Does not provide authentication or encryption.

Field	Description
Auth. Type	<p>Authentication type to be used. (Enabled if you select Authentication and Privacy or Authentication, No Privacy as Mode.) Choose one of the following authentication types:</p> <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA. • MD5 (not recommended): Authentication based on HMAC-MD5. <p>Note Catalyst Center does not support device discovery if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>
Auth. Password	<p>SNMPv3 password used for gaining access to information from devices that use SNMPv3. These passwords (or passphrases) must be at least eight characters in length.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • CISCOAES192: 192-bit CBC mode AES for encryption on Cisco devices. • CISCOAES256: 256-bit CBC mode AES for encryption on Cisco devices.
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 10 (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows the valid credentials with green tick mark and invalid credentials with red cross mark.

Update Compute Device Credentials

All the credentials will be validated except the SNMP Write credentials.

- Step 11** Click **Add**.
-

Update Compute Device Credentials

You can update the discovery credentials of selected compute devices. The updated settings override the global and job-specific settings for the selected devices.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

- Step 2** Select the devices that you want to update.

- Step 3** From the **Actions** drop-down list, choose **Inventory > Edit Device**.

- Step 4** In the **Edit Device** dialog box, from the **Type** drop-down list, choose **Compute Device**.

- Step 5** Expand the **HTTP(S)** area, if it is not already expanded.

- Step 6** In the **Username** and **Password** fields, enter the username and password.

- Step 7** In the **Port** field, enter the port number.

- Step 8** (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows valid credentials with a green tick mark and invalid credentials with a red cross mark.

If you have chosen more than one device for updating the credentials, the **Validation** button is disabled.

- Step 9** Click **Update**.
-

Manage Meraki Dashboards**Integrate the Meraki Dashboard**

You can integrate your Meraki dashboard with Catalyst Center.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

- Step 2** Click **Add Device**.

The **Add Device** slide-in pane appears with options to add devices.

- Step 3** In the **Add Existing devices** area, click the **Single Device** tile.

- Step 4** From the **Type** drop-down list, choose **Meraki Dashboard**.

- Step 5** Expand the **HTTP(S)** area, if it is not already expanded.

- Step 6** In the **API Key/Password** field, enter the API key and password credentials and click the **Get Organization details** link.
- Step 7** From the **Organization** drop-down list, select the organization options, or search for an organization name.
- Step 8** (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows valid credentials with a green tick mark and invalid credentials with a red cross mark.
- Step 9** Click **Add**.
- Only the selected organizations start collecting for the Meraki dashboard and devices.

Update Meraki Dashboard Credentials

You can update the Meraki dashboard credentials of selected devices. The updated settings override the global and job-specific settings for the selected devices.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.
- Step 2** Select the devices that you want to update.
- Step 3** From the **Actions** drop-down list, choose **Inventory > Edit Device**.
- Step 4** In the **Edit Device** slide-in pane, from the **Type** drop-down list, choose **Meraki Dashboard**.
- Step 5** Expand the **HTTP(S)** area, if it is not already expanded.
- Step 6** In the **API Key / Password** field, enter the API key and password credentials used to access the Meraki dashboard.
- Step 7** In the **Port** field, enter the port number.
- Step 8** (Optional) Click **Validate** next to **Credentials**. Catalyst Center validates the device credentials and shows valid credentials with a green tick mark and invalid credentials with a red cross mark.
If you have chosen more than one device for updating the credentials, the **Validation** button is disabled.
- Step 9** Click **Update**.

Manage Firepower Management Center

Integrate Firepower Management Center

You can integrate your Firepower Management Center (FMC) with Catalyst Center.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.
- Step 2** Click **Add Device**.

Update Firepower Management Center Credentials

The **Add Device** slide-in pane appears with options to add devices.

Step 3 In the **Add Existing devices** area, click the **Single Device** tile.

Step 4 From the **Type** drop-down list, choose **Firepower Management Center**.

Step 5 In the **Device IP / DNS Name** field, enter the IP address or name of the device.

Step 6 Expand the **HTTP(S)** area if it is not already expanded.

The **Add device specific credential** radio button is chosen by default.

Step 7 Enter the following information:

- Username:** Name used to authenticate the HTTPS connection.
- Password:** Password used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration.
- Port:** The number of the TCP/UDP port used for HTTPS traffic. The default port number is 443.

Step 8 Click **Add**.

Note When you add FMC to inventory, the Firepower Threat Defense (FTD) devices managed by FMC are also added to inventory automatically. The available High Availability (HA) pairs with details of active and standby FTDs are shown in the **Inventory** window.

Step 9 To view the HA details of the paired FTDs, do the following:

- Click the device name of FTD.
- Click **View Device Details**.

The paired FTD name is shown in the Device Details window. You can click the paired FTD name to view the paired FTD details.

- In the Device Details window, click **High Availability Details**.

You can view the **HA Pair Info**, **High Availability Link**, and **State Link** details.

Update Firepower Management Center Credentials

Catalyst Center allows you to update the Firepower Management Center (FMC) credentials. The updated settings override the global and job-specific settings for the selected devices.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Choose the FMC device that you want to update.

Note You cannot update, edit, or delete the Firepower Threat Defense (FTD) devices that are managed by FMC. You must manage FTD devices via FMC in inventory.

Step 3 From the **Actions** drop-down list, choose **Inventory > Edit Device**.

- Step 4** In the **Edit Device** slide-in pane, click **Credentials**.
- Step 5** Expand the **HTTP(S)** area if it is not already expanded.
- The **Add device specific credential** radio button is chosen by default.
- Step 6** Enter the following information:
- Username**: Name used to authenticate the HTTPS connection.
 - Password**: Password used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration.
 - Port**: The number of the TCP/UDP port used for HTTPS traffic. The default port number is 443.
- Step 7** Click **Management IP** and enter the IP address or name of the device in the **Device IP / DNS Name** field.
- Step 8** Click **Resync Interval** and choose a resync interval type:
- Custom**: You can enter the resync interval in minutes. The valid ranges are from 25 to 1440 minutes (24 hours).
 - Global**: By default, resync interval is set to 1440 minutes (24 hours).
 - Disable**: Resync interval is disabled or set to zero.
- Step 9** Click **Role** and choose a role in the **Device Role** drop-down list.
- Step 10** Click **Update**.
-

Add a Third-Party Device

You can add a third-party device to your inventory manually. Catalyst Center support limited base automation and assurance capabilities, such as Inventory and Topology as a best effort basis.

For third-party devices, reachability and interface related metrics are captured as part of Assurance capabilities. For more information, see [Cisco Catalyst Assurance User Guide](#).

Some of the third-party devices are capable of populating SNMP MIB-II values. For more information, see the [Cisco Catalyst Center Compatibility Matrix](#).

Before you begin

Make sure you configure your network device.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window displays the device information.
- Step 2** Click **Add Device**.
The **Add Device** slide-in pane is displayed.

Add a Third-Party Device

Add Device

Add Existing devices

Add existing devices in your network using one of the following methods.



Discovery



Single Device



Import Inventory

Add New devices

Add new devices using one of the following methods. To claim and manage newly added devices, use [Plug and Play](#)

**Step 3**

To add a device to your network, click the **Single Device** tile in the **Add Existing devices** area and do the following:

- Choose **Third Party Device** from the **Type** drop-down list.
 - In the **Device IP / DNS Name** field, enter the IP address or unique name for the device.
 - (Optional) Click **Validate** hyperlink in **Credentials** area to validate the device credentials. Valid credentials are authenticated with a green tick mark and invalid credentials are flagged with a red cross mark.
- Note** All the credentials will be validated except the SNMP Write credentials.
- Expand the **SNMP** area, if it is not already expanded, and do one of the following:
 - To use global SNMP credentials, choose the **Select global credential** radio button and click the **Network Settings > Device Credentials** hyperlink to add the credentials. For more information, see [Add Global SNMPv2c Credentials](#), on page 236 and [Add Global SNMPv3 Credentials](#), on page 237.

2. To use device-specific credentials, choose the **Add device specific credential** radio button and do the following:
 - a. Choose **V2C** (SNMP version 2c) or **V3** (SNMP version 3), from the **Select Value** drop-down list.
 - b. If you choose **V2C**, configure the following fields:

Table 25: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

- c. If you choose **V3**, configure the following fields:

Table 26: SNMPv3 Credentials

Field	Description
Username	Name associated with the SNMPv3 settings.
Mode	<p>Security level that an SNMP message requires. Choose one of the following modes:</p> <ul style="list-style-type: none"> Authentication and Privacy: Provides both authentication and encryption. Authentication, No Privacy: Provides authentication, but does not provide encryption. No Authentication, No Privacy: Does not provide authentication or encryption.

Add a Third-Party Device

Field	Description
Authentication Type	<p>Authentication type to be used (enabled if you select Authentication and Privacy or Authentication, No Privacy as Mode). Choose one of the following authentication types:</p> <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA. • MD5 (not recommended): Authentication based on HMAC-MD5. <p>Note Catalyst Center does not support device discovery if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>
Authentication Password	<p>SNMPv3 password used for gaining access to information from devices that use SNMPv3. These passwords (or passphrases) must be at least eight characters in length.</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Type	<p>Privacy type. (Enabled if you select Authentication and Privacy as Mode.) Choose one of the following privacy types:</p> <p>AES128: 128-bit CBC mode AES for encryption.</p> <p>Note Privacy type AES128 is supported for Discovery, Inventory, and Assurance.</p>

Field	Description
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support encryption standards. Passwords (or passphrases) must be at least eight characters long.</p> <p>Note</p> <ul style="list-style-type: none"> Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. Passwords are encrypted for security reasons and are not displayed in the configuration.

- e) In the **SNMP Retries and Timeout** area, configure the following fields:

Table 27: SNMP Properties

Field	Description
Retries	Number of times Catalyst Center tries to communicate with network devices using SNMP.
Timeout (in Seconds)	Time interval between the retries.

Step 4 Click **Add**.

Filter Devices

In the **Inventory** window, you can choose from basic or advanced filtering options to filter for device details in the **Devices** table.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Click **Filter devices**.

The following table describes the available filtering options.

Name	Description
Quick Filters	You can choose from basic filtering options to narrow down the device details. For example, you can toggle the Manageability filter option to Managed to see all the managed devices.

Name	Description
Advanced Filters	<p>You can set the filtering criteria using operators, such as Contains and Regex (Regular Expression), to narrow down the device details.</p> <p>For example, in the Tags drop-down list, you can choose the Contains operator and enter ipsec in the Tags field. Then from the autocomplete drop-down list, you can choose one option, such as branch-router-ipsec, which would filter for branch routers that are tagged with IP Security.</p> <p>You must enter filter criteria values based on the available data.</p>
Recent Filters	<p>In the RECENT area, you can choose a recent filter to reapply.</p> <p>To save a recent filter, drag and drop a recent filter to the SAVED area.</p>

Step 3

Choose a filtering option and enter the appropriate value in the selected filter field.

Catalyst Center presents you with autocomplete values as you enter values in the other fields. Choose one of the suggested values or finish entering the wanted value.

You can also use a wildcard (asterisk) with these filters. For example, you can enter values with an asterisk at the beginning, end, or in the middle of a string value. Then, press **Enter**.

Step 4

Click **Apply** to filter the information.

The data displayed in the **Devices** table updates automatically according to your filter selection.

Note You can use several filter types and more than one value per filter.

Step 5

(Optional) If needed, add more filters.

Step 6

(Optional) To remove all the filters, in the **Filter devices** field, click the **x** and then click **Apply**.

Step 7

(Optional) To delete a specific filter value, in the **Filter devices** field, drag your cursor over the value, press **Delete**, and then click **Apply**.

Manage Devices in Inventory

The following sections provide information about how to assign devices to sites and manage device tags by using the **Inventory** window.

Add a Device to a Site

**Note**

Third-party devices can be assigned to a site, but the devices are not managed by Catalyst Center, it is only for visibility.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Check the check box for the devices that you want to assign to a site.

Note You cannot assign Firepower Threat Defense (FTD) high availability (HA) paired devices to different sites. Both the paired devices must be assigned to the same site.

Step 3 From the **Actions** menu, choose **Provision > Assign Device to Site**.

Step 4 In the **Assign Device to Site** slide-in pane, click the link next to the Site icon () for the device.

Step 5 In the **Choose a floor** slide-in pane, select the floor to assign to the device and click **Save**.

Step 6 (Optional) If you select multiple devices to add to the same location, check the **Apply to All** check box for the first device to assign its location to the rest of the devices and click **Next**.

Step 7 Review summary settings and click **Next**.

Note Application Telemetry and Controller-Based Application Recognition (CBAR) is enabled on the applicable network devices by default, if you enable Application Telemetry and CBAR on **Design > Network Settings > Telemetry** window. For more information, see [Configure Syslog, SNMP Traps, NetFlow Collector Servers, and Wired Client Data Collection Using Telemetry](#), on page 31.

Application and Endpoint Visibility enablement is skipped by default for the devices that does not support Controller-Based Application Recognition (CBAR) enablement or undeployed Application Visibility Service (AVS).

Step 8 Based on the Visibility and Control of Configurations settings, choose an available option. For more information, see [Visibility and Control of Device Configurations](#), on page 132.

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations](#), on page 132.

Step 9 In the **Task Name** field, enter a task name.

Step 10 Do the following:

- If you chose **Now** or **Later**, click **Assign**.
- If you chose **Generate configuration preview**, click **Preview**.

Step 11 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks](#), on page 137.

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 12 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Device Configurations, on page 132](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Note If only MD5 authentication type is configured on the device, the site assignment will be blocked for devices with software image version or golden tagged image version 17.14.1 and later.

To continue the site assignment, you must configure SHA authentication as well. For information on how to configure SHA as the authentication type for SNMP credentials, see [Edit Global Device Credentials](#).

Step 13 When assigning devices to a site, if Device Controllability is enabled, a workflow is automatically triggered to push the device configuration from the site to the devices.

From the **Focus** drop-down list, choose **Provision** and click **See Details** in the **Provision Status** column. The configuration that is pushed to the device is shown in a separate window if you enabled Device Controllability.

What to do next

You can view the status of the task on the **Tasks** window. To navigate to the **Tasks** window, click the menu icon and choose **Activities > Tasks**.

Tag Devices

A device tag allows you to group devices based on an attribute or a rule. A single device can have multiple tags; similarly, a single tag can be applied to multiple devices.

You can add tags to or remove tags from devices in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Check the check box next to the device(s) for which you want to apply a tag, and then click **Tag**.

Step 3 Enter a tag name in the **Tag Name** field.

- If you are creating a new tag, click **Create New Tag**. You also can create a new tag with a rule. See [Tag Devices Using Rules, on page 112](#).
- If you are using an existing tag, select the tag from the list, and then click **Apply**.

A tag icon and the tag name(s) appear under the device name(s) for which you applied the tag(s).

Step 4 To remove a tag from a device, do one of the following:

- Select the device and click **Tag**. Unselect all tags, and then click **Apply**.
- Hover the cursor over the yellow tag icon or tag name, and then click delete icon to disassociate the tag from the device.

Create a Network Device Group Tag

Use this procedure to create a Network Device Group (NDG) tag.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Check the check box next to the device for which you want to apply a tag, and then click **Tag**.

Step 3 Click **Create New Tag**.

For the naming pattern, use the prefix **NDG:** and set the tag with the parent child hierarchy. For example, use Location#All Locations, Device Type#All Device Types, or IPSEC#Is IPSEC.

Note

- Custom roots are not allowed while creating the NDG tag.
- Only one NDG tag can be added per NDG type for a device.
- The maximum level of hierarchy, including parent and roots, is limited to seven.
- Each level name cannot exceed 32 characters. The tag length cannot exceed 100.
- NDG tags support the basic ASCII character set.

A tag icon and the tag name(s) appear under the device name(s) for which you applied the tag(s).

Note

Tags that are prefixed with **NDG:** are reflected in Cisco ISE.

Tag Devices Using Rules

You can group devices based on tags in which you define a rule. When you define a rule, Catalyst Center automatically applies the tag to all devices that match the specified rule. Rules can be based on device name, device family, device series, IP address, location, or version.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. The **Inventory** window displays the device information gathered during the discovery process.
- Step 2** Check the check box next to the device(s) for which you want to apply a tag, then click **Tag**.
- Step 3** Enter a tag name in the **Tag Name** field, then click **Create New Tag with Rule**.
The **Create New Tag** window appears.
The **Manually Added** field under **Total Devices Tagged Count** indicates the number of devices you selected.
- Step 4** Click **Add Condition**, then complete the required fields for the rule.
The **Matching Devices** number automatically changes to indicate how many devices match this condition.
You can have two options to create additional conditions:
- **And** conditions: Click the **Add Condition** link. **And** appears above the condition.
 - **Or** conditions: Click the add icon (+) next to an existing condition. **Or** appears next to the condition.
- You can add as many conditions as needed. As you make changes to the rule, the Matching Devices count changes to reflect how many devices in the inventory match the rule you specified. You can click on the device number to view the devices that match the rule.
- Step 5** Click **Save** to save your tag with the defined rule.
A tag icon and the tag name(s) appear under the device name(s) for which you applied the tag(s).
As devices are added to the inventory, if they match the rules you defined, the tag is automatically applied to the devices.
-

Edit Device Tags

You can edit device tags that you previously created.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. The **Inventory** window displays device information gathered during the discovery process.
In the **Device Name** column, you can see any previously created device tags listed under the device names.
- Step 2** Without selecting any devices, click **Tag**.
The previously created tags are listed.
- Step 3** Click **Manage Tags**.
The **All Tags** slide-in pane is displayed.

Step 4 Click the pencil icon next to the tag that you want to edit.

Step 5 Make changes to the tag, then click **Save**.

Delete Tags

You can delete a device tag or template tag only if it is not associated with a device or template.

Before you begin

Remove the tag that is associated statically or dynamically (using rules) with the device.

Remove the tag that is associated with a template.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Without selecting any devices, choose **Tag > Manage Tags**.

Step 3 Hover your cursor over the tag that you want to delete, then click the delete icon next to the tag name.

Step 4 At the prompt, click **Yes**.

An error message is generated if the tag is associated with a device or template. Remove the tag associated with the device or template and delete the tag.

Configure a REP Ring for Devices

The Resilient Ethernet Protocol (REP) ring provides a way to control network loops, handle link failures, and improve convergence time.



Note

- Limitation of a REP Ring: You should not select a root node that has connectivity only through interfaces of the ring.
 - Device support for REP Ring (nonfabric): Cisco Catalyst Industrial Ethernet Series Switch 3100, 3200, 3300, 3400, 4000, 5000, and 9300. Cisco Embedded Services 3300 Series Switches (ESS3300), S5200, and S5800.
-

Before you begin

- Make sure the devices are onboarded and are in reachable state.
- Identify the devices and its interfaces that terminate the REP ring.
- Make sure all the interfaces which are part of the ring are configured with “switchport mode trunk”.

Add a Node to a REP Ring for Nonfabric Deployment

-
- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Configure REP Ring (Non-Fabric)**. Alternatively, you can navigate to the **Inventory** Site topology view, select the device node on which you want to create the REP ring, and click **Create REP Ring** under the **REP Rings** tab.
- Step 2** If a task overview window appears, click **Let's Do It** to go directly to the workflow.
- Step 3** In the **Select a root device** window, select the root device.
- Note** The device must be in reachable state and have upstream connection.
- Step 4** In the **Select adjacent devices connected to root device** window, choose one adjacent device that is part of the ring and connected to the root device.
- Step 5** In the **Select adjacent devices connected to root device** window, choose other adjacent device that is part of the same ring and connected to the root device.
- You need to choose two devices, part of the same ring and directly connected to the root device.
- Step 6** **Review and Edit** your root device, and the chosen adjacent devices.
- Step 7** To initiate the REP ring configuration, click **Provision**.
- You can see a detailed status of the configuration progress on the **REP Ring Configuration Status** window.
- Step 8** The **REP Ring Summary** window displays the details of the REP ring that is created along with the discovered devices. After the creation of the REP ring, a success message is displayed.
- Step 9** To verify the creation of the REP ring, go to the **Inventory** window topology view and click any device that is part of the ring. In the slide-in pane, under the **REP Rings** tab, you can see the list of all REP rings that exist on that device. Click a REP ring name in the list to view the REP ring details, such as the devices present in the ring, ports of each device that connect to the ring, and so on.

Add a Node to a REP Ring for Nonfabric Deployment

Use this procedure to add a node to an existing REP ring.



Note The feature supports the following platforms: IE2000, IE3200, IE3300, IE3400, IE3400H, IE4000, IE4010, IE5000, IE9300 and ESS3300.

Before you begin

Make sure you add the device to Catalyst Center. For information on how to add a device, see [Add or Edit a Device, on page 455](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Plug and Play**. The device onboarded is shown in the **Plug and Play** window.

- Step 2** From the **Actions** drop-down list, click **Claim**.
- Step 3** In **Assign Site** window, click **Assign** to assign the device to a site and click **Next**.
- Step 4** To deploy the configuration to the device, click **Assign** and click **Next**.
- Note** Plug and Play provisioning automatically deploys a device onboarding configuration template that corresponds to the type of device. For more information, see [Plug and Play Provisioning Overview, on page 445](#).
- Step 5** In the **Provision Templates** window, click **Preview Configuration** to review the configuration and click **Claim**.
- Step 6** Click **Ok** and **Yes**.
A success message is displayed upon claiming the device.
- Step 7** Click **Refresh**. The device onboarding process might take some time.
By default, the devices table gets refreshed every 30 seconds. Click the **Auto-Refresh** drop-down list and choose a refresh time.
On completion of the process, the device is moved to the **Provisioned** tab.
- Step 8** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- Step 9** Click **Refresh** and wait until the device is in managed state.
- Step 10** Use the toggle button (|) to switch between the Topology map view and the Inventory view. The change in the topology automatically triggers device rediscovery and the device is added to the REP.
- Step 11** Click the REP and in the slide-in pane, click the **REP Rings** tab. The node insertion status is **Success** for successful addition of the device to the REP.
- Step 12** In the REP Rings tab, click the **REP** link to view the steps executed. If any failure occurs, you can view the step at which the device insertion failed.
- Step 13** (Optional) Under the **Actions** column, click the ellipsis to rediscover the failed node insertion.

Delete a Node from a REP Ring for Nonfabric Deployment

You can remove a node from an existing REP ring for nonfabric deployment.

The following devices can be deleted from a REP ring:

- Cisco Industrial Ethernet (IE) 2000, 3100, 4000, 4010, 5000 Series Switches
- Cisco Catalyst IE 3200, 3300, 3400, 3400H, 9300, 9310, 9320 Rugged Series Switches
- Cisco Embedded Services 3300 (ESS3300) and 9300 (ESS9300) Series Switches
- Stratix 5400, 5410, and 5800 Switches

The feature has the following limitations:

- If you remove an unreachable device, and instead of connecting the REP-configured ports, you connect the other port of reachable devices, the REP discovery fails.
- You can't delete the root device.

- If a REP ring contains both physical channels and port channels, deleting a node may break the REP ring.

Before you begin

Ensure that the REP ring to which the node belongs isn't incomplete.

Step 1 Manually remove the device from the network.

Step 2 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 3 Use the toggle button ( | ) to switch to the Topology map view.

If a REP ring has any unreachable devices (manually removed devices or devices that went down), a warning alert is displayed.

Step 4 In the warning alert, click the REP ring link.

The slide-in pane for the corresponding REP ring opens.

Step 5 In the **REP Rings** tab, under the **Actions** column, hover your cursor over the ellipsis icon () and click **Rediscover**.

Step 6 In the dialog box, click **Yes**.

The device is deleted from the REP ring, and the REP ring details are updated.

Create Port Groups

You can group ports based on an attribute or rule.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays device information gathered during the discovery process.

Step 2 To create a new port tag, click **Tag** and choose **Create New Tag**.

The **Create New Tag** slide-in pane is displayed.

Step 3 In the **Tag Name** field, enter the tag name. In the **Description** field, add a description for the tag.

Note The **WAN** tag is a reserved tag name. You can't create a new port tag named *WAN*, because the system autogenerates the **WAN** tag.

Step 4 In the **Tag Rules** area, click the **Port** tab.

Step 5 In the **Device Scope** area, click the drop-down list and choose **Location** or **Tag Name** of the device to define the filters.

Step 6 To add rules for tagging the ports, click the  icon. You can tag the ports based on port status, speed, tag name, operational status, and description. You can add additional conditions using Boolean operators (AND, OR).

To delete a condition, click the delete icon.

Step 7 As the conditions are set, you can find the link for ports matching the condition at the bottom-left corner of the pane.

Click the link to view the ports. In the **Matching Ports** slide-in pane, you can view the device to which the port belongs and the port name.

- Step 8** Click **Save**.
-

Assign Tags to Ports

You can manually assign tags to ports. For example, you can manually assign the system-generated **WAN** tag to a port.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
Step 2 In the **Inventory** window, click a device name and choose **View Device Details**.
Step 3 In the left pane, expand **Interfaces** and click **Ethernet Ports**.
Step 4 In the top-right corner of the window, switch to the table view.
Step 5 Choose the port or ports to tag and click **Tag**.
Step 6 Choose the appropriate tags.
Step 7 Click **Apply**.
-

Port Usage Information

You can check the last input received and last output sent by the port.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
Step 2 In the **Devices** table, click a device name, and then click **View Device Details**.
The device details are displayed in the window.
Step 3 In the left pane, choose **Interfaces > Ethernet Ports**.
Note This tab is available for all devices except APs.
Step 4 Click the port to view its details.
In the window, you can view the timestamp of **Last Input** received by the port and **Last Output** transmitted by the port.
-

Maintenance Mode for Devices

Schedule Maintenance for Devices

You can place one or more devices under maintenance mode in Catalyst Center. If a device is placed under maintenance mode, Catalyst Center will not process any telemetry data associated with the device. By placing faulty devices under maintenance mode, you can avoid receiving unnecessary alerts from the devices.



Note From the devices in maintenance mode, you cannot collect any information and perform polling operations.

While scheduling the maintenance mode for Cisco Wireless Controllers and APs, note the following:

- When you schedule maintenance for a Cisco Wireless Controller, all the APs associated with the wireless controller are moved under maintenance mode with the same schedule.
- When a wireless controller is in maintenance mode, you cannot modify the maintenance schedule of a single AP associated with the wireless controller. A warning message saying that the device is already scheduled for maintenance is displayed. If you modify the schedule of the wireless controller, then all the APs under the wireless controller will be impacted.
- When the wireless controller is not in maintenance mode, you can select the APs individually and schedule them for maintenance.
- When an AP moves from one wireless controller to another, the maintenance mode is impacted as below:
 - If the AP is moving from a wireless controller which is in maintenance mode to a wireless controller which is not under maintenance, then the AP will not have maintenance mode after moving.
 - If the AP is moving from a wireless controller which is not in maintenance mode to a wireless controller which is under maintenance, then the AP will be in maintenance mode after moving.
 - If the AP is in maintenance mode and is moving from a wireless controller which is not under maintenance mode to a wireless controller which is also not under maintenance, then the AP will retain its maintenance mode after moving.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Choose the devices that you want to schedule maintenance.

Step 3 From the **Actions** drop-down list, choose **Inventory > Schedule Maintenance**.

The **Schedule Maintenance** slide-in pane is displayed.

Step 4 In the **Reason For Maintenance** field, enter a reason for placing the device under maintenance mode.

By default, Catalyst Center adds a reason, and you can modify it.

Step 5 In the **Define Maintenance Window** area, do the following:

- a) Choose the start date and time for maintenance.
- b) Choose the end date and time for maintenance.
- c) Alternately, click **Days/Hours** and enter days and hours for maintenance.

Note: To choose recurrence for maintenance, choose **Days/Hours** option.

Step 6 In the **Maintenance Recurrence** area, click **None**, **Daily**, or **Weekly**.

- **None:** Maintenance will not recur.
- **Daily:** Enter the interval in days in the **Run at Interval (Days)** field.
- **Weekly:** Enter the interval in weeks in the **Run at Interval (Weeks)** field.

Step 7 If you have chosen **Daily** or **Weekly** for recurrence, check the **Set Schedule End** check box.

Step 8 Click **End Date** or **End After (Occurrences)**.

- **End Date:** Enter month, date, and year for maintenance end.
- **End After (Occurrences):** Enter the number of occurrences after you want maintenance to end.

Step 9 In the **Maintenance Time Zone** area, choose time zone for maintenance.

Step 10 Click **Submit**.

Manage Maintenance Schedule for Devices

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 From the **Actions** drop-down list, choose **Inventory > Manage Maintenance**.

The **Manage Maintenance** slide-in pane is displayed. The **Status** column shows the current status of maintenance schedules.

Step 3 Click the **Search** or **Filter** icon to search or filter maintenance schedules.

Step 4 In the **Actions** column, click the **Edit** icon to edit the maintenance schedule.

Note For in-progress maintenance schedules, you can only extend the maintenance end time.

Step 5 Click the **Delete** icon in the **Actions** column to delete the maintenance schedule.

Note You cannot delete in-progress maintenance schedules.

Remove a Device From Maintenance

You can remove a device from maintenance after achieving the purpose for scheduled maintenance.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 From the Actions drop-down list, choose **Inventory > Exit Maintenance**.

Step 3 In the **Exit Maintenance** window, click **Confirm**.

Note The schedule remains active even after removing the device from the maintenance window. You can schedule another maintenance for the device only after the existing maintenance window ends. Otherwise, edit the maintenance schedule to end sooner.

Inventory Insights

The **Inventory Insights** window displays devices that have configuration inconsistencies with other directly-connected devices. It also displays devices that are misconfigured, as compared with the Catalyst Center best-practice recommendations. Additionally, you can view whether the link between the devices is up (active) or down (inactive), a link is down when the connection between devices no longer exists. Historical data is retained for future reference.

For example, assume that there is a network link between *device A* and *device B*. If you remove the link from *device B* and connect it to a new *device C*:

- The old link between *device A* and *device B* remains present and can be manually deleted by the user from the **Tools > Topology** window. No action is required by the user on the **Inventory Insights** window, it is shown to retain the historical data for your reference.
- The new link between *device A* and *device C* is shown as up.

Catalyst Center provides the following insights with suggested actions.

Speed/Duplex Settings Mismatch

Catalyst Center displays the devices that are connected with each other but configured with different speed and duplex values at the two ends of a device link.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory Insights**.

The **Inventory Insights** window appears.

Step 2 Click **Speed/Duplex settings mismatch** to see the suggested actions that can be performed on devices.

The suggested actions appear in the right pane.

Step 3 Click the number of instances to see the mismatches.

The **Speed/Duplex settings mismatch** window highlights the mismatches of speed and duplex.

Step 4 Make the required changes in the device configuration by following the suggested actions.

VLAN Mismatch

Catalyst Center displays the devices that are connected with each other but configured with different VLANs at the two ends of a device link.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory Insights**.

The **Inventory Insights** window appears.

Step 2 Click **VLAN Mismatch** to see the suggested actions that can be performed on devices.

The suggested actions appear in the right pane.

Step 3 Click the number of instances to see the mismatches.

Step 4 Make the required changes in the device configuration by following the suggested actions.

Manage System Beacon

You can highlight switches in the Catalyst Center inventory by using system beacons.

You can enable a system beacon on the following devices:

- Cisco Catalyst 9200 Series Switches
- Cisco Catalyst 9300 Series Switches
- Cisco Catalyst 3850 Series Ethernet Stackable Switches

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Choose the devices for which you want to enable or disable beacons.

- Note**
- You can enable beacons on up to five standalone devices at a time.
 - To enable beacons on stacked devices, you must choose only one device at a time. In a stacked device, you can enable beacons on one or more stack members.

Step 3 From the **Actions** drop-down list, choose **Inventory > Manage System Beacon**.

Step 4 In the **Manage System Beacon** slide-in pane, click the **Enabled** radio button under **System Beacon State** and then click **Apply** to enable a beacon on the chosen devices.

After the system beacon is enabled, a blue beacon icon () is displayed next to the device name in the inventory.

Step 5 (Optional) If you have chosen a stacked device, do the following in the **Manage System Beacon** slide-in pane:

- a) Check the **Update System Beacon Status?** check box corresponding to the stack members that you want to enable beacon.
- b) Under **System Beacon State**, click the **Enabled** radio button.

Change the Device Role (Inventory)

- c) Click **Apply**.

Step 6 (Optional) To disable a beacon on the chosen devices, do the following in the **Manage System Beacon** slide-in pane:

- a) Under **System Beacon State**, click the **Disabled** radio button.
- b) Click **Apply**.

Alternatively, in the **Inventory** window, hover the cursor over the blue beacon icon () next to the device name and click **Disable**.

Change the Device Role (Inventory)

During the discovery process, Catalyst Center assigns a role to each of the discovered devices. Device roles are used to identify and group devices and to determine a device's placement on the network topology map in the Topology tool. The top tier is the internet. The devices underneath are assigned one of the following roles:

Table 28: Device Roles and Topology Positions

Topology Position	Device Role
Tier 1	Internet (not configurable)
Tier 2	Border Router
Tier 3	Core
Tier 4	Distribution
Tier 5	Access
Tier 6	Unknown



Note When you assign the **Access** role to a device, IP Device Tracking (IPDT) is either configured or removed from the device based on the IPDT settings of the Site.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 To update the device role in the **Edit Device** slide-in pane:

- a) Select the device whose role you want to change.
- b) From the **Actions** drop-down list, choose **Inventory > Edit Device**.

- c) Click the **Role** tab and choose an appropriate role from the **Device Role** drop-down list.

Note If you manually change the device role, the assignment remains static. Catalyst Center does not update the device role even if it detects a change during a subsequent device resynchronization.

Update a Device's Management IP Address

You can update the management IP address of a device.



Note You cannot update more than one device at a time. Also, you cannot update a Meraki device's management IP address.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Select the device that you want to update.

Step 3 From the **Actions** drop-down list, choose **Inventory > Edit Device**.

The **Edit Device** slide-in pane is displayed.

Step 4 Click the **Management IP** tab, and enter the new management IP address in the **Device IP/ DNS Name** field.

Note Make sure that the new management IP address is reachable from Catalyst Center and that the device credentials are correct. Otherwise, the device might enter an unmanaged state.

What to do next

Reprovision the device to update the source-interface configuration.

Update the Device Polling Interval

You can update the polling interval at the global level for all devices by choosing **System > Settings > Network Resync Interval** or at the device level for a specific device by choosing **Device Inventory**. When you set the polling interval using the **Network Resync Interval**, that value takes precedence over the **Device Inventory** polling interval value.

If you do not want a device to be polled, you can disable polling.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Resynchronize Device Information

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 Select the devices that you want to update.

Step 3 From the **Actions** drop-down list, choose **Inventory > Edit Device**.

Step 4 In the **Edit Device** slide-in pane, click **Resync Interval**.

Step 5 Select the resync type.

Note

- To set the resync type as global, go to **System > Settings**.
- The device-specific polling time supersedes the global polling time. If you set the device-specific polling time and then change the global polling time, Catalyst Center continues to use the device-specific polling time.

Step 6 In the **Resync Interval (in Mins)** field, enter the time interval (in minutes) between successive polling cycles.

Step 7 Click **Update**.

Resynchronize Device Information

You can immediately resynchronize device information for selected devices, regardless of their resynchronization interval configuration. A maximum of 40 devices can be resynchronized at the same time.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Select the devices for which you want to gather information.

Step 3 From the **Actions** drop-down list, choose **Inventory > Resync Device**.

Note

When the resync is done for a specific device, the debug log is enabled automatically for that device, and XDE and device pack logs are collected under **System > System 360 > Cluster Tools > Monitoring or Log Explorer**.

Step 4 Click **OK**.

Delete a Network Device

You can delete devices from the Catalyst Center database, as long as they have not already been added to a site.

When you remove a wireless sensor from the inventory, the sensor is reset to the factory defaults so that when it rejoins, it gets the current configuration.

Before you begin

You must have administrator (ROLE_ADMIN) permissions and access to all devices (RBAC Scope set to ALL) to perform this procedure.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

- Step 2** Check the check box next to the device or devices that you want to delete.

Note You can select multiple devices by checking additional check boxes, or you can select all the devices by checking the check box at the top of the list.

- Step 3** From the **Actions** drop-down list, choose **Inventory > Delete Device**.

Note When you delete devices integrated with ISE, those deleted devices are moved to new NDG group in Cisco ISE.

- Step 4** In the **Warning** window, check the **Config Clean-Up** check box to remove the network settings and telemetry configuration from the selected device.

- Step 5** Confirm the action by clicking **OK**.
-

Launch Command Runner (Inventory)

You can launch the Command Runner application for selected devices from within the **Inventory** window.

Before you begin

Install the Command Runner application. For more information, see the [Cisco Catalyst Center Administrator Guide](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

- Step 2** Select the devices on which you want to run commands.

- Step 3** From the **Actions** drop-down list, choose **More > Command Runner**.

For information about the commands that you can run and how to run them, see [Run Diagnostic Commands on Devices, on page 441](#).

Troubleshoot Device Reachability Issues Using Run Commands

You can launch the **Run Commands** window from the **Inventory** window and run platform commands, such as ping, traceroute, and snmpget, to troubleshoot device reachability issues.

**Note**

If you want to execute the platform commands directly on a Catalyst Center cluster, do not select any device before launching **Run Commands**. Otherwise, the execution of commands will be for that device and not the platform.

Before you begin

Install the Command Runner application. For more information, see the *Cisco Catalyst Center Administrator Guide*.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2

From the **Actions** drop-down list, choose **More > Run Commands**.

You can enter **man** anytime to retrieve a list of currently supported commands and shortcuts.

Use a CSV File to Import and Export Device Configurations

CSV File Import

You can use a CSV file to import your device configurations or sites from another source into Catalyst Center. If you want to download a sample template, follow the below steps:

1. Go to the **Inventory** window and click **Add Device**.
2. In the **Add Device** slide-in pane, click **Import Inventory**.
3. Click **Download Template** to download a sample CSV file template.

When you use a CSV file to import device or site configurations, the extent to which Catalyst Center can manage your devices depends on the information you provide in the CSV file. If you do not provide values for CLI username, password, and enable password, Catalyst Center will have limited functionality and cannot modify device configurations, update device software images, or perform any other valuable functions.

You can specify the credential profile in the CSV file to apply the corresponding credentials to a set of devices. If you specify the credential profile and also enter the values manually in the CSV file, the manually entered credentials take higher priority and the device is managed based on a combination of manually entered credentials and credential profile. For example, if the CSV file contains a credential profile with SNMP and SSH or Telnet credentials in addition to manually entered SNMP credentials, the device is managed based on the manually entered SNMP credentials and the SSH or Telnet credentials in the credential profile. Telnet is not recommended.

**Note**

You also must provide values for the fields that correspond to the protocol you specify. For example, if you specify SNMPv3, you must specify values for the SNMPv3 fields in the sample CSV file such as the SNMPv3 username and authorization password.

For partial inventory collection in Catalyst Center, you must provide the following values in the CSV file:

- Device IP address
- SNMP version
- SNMP read-only community strings
- SNMP write community strings
- SNMP retry value
- SNMP timeout value

For full inventory collection in Catalyst Center, you must provide the following values in the CSV file:

- Device IP address
- SNMP version
- SNMP read-only community strings
- SNMP write community strings
- SNMP retry value
- SNMP timeout value
- Protocol
- CLI username
- CLI password
- CLI enable password
- CLI timeout value

CSV File Export

Catalyst Center enables you to create a CSV file that contains all or selected devices in the inventory. When you create this file, you must enter a password to protect the configuration data that the file will contain.

Import Device Configurations from a CSV File

You can import device configurations from a CSV file.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window displays the device information gathered during the discovery process.

Step 2 Click **Add Device**.

Step 3 In the **Add Device** slide-in pane, click **Import Inventory** to import the device credentials.

Step 4 In the **Import Inventory** slide-in pane, drag and drop the CSV file into the boxed area or click **Choose a file** and browse to the CSV file.

- Step 5** Click **Import**.
-

Export Device Data

You can export specific data pertaining to selected devices to a CSV file. The CSV file is compressed. Click **Export** to export the data of filtered devices or all devices.



Caution Handle the CSV file with care because it contains sensitive information about the exported devices. Ensure that only users with special privileges perform a device export.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window displays the device information gathered during the discovery process.
- Step 2** To export configuration information for only certain devices, check the check box next to the devices that you want to include. To include all devices, check the check box at the top of the device list.
- Step 3** From the **Actions** drop-down list, choose **Inventory > Export Inventory** to export the device configurations.
The **Export Inventory** dialog box appears.
- Step 4** In the **Password** field, enter a password that will be used to encrypt the exported CSV file.
- Note** The password is required to open the exported file.
- Step 5** Confirm the encryption password.
- Step 6** Check the **Include SSH key information** check box to include information such as initial SSH key, initial SSH key algorithm, current SSH key, and current SSH key algorithm in the exported CSV file.
- Step 7** Click **Export**.
- Note** Depending on your browser configuration, you can save or open the compressed file.
-

Export Device Credentials

You can export device credentials to a CSV file. You are required to configure a password to protect the file from unwanted access. You need to supply the password to the recipient so that the file can be opened.



Caution Handle the CSV file with care because it lists all of the credentials for the exported devices. Ensure that only users with special privileges perform a device export.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.

- Step 2** Check the check box next to the devices that you want to include in the CSV file. To include all the devices, select the check box at the top of the list.
- Step 3** From the **Actions** drop-down list, choose **Inventory > Export Inventory**.
The **Export** dialog box appears.
- Step 4** In **Select Export Type**, click the **Credentials** radio button.
- Step 5** Check the **Include SSH key information** check box to include information such as initial SSH key, initial SSH key algorithm, current SSH key, and current SSH key algorithm in the exported CSV file.
- Step 6** In the **Password** field, enter a password that will be used to encrypt the exported CSV file.
Note The password is required to open the exported file.
- Step 7** Confirm the encryption password and click **Export**.
Note Depending on your browser configuration, you can save or open the compressed file.

Configuration Drift of a Device

Configuration changes made on devices are saved in the internal Catalyst Center server. For information on how to view the configuration drift, see [View Configuration Drift of a Device, on page 130](#).

Configuration drifts are captured when the following events occur:

- First-Time Collection: On adding a device to Catalyst Center, device configuration is collected.
- Syslog-Based Collection: Catalyst Center monitors syslog events sent by devices and identifies the configuration changes. The configuration archive is triggered after 5 minutes, on occurrence of the latest event. Based on the login IP address in syslog events, configuration drifts are marked in-band (configuration changes done by Catalyst Center) or out-of-band (configuration changes done outside Catalyst Center).



Note New traps within the 5-minute window will restart the timer to avoid multiple archives with partial changes. For accurate results, we recommend that you wait for at least 5 minutes.

- Weekly Backup Collection: Catalyst Center performs periodic weekly backup of device configurations. When no events are received for a device, the configuration changes made outside or from Catalyst Center are captured by the weekly backup archive. For more information, see Configure Device Configuration Backup Settings in the [Cisco Catalyst Center Administrator Guide](#).



Note Configuration drifts detected by the weekly backup archive are classified as in-band (configuration changes done by Catalyst Center), even though it is possible that the configuration changes were done outside Catalyst Center.

View Configuration Drift of a Device

Disk utilization is optimized by ignoring the collected archive when no changes are present. Disk space optimization is not applicable for the first-time collection.



Tip To create a new configuration archive for a device, the configuration archive service relies on syslog traps from the network device. If you plan to use your own syslog server, you must continue to use the Catalyst Center server as the syslog server (in addition to any other syslog servers that you want to use) so that the configuration archive receives the latest configuration from the device.

View Configuration Drift of a Device

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 In the **Devices** table, click the device name. More information about the device is displayed.

Step 3 Click **View Device Details** hyperlink.

The device details are displayed in the window.

Step 4 In the left pane, click **Config Drift**.

The **Configuration Changes** window appears, you can view the following information:

- **Total config drifts being saved:** Shows the number of configuration drifts saved per device that includes labelled configs.

You can change the number of config drifts being saved per device from **System > Settings > Device Settings > Configuration Archive** window.

- **Total labelled configs:** Shows the number of labelled configs for the device.

- **Last Archived:** Shows the timestamp of the last configuration archived. This timestamp ensures that the users have access to the most up-to-date configuration data. Also, by knowing the specific time of the last configuration archived, you can track changes and identify potential issues or discrepancies.

For information on how to archive the configuration of your network devices, see "Configure Device Configuration Backup Settings" section in [Cisco Catalyst Center Administrator Guide](#).

- **Last Verified:** Shows the timestamp of the config-drift verification that was performed when an event was received by the system. The event refers to first time collection, syslog-based collection, daily backup collection or weekly backup collection that is described in the previous section.

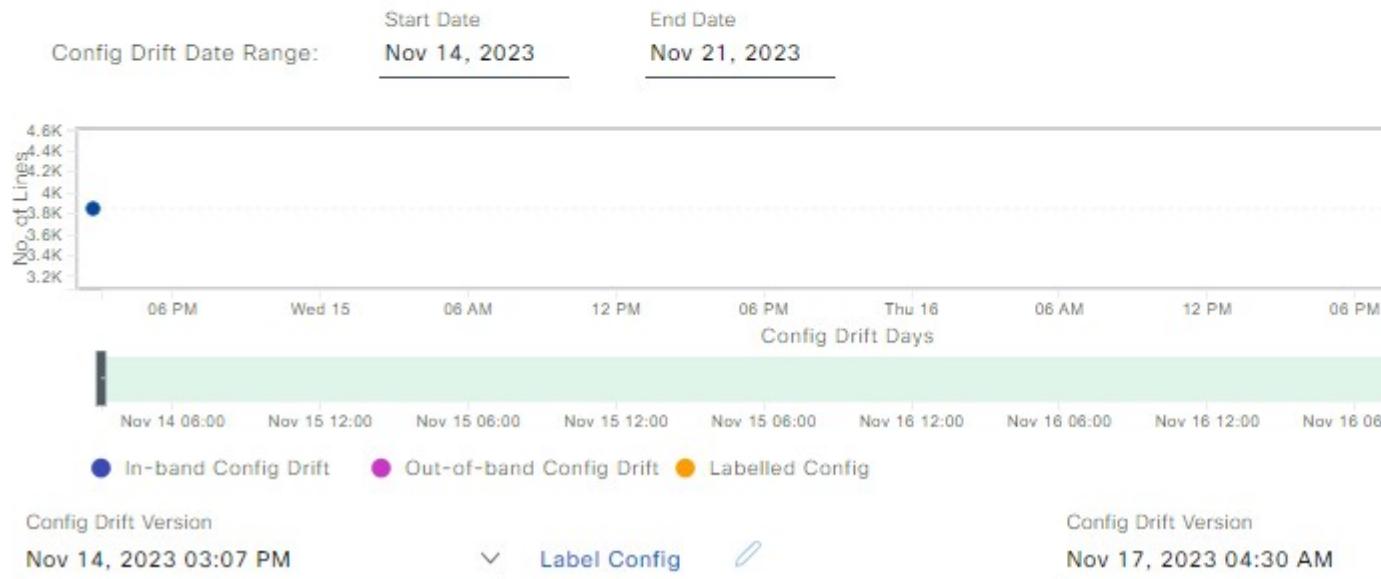
The last verified timestamp allows you to monitor when the check was last performed, ensuring the devices are continuously monitored for configuration inconsistencies.

Configuration Changes

Configuration changes on your device will be saved on the internal Catalyst Center server. The number of configuration drift (Configuration Archive) will include labelled configs and config drift versions.

Total config drifts being saved: 15 Total labelled configs: 0 Last Archived: Nov 17, 2023 04:30 AM Last Verified:

▼ Change History (Running Config)



Step 5

Expand the **Change History** tab to view the following details:

- Config drift date range:** Click the **Start Date** and **End date** to choose the date range for which you want to view the config drift. By default, the start and end dates are set to display the config drift for the last 15 days.
- Config drift timeline graph:** Shows the config drift for the chosen date range. By default, the last 15 days of config drift are shown in the timeline graph.

The timeline graph shows the following details:

- In-band Config Drift:** Configuration changes done by Catalyst Center are shown as a blue bubble in the timeline graph.
 - Out-of-band Config Drift:** Configuration changes done outside Catalyst Center are shown as a purple bubble in the timeline graph.
 - Labeled Config:** The config version labeled and archived in Catalyst Center is shown as an orange bubble in the timeline graph. For more information, see [Label Configuration Drift, on page 132](#).
- Config Drift Version:** Click the down arrow to view all the available config drift versions.
 - Running Config:** Click the config drifts on the timeline graph. The comparison is shown under the **Running Config** tab. The differences between the config versions are marked in different colors for better visibility.

Label Configuration Drift

You can label the config drift on the timeline graph for future reference. The labeled config drift will never be deleted unless it is unlabeled.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 Click the device name, and more information about the device is displayed.

Step 3 Click **View Device Details**.

Device details are displayed in the window.

Step 4 In the left pane, click **Config Drift**.

The **Configuration Changes** window is displayed.

Step 5 Choose the config drift in timeline graph that you want to label. The timestamp of the chosen config drift is shown in the **Config Drift Version** below the timeline graph.

Step 6 Click **Label Config** corresponding to the chosen config drift version.

Step 7 In the **Label Configuration** window, enter a name for the config version. The prefix of the label config is fixed as CCA_.

Note Do not use special characters for the config version name.

Step 8 Click **Save**. The labeled config drift is shown in orange in the timeline graph.

Note • If the number of labeled config versions is greater than the chosen range, change the total number of config drifts to be saved. For more information on how to configure the number of config drifts to be saved, see the "Configure Device Configuration Backup Settings" section in the [Cisco Catalyst Center Administrator Guide](#).

- Catalyst Center permits the labeling of up to 80% of the total configuration drift. When a user reaches this 80% threshold in labeled configurations drift, a warning banner will be displayed at the top of the **Configuration Changes** window.

Step 9 To remove the label, select the labeled config version and click **Remove label**.

Visibility and Control of Device Configurations

The Visibility and Control of Configurations feature provides a solution to further secure your planned network configurations before deploying them onto your devices. With enhanced visibility, you can enforce the previewing of device configurations (CLI and NETCONF commands) before deploying them. With enhanced control, you can ensure only authentic and authorized configurations are provisioned onto your network devices through an IT Service Management (ITSM) check. These two options also offer you the flexibility to preview configurations at your own pace.

By default, the Visibility and Control of Configurations settings are configured as follows:

- Visibility of Configurations (**Configuration Preview**) is enabled.

- Control of Configurations (**ITSM Approval**) is disabled.

To enable or disable these settings, see "Enable Visibility and Control of Configurations" in the [Cisco Catalyst Center Administrator Guide](#).

**Note**

- For SWIM workflows, if you have enabled Visibility of Configurations, the system cannot generate a configuration preview for an image upgrade.
- If a provisioning workflow supports Visibility and Control of Configurations, the following banner message is displayed when you schedule the deployment of your task:

This workflow supports enforcing network administrators and other users to preview configurations before deploying them on the network devices. To configure this setting, go to **System > Settings > Visibility and Control of Configurations**.

Visibility and Control of Configurations Workflow

When it's time to schedule your task during a provisioning workflow, depending on the Visibility and Control of Configurations settings, you can do the following:

- If **Configuration Preview** is enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because you must preview the device configurations before deploying them.
- If **Configuration Preview** and **ITSM Approval** are enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because you must preview the device configurations and submit them to an IT administrator for approval before deploying them.
- If **Configuration Preview** and **ITSM Approval** are disabled, you can choose any available option (**Now**, **Later**, or **Generate configuration preview**).

If you choose **Generate configuration preview**, Catalyst Center performs the following the high-level steps:

	Step	Description
1	Catalyst Center performs a set of network provisioning prechecks to ensure a seamless provisioning operation.	<p>On the Performing Initial Checks window, Catalyst Center checks for and notifies you of any Pending Operations and Device Compliance issues.</p> <p>You must address all the identified issues and perform a recheck to ensure all the validations are successful. For more information, see Network Provisioning Prechecks, on page 137.</p>

	Step	Description
2	Catalyst Center prepares the chosen devices to generate the configurations.	<p>On the Preparing Devices and Configuration Models window, if the provisioning workflow supports the workflow progression view, the steps the system takes to prepare a listed device are displayed. Otherwise, an in-progress message is displayed.</p> <p>Because this preparation step can take some time, you can exit the workflow and return to it later while the system continues the process in the background.</p>
3	Catalyst Center displays the device configurations for the first listed device.	<p>On the Preview Configuration window, Catalyst Center displays a side-by-side comparison of the running configuration and the planned configuration for the first listed device.</p> <p>You can review the device configurations and then, when you're ready, deploy them or submit them for ITSM approval.</p>

While reviewing the configurations on the **Preview Configuration** window, you can do the following:

To...	Do this...
Preview a device's configurations.	Choose a device in the left pane.
Filter the data in the configuration preview pane.	From the View by Configuration Source drop-down list, choose an available option.
View a side-by-side comparison of the planned configuration and the running configuration, or view only the planned configuration.	<p>Click the view switcher ().</p> <p>Note Viewing YANG configurations in the side-by-side comparison view isn't supported.</p>
Highlight corresponding commands between the running and planned configurations.	<p>Click one command in one configuration to highlight the corresponding command in the other configuration.</p> <p>Note Keep the following limitations in mind:</p> <ul style="list-style-type: none"> The system supports only side-by-side highlighting for first-level commands, not sublevel commands. All commands must be a complete match for the system to display the side-by-side highlighting between configurations. If you click any commands starting with <code>no</code> in one configuration, the system will ignore the <code>no</code> portion when checking for a match in the other configuration.

To...	Do this...
Search for a value in the displayed configuration.	Use the Search configuration field.
Display the workflow progression view.	<p>Choose a device in the left pane, and then click Back to workflow progress in the top-right corner of the right pane. To return to the configuration preview pane, click Go to generated config.</p> <p>Note Back to workflow progress and Go to generated config are only available if the workflow supports the workflow progression view.</p>
Exit the workflow and review the device configurations later.	<p>Click Exit and Preview Later. When you're ready to continue reviewing the configurations, go to the Activities > Tasks window and open the relevant work item.</p>

After reviewing the configurations, depending on the Visibility and Control of Configuration settings, you can do the following:

To...	Do this...
Discard the work item permanently.	<p>Click Discard and, in the Warning dialog box, click Yes. If you discard it, you can't recover it later.</p>
Retain any generated configurations and discard all other resources.	<p>Click Discard and, in the Discard dialog box, check the Retain generated configs (if any) check box and click Accept.</p> <p>Tip If a configuration preview fails, consider retaining any generated configurations and discarding all other resources so that you or your IT administrator can inspect the issue.</p> <p>If you retain any generated configurations and discard all other resources, Exit displays instead of Exit and Preview Later because you've previewed all the configurations and discarded the nongenerated ones.</p>

To...	Do this...
Deploy the configurations or submit them for ITSM approval.	<p>Click Deploy or Submit for ITSM Approval.</p> <p>Note</p> <ul style="list-style-type: none"> If Save Intent displays instead of Deploy, the parameters that you chose during the workflow are already present on the device. To save those parameters to the database, click Save Intent. No configuration is pushed to the device because the device already has the required configuration. If there are multiple devices, you must click each device to preview its configuration. However, when you click Deploy, the configurations are pushed to all the devices even if the configurations have not been previewed on all devices.
	<p>In the slide-in pane, schedule the time and date of the deployment and, if you're submitting the configurations for ITSM approval, add notes for the IT administrator. Then click Submit.</p> <p>Note For a provisioning task, after deploying the configuration on the devices, the Task Progress bar displays the progress of the ongoing provisioning task under Activities > Tasks (which you can view by clicking the task name).</p>
	<p>You can check the work item's approval status or the task's deployment status on the Tasks window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it is deployed at the scheduled time.</p> <p>Note When you preview the configurations, Catalyst Center creates a snapshot of the configuration previews. If there are any changes in the network settings or network profiles after this operation is scheduled for deployment, the changes are not included during the device provisioning.</p>

Network Provisioning Prechecks

To ensure a seamless provisioning operation, Catalyst Center performs a set of prechecks to ensure that there are no pending operations that might conflict with the current task and devices are compliant.



Note This feature is only applicable for provisioning, SWIM, and RMA workflows.

The prechecks are performed during any provisioning workflow after you schedule the configuration deployment by choosing the **Now** or **Later** option or after choosing the **Generate Configuration Preview** option, if applicable. On the **Performing Initial Checks** window, Catalyst Center notifies you of any issues as follows:

- If the icon displays next to all the prechecks, it indicates that there are no errors, and you can click **Next** or **Submit** to proceed with provisioning.
- If the icon displays next to any of the prechecks, you must address all the issues to proceed with provisioning.

If you are notified of any issues, do the following:

- If any pending operations are identified, click the **Manage in Activities** link to go to the **Activities > Tasks** window (as displayed in the following figure). You can **Discard** the pending operation, or you can wait for the process to complete. If you discard the pending operation, click **Recheck**, in the bottom-right corner of the window, to update the validation status.

The screenshot shows a table titled 'Pending Operations' with 2 items found. The table has columns for 'Task' and 'Action'. Each row contains a task name ('Provision Device - conflict') and a 'Manage in Activities' link. A message above the table states: 'There are pending operations whose configurations when deployed will conflict with those of the current operation. Further operations are not permitted until the pending ones are either deployed or discarded. You can manage them from the Activities page by clicking the link(s) provided below.'

Task	Action
Provision Device - conflict	Manage in Activities
Provision Device - conflict	Manage in Activities

- If the **Device Compliance** check displays any noncompliant devices with links to each device's **Compliance Summary** window (as displayed in the following figure), you must fix, acknowledge, or ignore the compliance issues to continue with provisioning.
 - To fix the issues, click **Manage Compliance** and then click **Fix Compliance** in the **Compliance Summary** window. For more information, see [Fix Compliance Violations, on page 435](#).

Replace a Faulty Device**Note**

The precheck checks for compliance violations (open and acknowledged) for only the Network Settings, Network Profiles, Fabric, Application Visibility, Umbrella, and Workflows tiles. It is not applicable for other categories available in compliance summary, as these categories are not affected by the provisioning workflow.

The acknowledged violations are also flagged during the precheck. This is to ensure that all compliance violations are checked before device provisioning.

- To ignore the issues, click **Ignore** in the **Device Compliance** area as shown in the following figure.

Device Name	Action
sapro-1	Manage Compliance
sapro-2	Manage Compliance
2 Record(s)	Show Records: 25 1 - 2 1 >

You must click **Recheck** in the bottom-right corner of the **Performing Validations** window to ensure the



icon displays next to the prechecks. Then click **Next** to proceed to the next step in the provisioning workflow.

**Note**

You must address the issues that are found during precheck to proceed with the deployment.

Replace a Faulty Device

The Return Material Authorization (RMA) workflow lets you replace failed devices quickly. RMA provides a common workflow to replace routers, switches, and APs.

When using the RMA workflow with routers and switches, the software image, configuration, and license are restored from the failed device to the replacement device. For wireless APs, the replacement device is assigned to the same site, which is provisioned with primary wireless controller, RF profile, and AP group settings, and placed on the same floor map location in Catalyst Center as the failed AP. For Cisco switch stacks (hardware stacking), you don't need to follow a separate procedure in Catalyst Center for member switch replacement, which is handled by the active switch. The member switch is replaced by the active switch by providing the software image and configuration. Full stack replacement is handled by Catalyst Center.



Note You can also replace a faulty device using the Replace Device workflow. For more details, see [Replace Device](#), [on page 868](#).

Before you begin

- The software image version of the faulty device must be imported in the image repository before marking the device for replacement.
- The faulty device must be in an unreachable state.
- If the replacement device onboards to Catalyst Center through Plug and Play (PnP), the faulty device must be assigned to a user-defined site.
- The replacement device must not be in a provisioning state while triggering the RMA workflow.
- For switch stacks replacement, the number of stacks for the faulty and replacement device must be the same.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

- Select the faulty device that you want to replace.
- From the **Actions** drop-down list, choose **Inventory > Device Replacement > Mark Device for Replacement**.
- In the **Mark for Replacement** window, click **Mark**.

Note To achieve seamless replacement of fabric devices, a DHCP server is configured on the neighbor device. This is required to assign an IP address to the replacement device for onboarding the device to Catalyst Center through PnP. This DHCP server is removed after successful replacement of the faulty device.

The latest configuration changes from the faulty device are pushed to the replaced device during the RMA workflow.

- From the **Inventory** drop-down list, choose **Marked for Replacement**.

A list of devices that are marked for replacement is displayed.

- (Optional) If you don't want to replace the device, select the device and choose **Actions > Unmark for Replacement**.

Step 2 (Optional) To replace the device, do the following:

- Select the device that you want to replace and choose **Actions > Replace Device**.
- In the **Choose Replacement Device** window, choose a replacement device from the **Unclaimed** tab or the **Managed** tab.

The **Unclaimed** tab shows the devices that are onboarded through PnP. The **Managed** tab shows the devices that are onboarded through the Inventory or the discovery process.

- (Optional) If the replacement device is not yet onboarded, do the following:

- In the **Choose Replacement Device** window, click **Add Device**.
- In the **Add New Device** window, enter the **Serial Number** of the device and click **Add New Device**.

Alternatively, do the following:

1. In the **Choose Replacement Device** window, click **Sync with Smart Account**.
2. In the **Sync with Smart Account** window, click **Sync**.
- d) Click **Next**.
- e) In the **Schedule Replacement** window, depending on the Visibility and Control of Configurations settings, choose an available option.
 - To schedule the replacement immediately, click **Now**.
 - To schedule the replacement for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
 - To preview the configurations, click **Generate configuration preview**.
 If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and the **Now** and **Later** options are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations, on page 132](#).
- f) Edit the default **Task Name**, if required.
- g) Do one of the following:
 - If you chose **Now** or **Later**, click **Apply**.
 - If you chose **Generate configuration preview**, click **Preview**.
- h) On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
 - Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
 If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
 - After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

- i) If you chose **Generate configuration preview**, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:
 1. Review the device configurations.
 2. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.
 3. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
 4. Click **Submit**.
- When the configurations are successfully submitted, a success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time, which you can view on the **Tasks** window.

- j) If you didn't choose to generate a configuration preview in the preceding steps, do the following:
 1. Click **Review** to view the chosen device type, faulty device details, and replacement device details.
 2. Click **Next** to review the details in the **Summary** window.
 3. To make changes, click **Edit**.
 4. Click **Submit** to submit the replacement request.
 5. Click the **Monitor Replacement Status** link to go to the **Mark for Replacement** view in the **Provision** window.
 6. Click **Replace Status** in the **Provision** window to view the status of the RMA workflow progress, as follows:
 - Running readiness checks for device replacement.
 - Claim the (PnP) replacement device.
 - Distribute and activate the software image to the replacement device.
 - Deploy licenses.
 - Provision VLAN configurations.
 - Provision startup configurations.
 - Reload the replacement device.
 - Check for reachability of the replacement device.
 - Deploy SNMPv3 credentials to the replacement device.
 - Synchronize the replacement device.
 - Remove the faulty device from CSSM.
 - Add the replacement device to CSSM.
 - Revoke and create the PKI certificate.
 - Update Cisco ISE.
 - Delete the faulty device.

After the workflow is complete, the **Replace Status** is updated to **Replaced**.

Step 3 If an error message appears, click the error link.

Step 4 Click **Retry** to retrigger the workflow with the same set of faulty and replacement devices.

The main inventory window displays the details of the new replacement device.

Note Marking the device for replacement and replacing the device can be done at different times.

Replace a Faulty Access Point

Using the AP RMA feature, you can replace a faulty AP with a replacement AP available in the device inventory.

Before you begin

- The AP Return Material Authorization (RMA) feature supports only like-to-like replacement. The replacement AP must have the same model number and PID as the faulty AP.
- The replacement AP must have joined the same Cisco Wireless Controller as the faulty AP.
- A Cisco Mobility Express AP that acts as the wireless controller is not a candidate for the replacement AP.
- The software image version of the faulty AP must be imported in the image repository before marking the device for replacement.
- The faulty device must be assigned to a user-defined site if the replacement device onboards Catalyst Center through Plug and Play (PnP).
- The replacement AP must not be in provisioning state while triggering the RMA workflow.
- The faulty device must be in an unreachable state.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window displays the device information that is gathered during the discovery process.

Step 2 Check the check box of the faulty AP that you want to replace.

From the **Actions** drop-down list, choose **Device Replacement > Mark Device for Replacement**.

In the **Mark for Replacement** window, click the radio button next to the faulty device name.

From the **Actions** drop-down list, choose **Replace Device**.

In the **Replace Device** window, click **Start**.

In the **Available Replacement Devices** table, click the radio button next to the replacement device name.

Click **Next**.

Review the replacement **Summary** and then click **Next**.

Step 10 In the **Schedule Replacement** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- To schedule the replacement immediately, click **Now**.
- To schedule the replacement for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** options are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations, on page 132](#).

- Step 11** Edit the default **Task Name**, if required.
- Step 12** Do one of the following:
- If you have chosen **Now** or **Later** option, click **Apply**.
 - If you have chosen **Generate configuration preview**, click **Preview**.
- Step 13** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
 - After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.
- For more information, see [Network Provisioning Prechecks, on page 137](#).
- Step 14** If you chose **Generate configuration preview**, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:
- a. Review the device configurations.
 - b. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.
- Note** You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.
- c. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
 - d. Click **Submit**.
- When the configurations are successfully submitted, a success message is displayed.
- If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.
- If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time, which you can view on the **Tasks** window.
- Step 15** If you haven't chosen to Generate configuration preview in the preceding steps, do the following:
- a. To monitor the replacement status, under **What's Next**, click **Monitor Replacement Status**.
The **Mark For Replacement** window lists the devices that are marked for replacement.
Check the status of the replacement in the **Replace Status** column, which initially shows **In-Progress**.
 - b. Click **In-Progress** in the **Replace Status** column.
The **Replace Status** tab shows the various steps that Catalyst Center performs as part of the device replacement.
 - c. In the **Marked for Replacement** window, click **Refresh** and click **Replace Status** to view the replacement status.

Limitations of the RMA Workflow in Catalyst Center

- Step 16** If the faulty AP replacement fails, then the **Replace Status** column shows the reason for failure with an error message. You can either replace the faulty AP with another new AP or retry the failed replacement using the AP RMA Retry feature.
- Step 17** To retry the failed replacement, click the error message in the **Replace Status** column against the device name.
- Step 18** Click **Retry**.
- Step 19** In the **Marked for Replacement** window, click **In-Progress** against the **Replace Status** column. The **Replace Status** tab shows success after successful replacement of the faulty AP.
- Step 20** The **Replace Status** in the **Replacement History** window shows **Replaced** after the faulty device is replaced successfully.
- Step 21** (Optional) If you do not want to replace the device, select the device and choose **Actions > Unmark for Replacement**.
-

Limitations of the RMA Workflow in Catalyst Center

- RMA supports replacement of all switches, routers, and Cisco SD-Access devices, *except for the following:*
 - Devices with embedded wireless controllers
 - Cisco Wireless Controllers
 - Chassis-based Nexus 7700 Series Switches
 - Switch stacks (SVL stacking)
- RMA supports devices with an external SCEP broker PKI certificate. The PKI certificate is created and authenticated for the replacement device during the RMA workflow. The PKI certificate of the replaced faulty device must be manually deleted from the certificate server.
- The RMA workflow supports device replacement only if:
 - Both the faulty and replacement devices have the same extension cards.
 - The number of ports in both devices does not vary because of the extension cards.
 - The faulty device is managed by Catalyst Center with a static IP. (RMA is not supported for devices that are managed by Catalyst Center with a DHCP IP, except extended node and AP in fabric.)
- Make sure that the replacement device is connected to the same port to which the faulty device was connected.
- Fabric edge replacement does not support the DHCP server configuration in the neighbor device if the neighbor device is not part of the fabric. Because intermediate nodes are not part of the Cisco SD-Access fabric, the DHCP server with option 43 is not pushed.
- Catalyst Center does not support legacy license deployment.

The RMA workflow deregisters the faulty device from Cisco SSM and registers the replacement device with Cisco SSM.

- If the software image installed on the faulty device is earlier than Cisco IOS XE 16.8, the **License Details** window does not display the Network and Feature License details and no warning message is displayed. Therefore, you should be aware of the legacy network license configured on the faulty device and manually apply the same legacy network license on the replacement device.

- If the software image installed on the faulty device is Cisco IOS XE 16.8 or later, the **License Details** window displays details of the network license (for example, **Legacy** or **Network**) and the feature license (for example, IP Base, IP Service, or LAN Base). The following warning message is displayed while marking the faulty device for replacement:

Some of the faulty devices don't have a license. Please ensure your replacement device has the same Legacy license of the faulty device enabled.

- If the legacy network licenses of the replacement and faulty devices do not match, the following error message is displayed during the license deployment:

Catalyst Center doesn't support legacy license deployment. So manually update the faulty device license on the replacement device and resync before proceeding.

- Catalyst Center supports PnP onboarding of the replacement device in a fabric network, *except when:*
 - The faulty device is connected to an uplink device using multiple interfaces.
 - LAN automation uses overlapping pools.
- If the replacement device onboards through the PnP-DHCP functionality, make sure that the device gets the same IP address after every reload and the lease timeout of DHCP is longer than two hours.

Reboot an Access Point

Using the AP Reboot feature, you can reboot one or more APs for troubleshooting and maintenance.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 Check the check box of the APs that you want to reboot.

Step 3 From the **Actions** drop-down list, choose **Inventory > Reboot Device**.

Step 4 In the **Reboot Device** slide-in pane, choose whether you want to reboot the AP **Now** or schedule it for later.

Step 5 Expand **Selected Devices** to view the AP name and floor details of the reboot AP.

Step 6 Click **Reboot**.

After the Cisco Wireless Controller initiates the task of rebooting the selected APs, a **Reboot Initiated Successfully** message is displayed.

Step 7 In the **Task Submitted** dialog box, click the **Task** link.

This dialog box displays for a few seconds and then disappears. To navigate to the task, click the menu icon and choose **Activities > Tasks**.

Step 8 Click the task name to view the reboot initiation status.



CHAPTER 6

Display Your Network Topology

- [About Topology, on page 147](#)
- [Display the Topology of Areas, Sites, Buildings, and Floors, on page 148](#)
- [Filter Devices on the Topology Map, on page 148](#)
- [Display Device Information, on page 149](#)
- [Display Link Information, on page 150](#)
- [Pin Devices to the Topology Map, on page 151](#)
- [Assign Devices to Sites, on page 151](#)
- [Save a Topology Map Layout, on page 151](#)
- [Open a Topology Map Layout, on page 152](#)
- [Share a Topology Map Layout, on page 152](#)
- [Export the Topology Layout, on page 153](#)

About Topology

The **Topology** window displays a graphical view of your network. Using the Discovery settings that you have configured, Catalyst Center discovers the devices in your network and assigns a device role to them. Based on the device role assigned during discovery (or changed in Device Inventory), Catalyst Center creates a physical topology map with detailed device-level data.

Using the topology map, you can do the following:

- Display the topology of a selected area, site, building, or floor.
- Display detailed device information.
- Display detailed link information.
- Filter devices based on a specific Layer 2 VLAN.
- Filter devices based on a Layer 3 protocol (such as Intermediate System - Intermediate System [IS-IS], Open Shortest Path First [OSPF], Enhanced Interior Gateway Routing Protocol [EIGRP], or static routing).
- Filter devices with Virtual Routing and Forwarding (VRF) capability.
- Pin devices to the topology map.
- Save a topology map layout.
- Open a topology map layout.

Display the Topology of Areas, Sites, Buildings, and Floors

- Export screen shots of the complete topology layout in PNG format.

Display the Topology of Areas, Sites, Buildings, and Floors

You can display the topology of an area, site, building, or floor.

Before you begin

- Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.
- You must have defined a network hierarchy and provisioned devices to the buildings or floors within it.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 From the left hierarchy tree, select the area, site, building, or floor that you are interested in.

Step 3 In the top-right corner, use the toggle button ( ) to switch between the Geographical map view and the Layer 2 map view.

The Geographical map view displays the sites. The nearer sites are grouped together and indicated with the number of sites in the group. The device health is indicated in different colors. Hover over the site to view the detailed device health.

Use the Search field in the top-right corner to find a building in the Geographical map view, and a device in the Layer 2 map view.

Note

- Click the legend icon (i) in the lower-right corner to open a legend that shows the available shortcut keys for the topology maps.
- Click the **Toggle Annotate** icon to draw annotations in the Layer 2 map. You can click the export icon to export the topology map along with the annotations.

Step 4 Click **Take a Tour** for information about the various options in the **Topology** window.

Filter Devices on the Topology Map

You can filter devices based on one of the following attributes:

- VLAN
- Routing
- VRF
- Tagging

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click **Filter**.

Note If you are not able to view the **Filter**, click a site in the left tree view menu.

Step 3 Do one of the following:

- From the **VLAN** drop-down list, choose the VLAN that you want to view.
- From the **Routing** drop-down list, choose the protocol that interests you.
- From the **VRF** drop-down list, choose the VRF that you want to view.
- Click **View All Tags** and choose the tags you want to view. The devices associated with the selected tags will be highlighted. If you want to create a new tag, do the following:
 - a) Click **Create New Tag**.
 - b) Enter the **Tag Name**.
 - c) Click **Save**.

You can also associate a device with the tag by doing the following:

- a) Click the device.
 - b) Click **Tag Device**.
 - c) Select the tag to which you want to associate the device.
 - d) Click **Apply**.
-

Display Device Information

Catalyst Center allows you to display the device name, IP address, and software version of devices.



Note The device information that is accessible in the **Topology** window is also accessible in the **Device Inventory** window.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 In the tree view menu, select the area, site, building, or floor that you are interested in.

Step 3 In the topology area, hover your mouse over the device or device group that interests you.

Note A device group is labeled with the number and types of devices it contains. A blue arrow under a switch indicates that switch has a host. Click the blue arrow to view the host.

Display Link Information

- Step 4** Click **Display** and enable the following items to view additional device details. For more information, hover your mouse over the  icon next to the items.
- **Device Health:** Displays the health of the devices.
 - **Link Health:** Displays the health of the links between the devices.
 - **License status:** Displays the license status of the device. Catalyst Center highlights a device if its license is about to expire and a warning icon appear next to it. Click the highlighted device to view its license details.
 - **Device IP:** Displays device IP address under device label.
 - **Device Suffixes:** Displays full name of the device, with its suffix.

Note

- Topology uses Link Layer Discovery Protocol (LLDP) to determine the neighbor devices when network devices are not configured with Cisco Discovery Protocol (CDP) in Catalyst Center.
 - For third-party devices, only the added device icon is displayed, the links are not detected.
-

Display Link Information

Catalyst Center allows you to display information about the links in the topology map. For simple links, the display shows information for the single link. For aggregated links, the display shows a listing of all the underlying links. The information includes the interface name, its speed, and its IP address.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Topology**.

- Step 2** In the tree view menu, select the area, site, building, or floor that you are interested in.

- Step 3** Hover your cursor over the link that interests you.

- Step 4** Click **Display** and enable **Link Health**.

A down link is shown in red. If you want to delete the link, select it and click **Delete**. You can bring the link up by doing the following:

- a) Log in to the device.
- b) Enable the interface.
- c) Resynchronize the device on the Inventory page.

Note Topology uses Link Layer Discovery Protocol (LLDP) to determine the links for devices that are discovered using LLDP in Catalyst Center.

Pin Devices to the Topology Map

Devices can be grouped or aggregated so that they take up less room on the map. However, at times, you might want to separate a device from its group. You can do this by pinning a device to the map.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Do one of the following:

- To pin a device, click the device group, and in the dialog box, click the pin icon to the left of the device name.
- To pin all the devices, click the device group, and, in the dialog box, click **Pin All**.

Note Double click the group to unpin the devices in the group.

Assign Devices to Sites

Devices can be assigned to specific sites using the topology map.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click **Unassigned Devices** in the left pane. All the unassigned devices are displayed in the topology area.

Step 3 Click the device for which you want to assign a site. Device details are displayed in a pop-up window. In the **Assign devices to:** section, click the **choose the location** drop-down list to select a location.

Step 4 (Optional) To assign the site only for the selected device and not for the connected (downstream) devices, uncheck the **Auto-assign unclaimed downstream devices** check box.

Step 5 Click **Assign**.

Save a Topology Map Layout

Catalyst Center has a Cisco-recommended topology layout that is displayed by default when you open the topology tool. You can customize multiple layouts and save them to view later. You can also set one of the layouts as the default to be displayed when you open the topology map.

Open a Topology Map Layout

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click **Custom View**.

Step 3 In the **Enter View Title** field, enter a name for your customized map.

Step 4 Click **Save**.

Step 5 (Optional) To set your customized map as the default, click **Make Default**.

Open a Topology Map Layout

You can open previously saved topology maps.

Before you begin

You should have saved topology map layouts.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click **Custom View**.

Step 3 Click the name of the map that you want to display.

Share a Topology Map Layout

You can share a customized map with other users.

Before you begin

- You must have topology map layouts saved.
- You must have at least one topology view saved.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click **Custom View**.

Step 3 Hover the cursor over the name of the custom map and click the **Share Focus** icon.

Step 4 In the confirmation window, click **Yes**.

Export the Topology Layout

You can export a snapshot of the full topology layout. The snapshot is downloaded as a SVG, PDF, PNG file to your local machine.

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Topology**.

Step 2 Click  (this icon represents **Export Topology**).

Step 3 Select a file format and click **Export**.

Export the Topology Layout



PART III

Design Your Network

- [Design the Network Hierarchy, on page 157](#)
- [Work with Wireless 2D and 3D Floor Maps, on page 171](#)
- [Configure Network Settings, on page 231](#)
- [Configure Network Profiles, on page 333](#)



CHAPTER 7

Design the Network Hierarchy

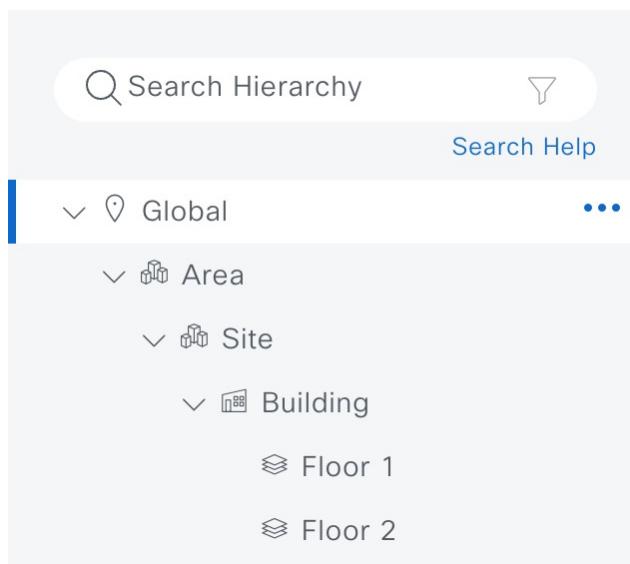
- [Network Hierarchy Overview](#), on page 157
- [Design a New Network Hierarchy](#), on page 159
- [Use an Existing Cisco Network Hierarchy](#), on page 159
- [Use an Existing Ekahau Network Hierarchy](#), on page 162
- [Export Your Network Hierarchy from Catalyst Center](#), on page 165
- [Search the Network Hierarchy](#), on page 166
- [Create a New Network Hierarchy](#), on page 167

Network Hierarchy Overview

You can create a network hierarchy that represents your network's geographical locations. The hierarchical organization enables you to easily apply design settings or configurations to a specific hierarchical element. For example, you can apply design settings to an entire area or to only a floor.

You can name hierarchical elements to help you identify where to apply design settings later.

The hierarchical elements that you can create have rules that dictate under which elements they can reside and which elements can reside under them. See the following figure and descriptions:

Figure 3: Network Hierarchy

- **Global:** Default element under which all other hierarchical elements reside. Areas or sites are the only elements that can reside directly under **Global**.

- **Areas and Sites** (): Areas and sites reside under **Global** or under other areas or sites. They do not have a physical address. As the largest element, they identify a geographic region. They provide a way to group areas or sites.

- **Buildings** (): Buildings reside under areas or sites. When you create a building, specify a physical address or latitude and longitude coordinates. Buildings can't contain areas. However, they can contain floors.

- **Floors** (): Floors reside under buildings. You can add floors to buildings with or without maps that contain various building components, like walls and windows. If you decide to use floor maps, you can manually create them or import them from files, such as DXF, DWG, JPG, GIF, PNG, or PDF file types. Then you can position your wireless devices on the floor maps to visualize your wireless network coverage.

You can change the site hierarchy for unprovisioned devices while preserving AP locations on floor maps. Note, however, that you can't move an existing floor to a different building.

To get started, build your network hierarchy using one of the following methods:

- Create a new network hierarchy. For more information, see [Create a New Network Hierarchy, on page 167](#).
- Import an existing network hierarchy from Cisco Prime Infrastructure or Ekahau Pro. For more information, see [Use an Existing Cisco Network Hierarchy, on page 159](#) or [Use an Existing Ekahau Network Hierarchy, on page 162](#).

Design a New Network Hierarchy

The **Design** area is where you create the structure and framework of your network, including the physical topology, network settings, and device type profiles that you can apply to devices throughout your network. Use the **Design** workflow if you do not already have an existing infrastructure. If you have an existing infrastructure, use the **Discovery** feature. For more information, see [Discovery Overview, on page 43](#).

You can perform these tasks in the **Design** area:

Step 1 Create your network hierarchy. For more information, see [Create, Edit and Delete a Site, on page 167](#).

Step 2 Define global network settings. For more information, see [Network Settings Overview, on page 231](#).

Step 3 Define network profiles. For more information, see [Network Profiles Overview, on page 333](#).

Use an Existing Cisco Network Hierarchy

If you have an existing network hierarchy in Cisco Prime Infrastructure, you can export it and then import it into Catalyst Center, saving time and effort spent in creating a new network hierarchy.

The following information is available for you to re-create your network hierarchy:

- **Site Hierarchy:** Your existing site hierarchy is downloaded in a CSV file format. The CSV file contains details such as site names, parent hierarchy, number of floors, location, and site address.
- **Map Archive:** Map information is downloaded as a map archive in a TAR file format. The map archive file contains data such as the date and time, number of floors, and APs. Depending on what you choose to download, the map archive can also include map information, such as floor dimensions (length, width, and height) and details about the APs and overlay objects that have been placed on the floor maps. You can also choose to download calibration information, such as the RF attenuation model that has been applied to each floor.

You can choose to base the map archive on the global hierarchy or the hierarchy of a single site, building, or floor, as follows:

- **Site:** The chosen site and all of its subsites, buildings, and floors are exported.
- **Building:** The chosen building and all of its floors are exported.
- **Floor:** The chosen floor is exported.



Note

Catalyst Center supports the United States' Federal Information Processing Standards (FIPS). FIPS is an optional mode that can be enabled when installing the Catalyst Center image. By default, FIPS mode is disabled.

FIPS mode has the following impact on the export and import of map archives.

If FIPS mode is *enabled*:

- Exported map archives are unencrypted.

Export Your Site Hierarchy from Cisco Prime Infrastructure

- Only unencrypted map archives can be imported.

If FIPS mode is *disabled*:

- Exported map archives are encrypted.
- Both encrypted and unencrypted map archives can be imported.

Export Your Site Hierarchy from Cisco Prime Infrastructure

You can export your site hierarchy from Cisco Prime Infrastructure in a CSV file format. The CSV file contains details such as site names, parent hierarchy, number of floors, location, and site address.

Site hierarchy export is supported in Cisco Prime Infrastructure, Release 3.2 and later.

Step 1 In Cisco Prime Infrastructure, choose **Inventory > Group Management > Network Device Groups**.

Step 2 In the **Device Groups** window, click **Export Groups**.

Step 3 In the **Export Groups** dialog box, click the **APIC-EM** radio button.

Step 4 To download the CSV file, click **OK**.

Export Your Map Archive from Cisco Prime Infrastructure

You can export map archive files from Cisco Prime Infrastructure and import them into Catalyst Center. Map archives contain map information, such as floor dimensions, and calibration information, such as the Radio Frequency (RF) attenuation model that has been applied to each floor in Cisco Prime Infrastructure.

Step 1 From the Cisco Prime Infrastructure GUI, choose **Maps > Wireless Maps > Site Maps (New)**.

Step 2 From the **Export** drop-down list, choose **Map Archive**.

The **Export Map Archive** window opens, and the **Select Sites** window opens by default.

Step 3 Check the check box adjacent to a specific site, campus, building, or floor that you want to export. Alternatively, check the **Select All** check box to export all the maps.

Step 4 Select at least one of the following options:

- **Map Information:** Click the **On** button to export floor dimensions (length, width, and height) and details about the APs and overlay objects that have been placed on the floor maps.
- **Calibration Information:** Click the **On** button to export the RF attenuation model that has been applied to each floor. It is a good practice to export the existing calibration data from Cisco Prime Infrastructure. Otherwise, you must re-enter the calibration details manually.

If you choose to include calibration information, you also need to specify whether to include information for the selected maps or all the information, as follows:

- **Calibration Information for selected maps:** Calibration information for the selected site maps is exported.
- **All Calibration Information:** Calibration information for the selected map and any additional calibration information that is available in the system is exported.

Step 5 Click **Generate Map Archive**.

The following message shows the progress of the operation:

Exporting data is in progress

A TAR file is created and is saved to your local machine.

Step 6 Click **Done**.

Import Your Site Hierarchy to Catalyst Center

You can import a site hierarchy that you exported from Cisco Prime Infrastructure as a CSV file. For information about exporting the site hierarchy, see [Export Your Site Hierarchy from Cisco Prime Infrastructure, on page 160](#).

Before you begin

- Make sure that you have Cisco Wireless Controllers and APs in your Catalyst Center inventory. If not, discover them using the **Discovery** feature.
- Add and position APs on a floor map.
- If you manually created sites in Catalyst Center that are present in Cisco Prime Infrastructure, you must remove them from Catalyst Center before you can import them.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.**Step 2** From the map toolbar, click **Import** and choose **Import Sites**.**Step 3** In the dialog box, click one of the following radio buttons:

- **Merge with Existing Sites:** The downloaded site information is combined with the existing site information.
- **Overwrite Existing Sites:** If the same site already exists in Catalyst Center, the existing site information is overwritten with the downloaded site information.

Step 4 In the dialog box, drag and drop your CSV file into the download area. Alternatively, you can click **Choose a file**, navigate to where your CSV file is located, and then click **Import**.

Note If you do not have a CSV file, click **CSV template** to download a CSV file that you can edit and upload.

Import Your Map Archive to Catalyst Center

You can import a map archive TAR file into Catalyst Center. For example, you can upload the TAR file that you exported from Cisco Prime Infrastructure.

Use an Existing Ekahau Network Hierarchy


Note

Catalyst Center supports the United States' Federal Information Processing Standards (FIPS). FIPS is an optional mode that can be enabled when installing the Catalyst Center image. By default, FIPS mode is disabled.

For information about exporting site hierarchy, see [Export Your Map Archive from Cisco Prime Infrastructure, on page 160](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the map toolbar, click **Import** and choose **Import Floor Maps**.

Step 3 In the **Import Floor Maps** dialog box, drag and drop the map archive file.

Step 4 Click **Import**.

The map archive file is imported.

Use an Existing Ekahau Network Hierarchy

The Ekahau Pro tool allows you to create a complete network plan for your enterprise, including floor layout, AP locations, and obstacles. After creating the floor layout, you can export the simulated network plan as an Ekahau project file. You can also export the real-world site survey data into a format that Catalyst Center can use.

Export the Ekahau Project from Catalyst Center

To augment the preconfigured working floors, the Catalyst Center allows you to export the working floors from Catalyst Center as an Ekahau project and import the project into the Ekahau Pro Tool.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

A world map displays in the right pane.

Step 2 In the left pane, select the desired site, building, or floor.

Step 3 To export a complete network map as an Ekahau project, from the **Export** drop-down list, choose **Export Floor Maps**.

To export an Ekahau project of a site, building, or floor map, from the left pane, hover your cursor over the ellipsis **...** next to the desired site, building, or floor and choose **Export Floor Maps**.

The **Export Floor Maps** dialog box is displayed.

Step 4 In the **Export Floor Maps** dialog box, select the **Ekahau Project** export format.

Step 5 Click **Export**.

An ESX file is created and saved to your local machine.

Step 6 Import the ESX file into the Ekahau Pro tool, augment the floor, and save the file.

- Step 7** Import the Ekahau project into the Catalyst Center under the site. For more information, see [Import an Ekahau Project to Catalyst Center, on page 163](#).

Import an Ekahau Project to Catalyst Center

Before you begin

Importing an Ekahau Cloud project can fail if the project has local changes (such as removing an AP or wall), that are out-of-sync with the Ekahau Cloud project. To avoid this situation, make sure to synchronize any local changes to the Ekahau Cloud before importing the Ekahau Cloud project to Catalyst Center.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

- Step 2** Design your network hierarchy by adding sites, buildings, and floors.

Note For more information, see [Create, Edit and Delete a Site, on page 167](#), [Add, Edit, and Delete a Building, on page 168](#), and [Add, Edit, and Delete a Floor, on page 169](#).

While adding floors, make sure that you create floors with the same name given in the Ekahau project.

- Step 3** In the left pane, hover your cursor over the ellipsis  icon next to the site where you want to import the Ekahau project and choose **Import Ekahau Project**.

The **Import Ekahau Project** dialog box appears.

- Step 4** Drag and drop the ESX file into the boxed area in the **Import Ekahau Project** dialog box, or click the **click to select** link and browse to the ESX file.

Note To import buildings, they need to contain coordinates inside the Ekahau Project. You can add coordinates in Ekahau Pro. After successfully importing an Ekahau Project, each planned AP is mapped to an existing real AP in the inventory using the AP name. The planned AP is displayed with an icon **P** on the floor map. For example, if the name of the planned AP is SJC01-02-AP-B-1, the import process searches for the real AP with the same name.

- Step 5** If an AP is not found in the inventory and remains unmapped, the planned AP is retained on the floor.

To see the reason for the mismatch, hover your cursor over the planned AP icon on the floor map, and click **Import History**.

The following attempts are made to map the planned APs to real APs:

- If the newly discovered APs match the planned AP, the planned AP is replaced with the discovered real AP.
- If a planned AP remains unmapped, you can manually replace the planned AP with the real AP, providing reasons for the failure.

- Step 6** To manually assign the planned AP to a real AP, hover your cursor over the planned AP icon on the floor map, and click **Assign > Assign**.

The **Assign Planned APs** panel appears.

- Step 7** In the **Assign Planned APs** panel, map the planned AP to a real AP by AP name, AP type, or All APs.

Import an Ekahau Site Survey to Catalyst Center

Step 8 Click the radio button next to the AP Name, and click **Assign** to manually assign the planned AP.

Step 9 Click **Save**.

Import an Ekahau Site Survey to Catalyst Center

To create your network hierarchy, you can upload an Ekahau site survey file and an AP mapping file (in CSV format).

The Ekahau site survey only contains the floor map with the APs known by name and position on the map. By default the AP model might not be set in the Ekahau site survey. A pre-requisite of importing to Catalyst Center is to open the project in Ekahau and configure the AP models using Ekahau-allowed model names, for example, *Cisco C9130i* for the Catalyst Center 9130 AP.

Because the Ekahau site survey doesn't provide Catalyst Center with any information about the radios of each AP, the AP mapping file augments the Ekahau site survey with this information. The AP mapping file is limited in that you can only provide the desired AP mapping by AP model, not by AP name. So, if you have multiple APs of the same type but different antenna configurations, only one antenna configuration can be applied to all APs of that type within the project.

For each AP in the AP mapping file, you define the model number followed by the configuration of each antenna:

```
model,antennaName0,antennaAzimuth0,antennaElevation0,antennaName1,antennaAzimuth1,antennaElevation1
```

For example, the following AP mapping file defines the configuration of a Cataylst 9130I with two antennas:

```
AP9130I,Internal-9130-2.4GHz,90d,0d,Internal-9130-5GHz,90d,0d
```

The model attribute must be the same as the equivlent planned AP model in the Catalyst Center GUI, for example, AP9130I for the Catalyst Center 9130 AP. Similarly, the *antennaName* attributes must also be the same names found and supported in the Catalyst Center GUI. If the AP has three or more radios, you can continue the *n*-based numbering pattern of the *antennaName*, *antennaAzimuth*, and *antennaElevation* parameters to define the antenna information for each radio by slot number supported by that AP model.

Catalyst Center includes a CSV template file that you can download and edit to define the required AP antenna information.

Figure 4: The CSV template file contains the following fields and defaults:

A	B	C	D	E	F	G	H	I	J
1	model	antennaName0	antennaAzimuth0	antennaElevation0	antennaName1	antennaAzimuth1	antennaElevation1	antennaName2	antennaAzimuth2
2	AP2700I	Internal-2700-5GHz	90d	0d	Internal-2700-2.4GHz	90d	0d		
3	AP1850I	Internal-1850-5GHz	90d	0d	Internal-1850-2.4GHz	90d	0d		
4	AP3800E	AIR-ANT2524DB-R-5GHz	179.9543762d	0d	AIR-ANT2524DB-R-2.4GHz	179.9543762d	0d		
5									

If an AP isn't in the Catalyst Center device inventory, it's imported as a planned AP. However, you can use a naming convention so that when you add an AP to the device inventory, Catalyst Center can automatically convert it to an actual AP.

The naming convention is AP followed by the last four digits of the AP's MAC address, for example, AP-c4:e0. Using this information, Catalyst Center attempts to match the provided digits with the last four digits of an AP's Ethernet MAC or radio MAC address. If this information isn't available or a match is unsuccessful, Catalyst Center attempts to match AP names.

Before you begin

- Open the project in Ekahau and configure the AP models using Ekahau-allowed model names, for example, *Cisco C9130i* for the Catalyst Center 9130 AP.
- Create an AP mapping file (CSV format) to provide Catalyst Center with information about the radios of each AP model that is being used.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 Click **Add Site > Add Area**.

Alternatively, you can hover your cursor over the ellipsis  next to the parent site or **Global** in the left pane, and choose **Add Area**. For more information, see [Create, Edit and Delete a Site, on page 167](#).

Step 3 In the left pane, hover your cursor over the ellipsis  icon next to the site you just created and choose **Import Ekahau Survey**.

Step 4 In the **Import Ekahau Survey** dialog box, drag and drop the Ekahau Survey file into the **Ekahau Survey** boxed area, or click the **Choose a file** link and browse to the ESX file.

Step 5 Drag and drop the CSV file into the **AP Mapping CSV** boxed area, or click the **Choose a file** link and browse to the CSV file.

Note If you do not have a CSV file, click **Download AP Mapping Template** to download a CSV file that you can edit and upload.

Step 6 Click **Import**.

After the files are successfully downloaded, a success message is displayed.

Step 7 Click **View Hierarchy** and navigate to the floors to verify that the devices have been imported and positioned properly. Hover the cursor over a device to view its details.

Export Your Network Hierarchy from Catalyst Center

You can export a site hierarchy to a CSV format file. You can also export a complete network map (global hierarchy) or the hierarchy of a site, building, or floor. You can choose either a Cisco Prime Infrastructure or Ekahau Pro format. Exporting your network hierarchy into these formats allows you to continue to work on your network hierarchy in these tools.

Export Your Site Hierarchy from Catalyst Center

You can export a site hierarchy to a CSV format file. The CSV file contains details such as site names, parent hierarchy, number of floors, location, and site address.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the map toolbar, click **Export** and choose **Export Sites**.

- Step 3** In the **Export Sites** dialog box, click **OK**.
-

Export Your Map Archive from Catalyst Center

You can export a complete network map (global hierarchy) or the hierarchy of a site, building, or floor to either a Cisco Prime Infrastructure or Ekahau Pro format. You can export up to 500 floors.



Note Catalyst Center supports the United States' Federal Information Processing Standards (FIPS). FIPS is an optional mode that can be enabled when installing the Catalyst Center image. By default, FIPS mode is disabled.

FIPS mode has the following impact on the export and import of map archives.

If FIPS mode is *enabled*:

- Exported map archives are unencrypted.
- Only unencrypted map archives can be imported.

If FIPS mode is *disabled*:

- Exported map archives are encrypted.
- Both encrypted and unencrypted map archives can be imported.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 To export the complete network map, from the map toolbar, click **Export** and choose **Export Floor Maps**.

To export the hierarchy of a site, building, or floor map, from the left pane, hover your cursor over the ellipsis (...) next to a site, building, or floor and choose **Export Floor Maps**.

The information that is exported depends on what you choose:

- **Site**: The chosen site and all of its subsites, buildings, and floors are exported.
- **Building**: The chosen building and all of its floors are exported.
- **Floor**: The chosen floor is exported.

- Step 3** In the **Export Floor Maps** dialog box, click either the **Ekahau Project** or the **Prime** radio button.

Step 4 Click **Export**.

Search the Network Hierarchy

You can search the network hierarchy to quickly find a site, building, or area. This is particularly helpful after you have added many sites, areas, or buildings.

Step 1 To search the hierarchy, from the **Search Hierarchy** search field in the left pane, enter either the partial or full name of the site, building, or floor name that you are searching.

The hierarchy is filtered based on the text you enter in the search field.

Step 2 To search the hierarchy by **Site Name** and **Site Type** filter criteria, click the filter icon in the **Search Hierarchy** search field and do the following:

- a. In the **Site Name** field, enter the name of the site that you want to search.
- b. Check the **Include Address for all Building** check box to include the address of all building in the search result.
- c. In the **Site Type** area, check the check boxes next to **Area**, **Building**, or **Floor** that you want to include in filter criteria.
- d. Click **Search**.

The hierarchy is filtered based on the filter criteria.

- e. To exclude the search criteria in the left pane, click the cross-mark next to respective criteria.
-

Create a New Network Hierarchy

Create a new network hierarchy by creating new sites (or areas), building, and floors.

Create, Edit and Delete a Site

Catalyst Center allows you to easily define physical sites and then specify common resources for those sites. The **Design** area uses a hierarchical format for intuitive use, while eliminating the need to redefine the same resource in multiple places when provisioning devices. By default, there is one site called **Global**. You can add more sites, buildings, and areas to your network hierarchy. You must create at least one site before you can use the provision features.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

A world map appears in the right pane.

Step 2 From this window, you can add, edit, and delete sites. See the following table for details.

Action	Steps
Add a site.	<p>a. From the map toolbar, click + Add Site > Add Area. Alternatively, you can hover your cursor over the ellipsis ••• next to the parent site in the left pane, and choose Add Area.</p> <p>b. In the Area Name field, enter the site name. The Area Name field has the following restrictions:</p> <ul style="list-style-type: none"> • The area name cannot exceed 40 characters. • Special characters & > < ? ' " / [] aren't allowed. <p>c. From the Parent drop-down list, choose a parent node. Global is the default parent node.</p> <p>d. Click Add.</p>
Edit a site.	<p>a. In the left pane, hover your cursor over the ellipsis ••• next to the site and choose Edit Area.</p> <p>b. In the Edit Area dialog box, make the necessary edits.</p> <p>c. Click Update.</p>
Delete a site.	<p>a. In the left pane, hover your cursor over the ellipsis ••• next to the site and choose Delete Area.</p> <p>b. Click OK.</p>

Add, Edit, and Delete a Building

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From this window, you can add, edit, and delete a building. See the following table for details.

Action	Steps
Add a building.	<p>a. In the Network Hierarchy window, click +Add Site > Add Building. Alternatively, you can hover your cursor over the ellipsis  next to the parent site in the left pane, and choose Add Building.</p> <p>b. In the Add Building dialog box, add the building details. The Building Name field has the following restrictions:</p> <ul style="list-style-type: none"> • The building name cannot exceed 40 characters. • Special characters & > < ? ! " / [] aren't allowed. <p>You can enter the address in the field or click the map. Adding an address causes the Longitude and Latitude coordinate fields to be automatically populated. These coordinates correspond to the northwest corner of the building and are used by location services, such as Cisco Spaces or Cisco Connected Mobile Experiences (CMX), if they are integrated with Catalyst Center.</p> <p>c. Click Add.</p>
Edit a building.	<p>a. In the left pane, hover your cursor over the ellipsis  next to the site and choose Edit Building.</p> <p>b. In the Edit Building dialog box, make the necessary edits.</p> <p>c. Click Update.</p>
Delete a building.	<p>a. In the left pane, hover your cursor over the ellipsis  next to the building and choose Delete Building.</p> <p>b. Click OK.</p>

Add, Edit, and Delete a Floor

After you add a building, you can add floors to it. You can add a basic floor that doesn't have a floor map and add the floor map later, or you can add a floor and include a floor map at the same time.

To add a basic floor to a building, use this procedure.

To add a floor and a floor map at the same time, see one of the following topics:

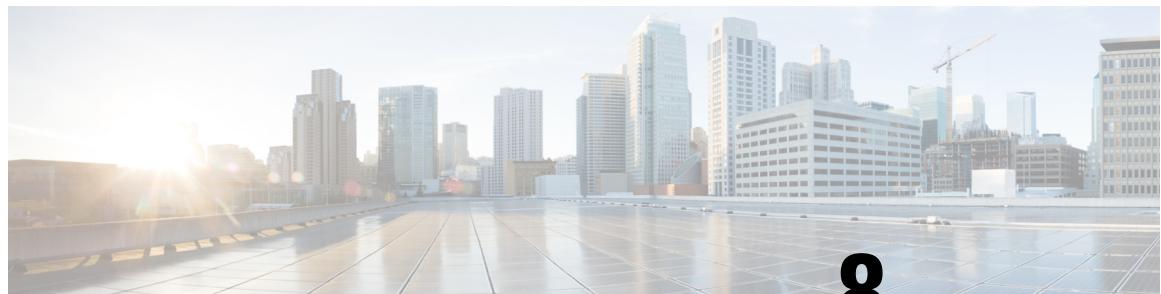
- [Add a Floor with a CAD Map File, on page 174](#)
- [Add a Floor with a Non-CAD Map File, on page 175](#)
- [Import an Ekahau Project to Catalyst Center, on page 163](#)

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Add, Edit, and Delete a Floor

Step 2 From this window, you can add, edit, and delete a floor. See the following table for details.

Action	Steps
Add a basic floor	<p>a. In the left pane, hover your cursor over the ellipsis next to the desired building and choose Add Floor.</p> <p>b. In the Floor Name field, enter a name for the floor.</p> <p>The Floor Name field has the following restrictions:</p> <ul style="list-style-type: none"> • The floor name cannot exceed 40 characters. • Special characters & > < ? ' " / [] aren't allowed. <p>c. In the Global Unit System area, select Feet or Meters.</p> <p>When the floor is added, all the floors across all the sites sync to display all measurements in your chosen unit system. To update the global unit system, see 2D Map View Options, on page 206.</p> <p>d. If you have wireless devices, for the Type (RF Model) drop-down list, choose the RF model to apply to the floor.</p> <p>The RF model determines how the RF is calculated when computing 2D and 3D heatmaps that show the relative intensity of the RF signals in the coverage area.</p> <p>e. Configure the Floor Number, Floor Type and Thickness fields.</p> <p>The floor type and thickness are used when calculating a heatmap for wireless devices.</p> <p>f. Skip uploading a floor map image in Floor Image area.</p> <p>g. Configure map dimensions in the Width, Length, and Height fields.</p> <p>h. Click Add.</p>
Edit a floor	<p>a. In the left pane, hover your cursor over the ellipsis next to the floor and choose Edit Floor.</p> <p>b. In the Edit Floor dialog box, make the necessary changes.</p> <p>c. Click Update to save the changes.</p>
Delete a floor	<p>a. In the left pane, hover your cursor over the ellipsis next to the floor and choose Delete Floor.</p> <p>b. Click Ok.</p>



CHAPTER 8

Work with Wireless 2D and 3D Floor Maps

- [Floor Maps Overview, on page 171](#)
- [Heatmap Overview, on page 172](#)
- [Wireless Maps Prerequisite, on page 173](#)
- [Add a Floor with a Map File, on page 173](#)
- [Work with 2D Maps, on page 178](#)
- [Work with 3D Maps, on page 214](#)

Floor Maps Overview

There are several reasons to add floors with floor maps. One reason is to see your wireless network the way it exists today. Another reason is to help you plan and visualize future changes.

You can visualize your wireless network by creating or importing a floor map that contains various building components, like walls and windows, and then positioning your wireless devices on it.

Interactive planning helps you plan a floor layout by drawing planned, or hypothetical, APs and obstacles with a raster image or a CAD floor plan as the backdrop. You can export the floor map as a PDF and share it with the technicians who are mounting the APs. The floor drawing helps the technicians to visualize the floor layout and the exact AP mount locations.

With interactive floor planning, you can:

- Create a floor layout with a raster or CAD floor plan as the canvas.
- Place the planned APs or hypothetical APs on the floor map based on the signal coverage requirement. These hypothetical APs or planned APs are not yet installed or discovered by Catalyst Center.
- Assign the antenna type and orientation.
- Draw obstacles, such as walls and shelving on the floor, that impact the signal attenuation.
- Plan all APs in sequence.
- Export the floor map as a PDF.

Heatmap Overview

A heatmap is a visual representation of the Radio Frequency (RF) signal coverage of the wireless network devices in a particular area. In Catalyst Center, you can generate a heatmap on a per floor basis by creating or importing a floor map that contains various building components, like walls and windows, and then positioning your wireless devices on it.

Using the floor map, Catalyst Center computes 2D and 3D heatmaps that show the relative intensity of the RF signals in the coverage area. For 2D wireless maps, the heatmap is computed at height of 3 feet from the floor, while in 3D wireless maps, the heatmap is computed using the entire volume of the floor (from floor-to-ceiling). For this reason, using 3D wireless maps is especially useful for computing wireless coverage in high-ceiling environments, like warehouses.

In addition, the 3D wireless heatmap can compute the effect of a floor's signal coverage on its neighboring floors. Neighboring floors are the two floors directly above and below the selected floor. Neighboring floors are configurable, meaning you can choose which neighboring floors you want to use in a heatmap computation. (See **Contributing Floors** in [3D Map View Options, on page 218](#).) In this way, you can detect, visualize, and analyze the impact of a floor's signal coverage on other floors. For example, you might have clients on the first floor who are connecting with APs on the second floor, or clients might be competing for signal on the same channel (called cochannel interference). In some cases, this might be an intentional design. However, if this design isn't intentional, you can take steps to change it.

The legacy heatmap generator is still available to be used. However, we recommend that you use the enhanced 3D-computed heatmap generator for both 2D and 3D heatmaps, because it can generate heatmaps much faster.

3D-Computed Heatmap Generator

The 3D-computed heatmap generator, which is enabled by default, offers several advantages over the legacy heatmap generator. It uses the specialized graphics processing unit (GPU) to accelerate graphics rendering. Therefore, it can generate heatmaps substantially faster than the legacy heatmap generator. In addition, you can set a limit to the number of walls that are included in a heatmap computation, which also helps to enhance processing speed.

The 3D-computed heatmap generator automatically removes small obstructions (under 0.75 ft) and the second sides of the walls, leaving only one side per wall. (Catalyst Center applies an attenuation value for each wall, not for each side of a wall.)

Legacy Heatmap Generator

The legacy (server-based) heatmap generator is still available to be used. However, we recommend that you use the enhanced 3D-computed heatmap for 2D heatmaps because performance and accuracy are much better.

The legacy server-based heatmap generator has a limit on the number of walls that can be used to compute 2D and 3D heatmaps. The maximum number of walls for a 2D heatmap is 300, after optimization. If your CAD file contains more, Catalyst Center alerts you and preserves the 300 most relevant walls (based on the length of the wall multiplied by its attenuation). The maximum number of walls for a 3D heatmap is 3000, after optimization. If your CAD file contains more, Catalyst Center alerts you and preserves the 3000 most relevant walls (based on the length of the wall multiplied by its attenuation).

Although the 3D-computed heatmap generator is enabled by default, you can disable it and use the legacy heatmap generator instead.

Wireless Maps Prerequisite

The system you use to compute and display both 2D and 3D wireless heatmaps must have a Graphical Processing Unit (GPU) installed and enabled on it. For example, if you're using a Windows virtual machine (VM), you need to make sure that it has a GPU.

Add a Floor with a Map File

When you create a floor, you can include a floor map at the same time. The following topics help you understand the different floor creation methods depending on the floor map file type that you use. Procedures for each method are also provided.

Floor Map Creation Methods

To view a wireless map, first you need to create or import a floor map:

- **Create a Floor Map:** To create a floor map from scratch, you need to add the floor elements manually. The floor elements, like walls, windows, shelving, and so on, are displayed in the wireless map and used for heatmap computations. For details, see [2D Floor Map Devices and Overlay Objects, on page 179](#).
- **Import a CAD file:** When you use a CAD file (DXF or DWG file type) to import a floor map, Catalyst Center converts the CAD layers into the floor elements (walls, windows, shelving, and so on) that you specify. The floor elements are displayed in the wireless map and are used for heatmap computations.

Previously, Catalyst Center didn't limit the number of walls that could be imported from a CAD file. Now, however, Catalyst Center allows you to set a limit. The fewer walls you import, the less time it takes for the heatmap to be computed. For more information about heatmap generation, see [Heatmap Overview, on page 172](#).

When deciding which layers and elements to import, focus on obstacles that create the most signal attenuation. In principle, the longer, thicker, and denser a wall is, the higher its attenuation. Low walls, like cubicles, and narrow walls, like columns, have low attenuation and have little effect on the heatmap. However, even if a material of an obstacle is dense, the attenuation might not be significant if the signal can radiate around it. If you're not interested in the coverage outside of a building, don't include external walls or windows. Doing so provides better 3D visualization of the inside of the building.

If your CAD file doesn't have walls in specific layers but has walls mixed with other elements, don't select them for import. You can add walls manually later. For information, see [Add, Edit, and Remove Walls, on page 198](#).

Block inserts and proxy entities can't be imported. Imported layers must contain only native elements like lines, polylines, arcs, and so on.

For the procedure, see [Add a Floor with a CAD Map File, on page 174](#).

- **Import a non-CAD image file:** You can use JPG, GIF, PNG, or PDF files to import the floor plan. Typically, this type of file is used to create 2D floor maps. However, you need to manually create the floor elements, such as the walls and shelving, for them to be represented in the wireless map. For the procedure, see [Add a Floor with a Non-CAD Map File, on page 175](#).

Guidelines for Image Files to Use in Maps

- **Import a Ekahau Pro Project plan:** You can import Ekahau project data, such as the obstacles, APs, and more, to create a wireless map. For the procedure, see [Import an Ekahau Project to Catalyst Center, on page 163](#).

Guidelines for Image Files to Use in Maps

Follow these guidelines to use map image files:

- Use a graphical application that can save the map image files to any of these formats—.jpg, .gif, .png, .pdf, .dxf, and .dwg.
- Map image files can be of any size. Catalyst Center imports the full definition of the original images to its database, but during display, it automatically resizes them to fit the workspace.
- Obtain the horizontal and vertical dimensions of the site in feet or meters before importing. This helps you to specify these dimensions during map import.
- Avoid using floor map images with rotation metadata, because the images might not render correctly when synced to CMX or Cisco Spaces. Although the floor map images might be in formats that are supported by Catalyst Center, the ways in which certain tools add the metadata can be rendered differently. For example, an image file with rotation metadata that is opened in three different applications might render horizontally in two applications and vertically in the other.

Add a Floor with a CAD Map File

You can use CAD files (DXF or DWG file types) to create a floor map.

For 2D floor maps, you must choose the CAD layers that you want to be used in the 2D view. For 3D floor maps, Catalyst Center converts the CAD layers you choose into the floor elements that you define. You can define floor elements as walls, shelving, windows, obstacles, and so on.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, hover your cursor over the ellipsis  next to the building and choose **Add Floor**.

Step 3 In the **Floor Name** field, enter a name for the floor.

Step 4 From the **Type (RF Model)** drop-down list, choose the RF model to apply to the floor. The RF model determines how the RF is calculated based on the characteristics of the floor.

Step 5 Drag and drop the CAD file (the DXF or DWG file type) to the **Floor Image** area.

When importing a CAD file, Catalyst Center will only import entities of the following types:

- Lines, open polylines, and closed polygons: LINE, LWPOLYLINE, POLYLINE, and SOLID
- Radius-based: ARC, CIRCLE, ELLIPSE (including arcs of ellipse)
- Other geometry elements: SPLINE
- Texts: ATTRIB, MTEXT, TEXT
- Block insertions (normally used for furniture): INSERT

Note By default, overlays are not displayed after you import a map. So, after you import a floor plan, make sure that you enable the overlay visibility. From the map toolbar, click **View Options**. From the right pane, expand **Overlay Objects** and click the toggle button for each object you want to display.

Step 6 In the **Floormap** window, choose the CAD layers that you want to include in the floor map:

- In the **2D** column, check the check boxes corresponding to the CAD layers that you want in the 2D floor map.

Tip If some elements aren't displayed on the map (even when the **2D** check boxes are checked for the corresponding CAD layers), go to AutoCAD, open the required CAD file, select all the elements in the required layers, run the **Explode** command, and save it as a new DWG file. This action converts unsupported wrapper entities, like group and proxy entities, to entities that Catalyst Center can read. Then close the **Floormap** window and upload the updated CAD file (see [Step 5, on page 174](#)).

- In the **Wall/Shelving Type** column, click the drop-down and, for each CAD layer that you want converted, choose the wall or shelving type that you want the CAD layer converted into.

Each wall or shelving type has a decibel (dB) value associated with it. This dB value is used to compute signal attenuation in the heatmap. For more information, see [Floor Map Creation Methods, on page 173](#).

After a wall/shelving type is selected, the **Counter** column is updated with the number of units detected in the CAD file and the **Total Selected Walls Counter** is incremented. If the total number of selected walls exceeds the import walls limit, you have three options to proceed:

- Add the floormap with the current number of walls. In this case, Catalyst Center imports only the most relevant walls (equal to the import walls limit).
- Increase the import walls limit. Keep in mind that the more walls you import, the longer it takes for the heatmap to be computed.
- Decrease the total number of selected walls to a number that doesn't exceed the import walls limit by deselecting one or more wall/shelving types.

- Click **Use Selected Layers**.

Step 7 Enter the floor map dimensions in the **Width**, **Length**, and **Height** fields.

Step 8 Click **Add**.

By default, the map is displayed with a grid. To turn the grid off or on, use the **Show Grid** toggle button at the bottom-left side of the map.

Note After you import a floor plan, make sure that you enable the overlay visibility. (From the floor, click **View Options** and enable the overlay toggles in **Overlay Objects**). By default, overlays are not displayed after you import a map.

Add a Floor with a Non-CAD Map File

You can use non-CAD files (JPG, GIF, PNG, or PDF file types) to create a floor map. However, when using a non-CAD file, the 3D floor elements, such as walls and shelves, cannot be imported, and you must add them manually later. For more information, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Add a Floor with a Non-CAD Map File

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, hover your cursor over the ellipsis **...** next to the building and choose **Add Floor**.
- Step 3** In the **Floor Name** field, enter a name for the floor.
- Step 4** In the **Global Unit System** area, select **Feet** or **Meters**.
- When the floor is added, all the floors across all the sites sync to display all measurements in your chosen unit system. To update the global unit system, see [2D Map View Options, on page 206](#).
- Step 5** From the **Type (RF Model)** drop-down list, choose the RF model to apply to the floor. The RF model determines how the RF is calculated based on the characteristics of the floor.
- Step 6** Drag and drop the non-CAD file (JPG, GIF, PNG, or PDF file type) onto the **Floor Image** area.
- Note** Ensure to provide the precise dimensions of floors that are in the PDF format, because the image width and height ratio cannot be extracted from them.
- Step 7** Click **Add**.
The floor map is created.
- Note** After you import a floor plan, make sure that you enable overlay visibility. (From the floor, click **View Options** and in **Overlay Objects**, enable overlay visibility by clicking the overlay object's corresponding toggle button.) By default, overlays are not displayed after you import a map.
- Step 8** To add walls as a 3D floor element, do the following:
- From the map toolbar, click **2D > Add/Edit > Overlays > Walls**.
 - From the left pane of the map, click the wall type that you want to add.
- If the wall type is not in the list, click **Add Wall Type** to create a new wall type.
- Use the drawing tool to create a wall on the map:
 - Click where you want to begin the wall. Then move your cursor to the next point and click again. Continue this process until you have created the wall in the shape you want.
 - To finalize the wall, double click where you want the wall to end. To cancel the drawing, right-click the map.
 - To change the type of an existing wall, right-click the shape and choose **Change Type**.
 - To move an existing wall, drag and drop the shape to the new location.
 - To remove an existing wall, right-click the shape and choose **Delete**.

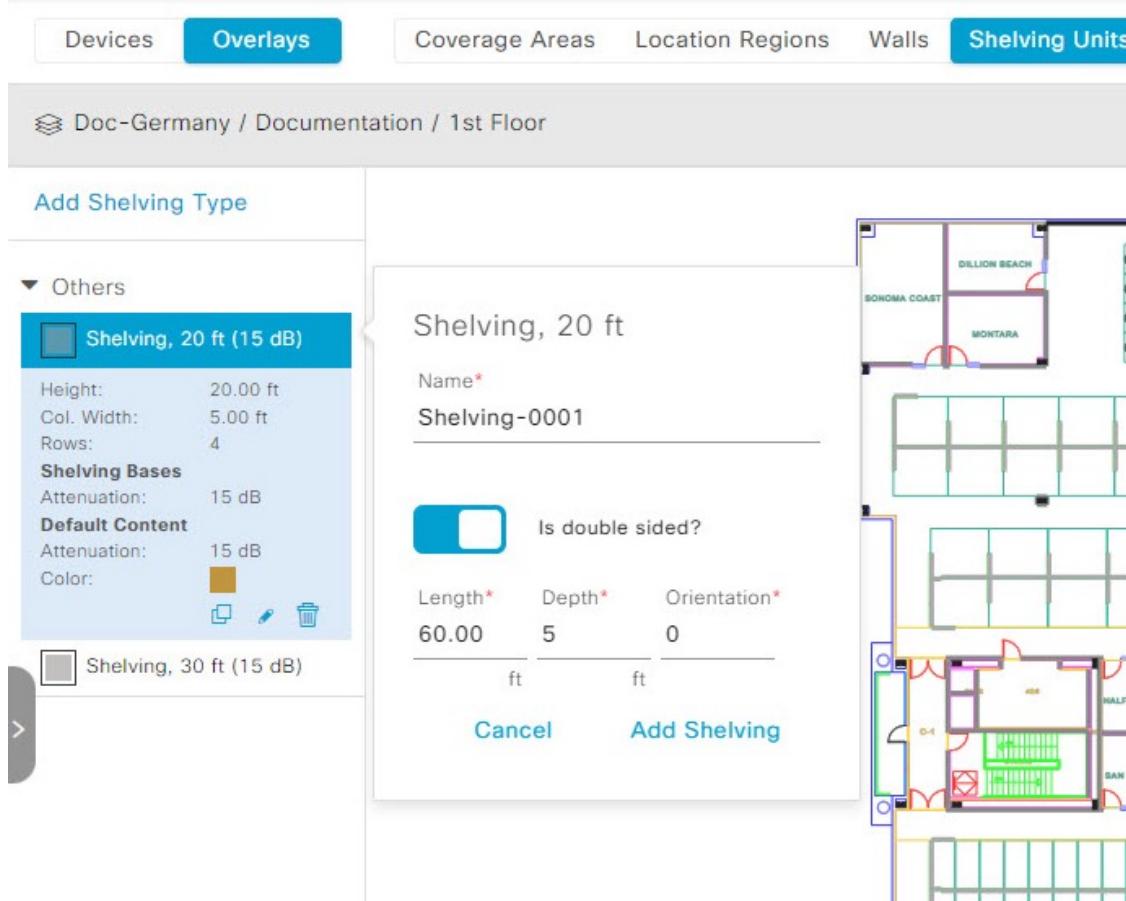
Figure 5: Adding a Wall with the Drawing Tool**Step 9**

To add shelving units as a 3D floor element, do the following:

- In the map toolbar, click **2D > Add/Edit > Overlays > Shelving Units**.
- In the left pane of the map, click the shelving type that you want to add.
 - In the **Shelving** dialog box, you can edit the name, dimensions, and orientation of the shelving type. Orientation refers to the angle of the shelving, for example, 0 means that the shelving is vertical and parallel to the y axis.
 - If a shelving type is not in the list, click **Add Shelving Type** to create a new shelving type.

Work with 2D Maps

Figure 6: Choosing a Shelving Type to Add



- c) In the **Shelving** dialog box, click **Add Shelving** to add the shelving to the floor map.
- d) Drag and drop the shelving to move it to a location on the floor map.
- e) Right-click the shelving and choose one of the following actions:
 - **Edit:** Edit the name, dimensions, and orientation of the shelving.
 - **Clone:** Create a copy of the shelving.
 - **Array:** Create an array of shelving by specifying the number of shelves and the distance between them.
 - **Remove:** Remove the shelving from the floor map.

Step 10 When you're done, click **Save** in the map toolbar.

Work with 2D Maps

2D maps are primarily used to configure elements on a floor map and view heatmaps.

Using 2D maps, you can add floor map elements and overlays. While viewing a 2D map, you can manipulate the display of the various elements and overlays. You can also filter device data and identify wireless interferers.

Catalyst Center calculates the strength and quality of wireless signals. These RF predictions are commonly known as heatmaps, because they show the relative intensity of the RF signals on the 2D wireless coverages area map.

2D Floor Map Devices and Overlay Objects

In 2D maps, you can configure devices and overlay objects on your floor maps.

Devices

- **APs:** An access point (AP) serves as the connection point between wireless and wired networks or as the center point of a standalone wireless network. In 2D maps, an AP represents an actual, installed device. For a list of APs that Catalyst Center supports, see the [Cisco Catalyst Center Compatibility Matrix](#).
- **Planned APs:** Planned APs are representations of APs that have not been installed yet. By placing planned APs on a map, you can envision your wireless network RF coverage and make changes before you actually install the APs.
- **Sensors:** A sensor is a dedicated Cisco Aironet 1800S Active Sensor that gets bootstrapped using Cisco PnP. After it obtains the Assurance server reachability details, it communicates directly with the Assurance server. For more details, including information about sensor tests, see the [Cisco Catalyst Assurance User Guide](#).

Overlay Objects

- **Coverage Areas:** By default, any area defined as part of a floor map is considered as a wireless coverage area. However, if you have a building that is nonrectangular or you want to mark a nonrectangular or polygon-shaped area on a floor, you can use the **Coverage Areas** drawing tool to create a coverage area.
- **Openings:** An opening, also called an atrium, is an open-air or skylight-covered area within a building. An opening can extend through multiple floors and can affect wireless signal coverage areas.
- **Location Regions:** Location regions define areas that are included in or excluded from the computation of heatmaps. Inclusion areas are included in the calculations, and exclusion areas are not included. For example, you might want to exclude areas such as openings, atriums, or stairwells within a building, but include a work area, such as cubicles, labs, or manufacturing floors.
- **Walls:** Walls define any exterior or interior vertical structures in a building, such as windows, cubicles, and doors. Because they can be made of different materials and have different densities, they can significantly impact RF signal attenuation and heatmap calculation. For example, the more walls you include in a floor map, the longer it can take to compute a heatmap. Although, even if you have a high number of walls on your floormap, you can adjust the number used to compute the heatmap. For information, see [2D Map View Options, on page 206](#) and [3D Map View Options, on page 218](#).
- **Shelving Units:** Shelving units are obstacles that can significantly impact RF signal attenuation and heatmap calculation. A high-ceiling warehouse is an example of a location with shelving units.
- **Markers:** A marker identifies a location on a map. When you create a marker, you can name it and position it to help you identify it later.

Work with APs on a Floor Map

- **GPS Markers:** When integrated with Catalyst Center, location services, such as Cisco Spaces or Cisco Connected Mobile Experiences (CMX), use GPS markers to calculate the approximate geographical location of clients.
- **Align Points:** Align points are markers that are used to position multiple floors that have different physical shapes. In 3D maps, floors are aligned at the top-left corner of the map (point 0,0). If you manage each floor independently, the misalignment is not a problem. However, to use some of the features of 3D maps, the floors need to be aligned as they are in reality. To compensate this misalignment, you can insert one or more align points on two or more floors, so that the floors align properly one on top of the other in a 3D map.

Work with APs on a Floor Map

Catalyst Center computes heatmaps for the entire map that show the relative intensity of the Radio Frequency (RF) signals in the coverage area. For 2D wireless maps, the heatmap is only an approximation of the actual RF signal intensity because it does not consider the attenuation of various building materials, such as drywall or metal objects, nor does it display the effects of RF signals bouncing off obstructions.

Follow these guidelines while placing APs on the floor map:

- Place APs along the periphery of coverage areas to keep devices close to the exterior of rooms and buildings. APs placed in the center of these coverage areas provide good data on devices that would otherwise appear equidistant from all other APs.
- Location accuracy can be improved by increasing overall AP density and moving APs close to the perimeter of the coverage area.
- In long and narrow coverage areas, avoid placing APs in a straight line. Stagger them so that each AP is more likely to provide a unique snapshot of the device location.
- Although the design provides enough AP density for high-bandwidth applications, location suffers because each AP view of a single device is not varied enough. Therefore, location is difficult to determine. Move the APs to the perimeter of the coverage area and stagger them. Each has a greater likelihood of offering a distinctly different view of the device, resulting in higher location accuracy.
- For optimal heatmap visibility on floor maps, configure the AP height to approximately 10 feet (3 meters) or lower.

Export APs from Cisco Prime Infrastructure and Import into Catalyst Center

Catalyst Center allows you to import, assign, and position a collection of APs to the floor map. If you have an existing collection of APs on Cisco Prime Infrastructure, you can import it into Catalyst Center, saving time and effort spent in importing, assigning, and positioning APs to the floor map.

This procedure describes how to export an existing collection of APs from Cisco Prime Infrastructure and to import it into Catalyst Center.

Before you begin

- To perform the following task, you must be a **Super Admin** or **Network Admin**.
- Make sure that you have APs in your inventory. If not, discover them using the **Discovery** feature.
- Add and position APs on a floor map.

- The area, building, and floor must be present in the site hierarchy.

-
- Step 1** Export the AP positions from Cisco Prime Infrastructure as a CSV file to your workstation.
- Step 2** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 3** From the left hierarchy tree, hover your cursor over the ellipsis  next to the site and choose **Import Access Points**. Alternatively, from the map toolbar, you can click **Import** and choose **Import Access Points**.
- Step 4** In the **Import Access Points** dialog box, drag and drop the AP file, or click **Choose a file** to select the file from your workstation.

Note

- To manually create the **AP Positions** CSV file with the Prime template, export the Prime template to your workstation by clicking **Download Prime Template**. The Prime template does not support nested files.
- To manually create the **AP Positions** CSV file with the Catalyst Center template, export the Catalyst Center template to your workstation by clicking **Download Cisco DNA Center Template**. The Catalyst Center template supports nested files.

Wait for the CSV file to download. The CSV file contains information about the AP positions of various sites in the network.

- Step 5** Click **Import**.

The **Import Summary** window is displayed.

- The **Information** tab shows the list of successfully imported APs.
- Click the **Warning** tab to see the list of warnings.
- Click the **Error** tab to see the list of errors.

- Step 6** In the top-right corner of the **Import Summary** window, click **Done** to return to the **Network Hierarchy** window.
-

Add APs to a Map

This procedure describes how to add APs to a map.

Before you begin

Make sure that you have Cisco APs in your inventory. If not, discover them using the Discovery feature. See [Discovery Overview, on page 43](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** From the map toolbar, click **2D > Add/Edit**.
By default, the **Devices** and **Access Points** toggle buttons are chosen.
- Step 4** In the left pane of the map, click **Add Access Points**.

 Add Planned APs to a Map

Step 5 In the **Add Access Points** slide-in pane, do one of the following in the table:

- **To add a single AP:** Locate the AP that you want to add, and scroll to the right and click **Add**.
- **To add multiple APs:** Check the check boxes next to the APs you want to add, and click **Add Selected**.

Note You can search for APs using the search option available. Use the **Filter** field to search for APs using the AP name, MAC address, model, or Cisco Wireless Controller. The search is case-insensitive. The search results appear in a table. Click **Add** to add one or more of these APs to the floor area.

In edit mode, newly added APs are displayed in the **Unpositioned** category in the map left pane. For more information, see [Position an AP on a Map, on page 185](#).

Step 6 After adding the APs to a floor, close the **Add Access Points** slide-in pane.

What to do next

When you add an AP to a map, the wireless map automatically stores the following data even after the AP is deleted from the inventory:

- AP name
- AP MAC address
- Current site of the AP
- Current position of the AP on the map



Note If you delete the corresponding site from the network hierarchy, the stored AP data is also removed.

When you delete the wireless controller with all its managed APs from the inventory, Catalyst Center displays a planned AP icon for the corresponding APs on the map. For more information, see [About the AP Icon and Planned AP Icon, on page 209](#).

If the same AP is rediscovered in the inventory later, Catalyst Center automatically places it back on the map at the same site and position even if a different wireless controller manages it.

To remove the AP data from the map when the AP is deleted from the inventory, you can do one of the following:

- Before deleting the wireless controller from the inventory, assign the corresponding APs to the **Global** site. For more information, see [Add a Device to a Site, on page 108](#).
- After deleting the wireless controller from the inventory, remove the corresponding planned APs from the map. For more information, see [Remove APs from a Map, on page 193](#).

Add Planned APs to a Map

This procedure shows you how to use the AP Model Catalog feature to add a planned AP to a floor and configure its model, antenna type, azimuth, and elevation orientation. Using the planned AP that you just created and placed, you can add more planned APs with the same properties.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit**.
- By default, the **Devices** and **Access Points** toggle buttons are chosen.
- Step 4** In the left pane of the map, in the **Planned AP Models** area, click the AP model of the planned AP that you want to add.
- Note** If the AP model isn't listed, click **Add Model** and choose the AP model to add to the list.
- Step 5** On the floor map, click the location where you want to place the planned AP.
- A planned AP of the selected model is added to the floor map, and the **Edit Planned AP** slide-in pane is displayed with an AP name added to it by default.
- Step 6** In the **Edit Planned AP** slide-in pane, click the gear icon that is located next to the **AP Name** field.
- The **Name pattern** dialog box is displayed.
- Step 7** When you add the first AP to the floor, make sure that you enter a valid name pattern, for example, SJC-BLD21-FL2-AP####, and then click **Set name pattern**.
- Note** The planned APs must be unique within Catalyst Center. So, make sure that the name pattern identifies the floor.
- The ##### in the name pattern is replaced by numbers in the **AP Name**, for example, SJC-BLD21-FL2-AP0001, SJC-BLD21-FL2-AP0002, and so on.
- Step 8** From the **Antenna** drop-down list, choose the appropriate antenna type, including dual antennas, for the AP.
- Note** The antenna image reflects the selected antenna.
- Step 9** Depending on the antenna type, enter the **Azimuth** and **Elevation** orientation in degrees.
- Step 10** (Optional) Configure any of the other settings, as needed. For information about these settings, see [Edit an AP, on page 189](#).
- Step 11** Perform the following actions, as needed:
- To add another planned AP with the same properties as that of the planned AP that you just added, on the floor map, click a location where you want to position the new AP.
A new AP icon is displayed on the map with all of the properties inherited and the AP name appended, for example, BLD1-AP0002-TX.
 - To add more planned APs with the same properties and appended AP name, click the floor map.
 - To stop adding planned APs to the floor map, press **Esc** or right-click the floor map.
 - To reposition the planned APs, drag and drop them to the appropriate location in the floor map.
 - To delete a planned AP, right-click the AP icon and click **Remove**.
 - To edit a planned AP, right-click the AP icon and click **Edit**.
 - To autoplace a planned AP, see [Autoplace Planned APs on a Map, on page 184](#).

Autoplace Planned APs on a Map

- Step 12** In the map toolbar, click **Save**.
-

Autoplace Planned APs on a Map

Autoplacing planned APs on a floor map allows you to see how many planned APs can be placed within the dimensions of the map. Using the planned AP model, maximum distance you'd like between the planned APs, and coverage area dimensions, the system calculates the maximum number of planned APs placements and adds them to the floor map.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit**.
- By default, the **Devices** and **Access Points** toggle buttons are chosen.
- Step 4** In the left pane of the map, click **Autoplace Planned APs**.
- Step 5** In the **Autoplace Planned APs** dialog box, choose the AP model, enter the maximum distance you'd like between the planned APs, and enter a valid name pattern.
- The ##### in the name pattern is replaced by numbers in the planned AP name—for example, AP-0001, AP-0002, and so on.
- Step 6** Click **Create**.
- The system calculates the maximum number of planned APs placements and adds them to the floor map. The system automatically selects all the newly placed planned APs, and the **Edit APs** slide-in pane, where you can collectively edit all the new planned APs, is displayed.
- Step 7** From the **Antenna** drop-down list, choose the antenna type.
- Step 8** (Optional) To collectively update the planned APs, edit the available fields.
- Step 9** Click **Apply** to apply the update to all the autoplaed planned APs.
- Step 10** (Optional) Perform the following actions, as needed:
- To edit a planned AP, either click the planned AP icon or right-click the planned AP icon and choose **Edit**.
 - To stop editing a planned AP, press **Esc**, right-click the floor map, or close the **Edit Planned AP** slide-in pane.
 - To reposition the planned APs, drag and drop them to the appropriate location in the floor map.
 - To remove a planned AP, right-click the planned AP icon and choose **Remove**.
- Step 11** When you're ready, click **Save** to save the changes to the map.
-

Assign Actual APs to Planned APs

After you install the actual APs in your wireless network, you can assign them to the planned APs on your map. This procedure describes how to assign planned APs to actual APs.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit**.

By default, the **Devices** and **Access Points** toggle buttons are chosen.

Step 4 In the left pane of the map, click **Assign Planned APs**.

Step 5 On the floor map, click a planned AP.

Step 6 In the **Assign Planned APs** slide-in pane, check the check box next to the AP that you want to assign.

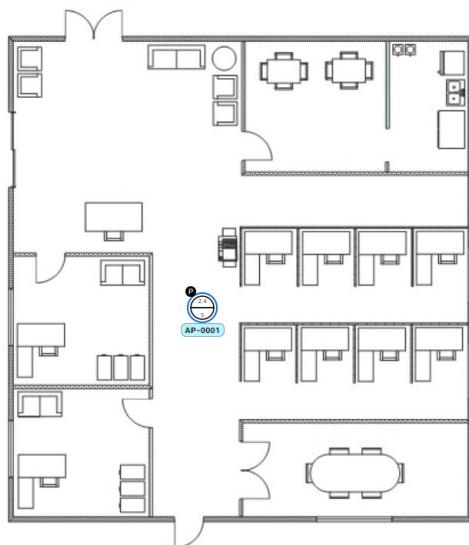
Step 7 Click **Assign**.

Step 8 In the map toolbar, click **Save**.

Position an AP on a Map

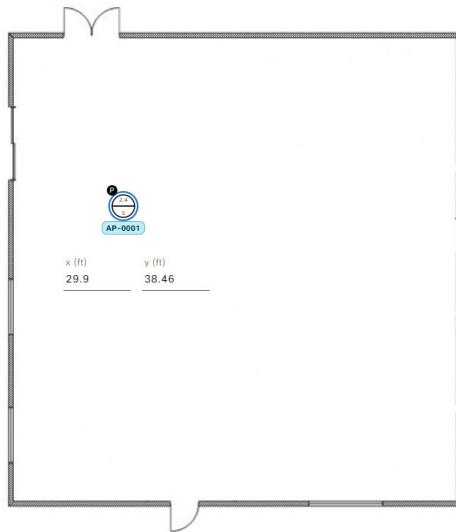
After adding an AP to a floor, you must position it on the map using one of the following methods:

- Manually position it on the map. Use this method if you can approximate the location of the AP using reference points in the building that you can correlate to the detail on the floor map.

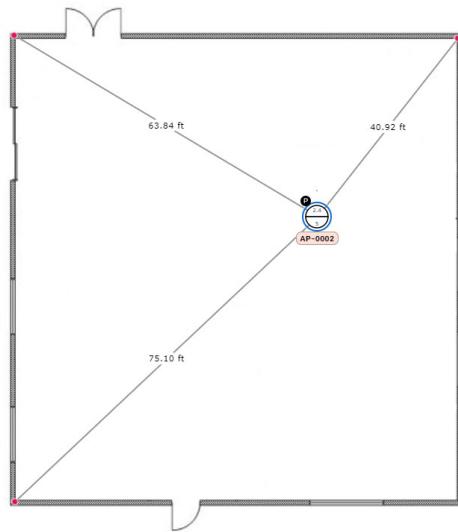


- Define its **x** and **y** coordinates. Use this method if you have the exact coordinates of the AP and you want its position on the map to be as accurate as possible.

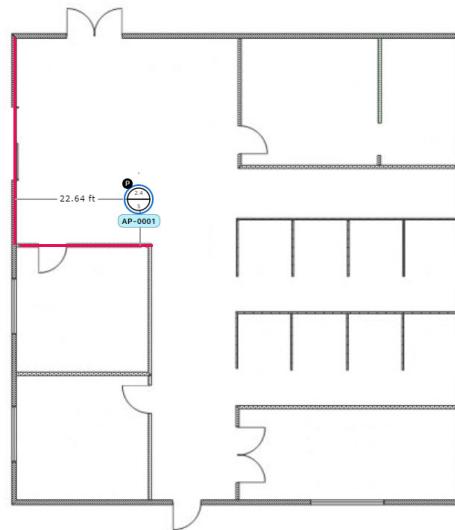
Position an AP on a Map



- Triangulate it using 3 points. Use this method if you have large open space with only a few points from which to measure the distance to the AP. For example, you might measure from the AP to each corner of the room.



- Intersect it based on its distance from two walls. Use this method if the AP is located in a space where you have two walls that intersect, even if they aren't perpendicular to one another.



For all but the first method (manual positioning), you need to have your measurements on hand, and make sure the unit of measure is specified correctly in the **Global Map Properties** settings. For information, see in [2D Map View Options](#), on page 206.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

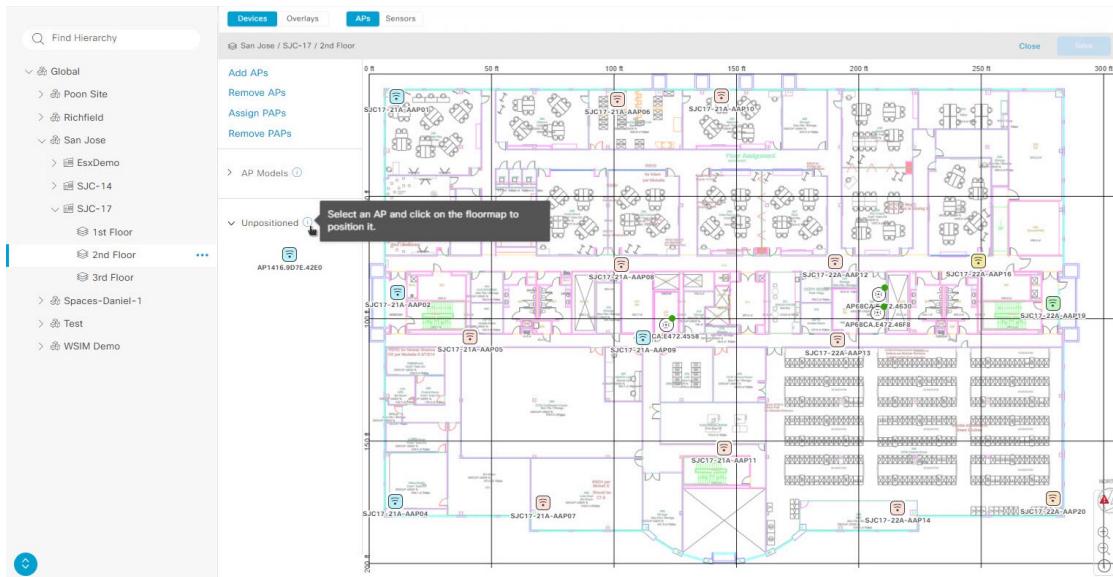
Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit**.

By default, the **Devices** and **Access Points** toggle buttons are chosen.

Step 4 From the left pane of the map, in the **Unpositioned** area, click an AP.

Figure 7: Unpositioned APs



Reposition an AP on a Map

Step 5 To position the AP, use one of the following methods:

- Click the location on the floor map where you want to position the AP.
- Define its **x** and **y** coordinates in the **Edit AP** slide-in pane.
- Triangulate its location:
 - a. In the **Edit AP** slide-in pane, click **3 points**.
 - b. Click on floor map to draw the first point.
 - c. In the dialog box, set the distance from the AP to the first point and click **Set Distance**.
 - d. Define the second and third points similarly, and click **Save**.
- Define two walls on the floor map and position the APs between the defined walls:
 - a. In the **Edit AP** slide-in pane, click **2 walls**.
 - b. To define the first wall, click the floor map to start drawing the line. Click again to finish drawing the line. A dialog box is displayed to set the distance from the AP to the first wall.
 - c. Enter the distance in meters, and click **Set Distance**.
 - d. Define the second wall similarly, making sure that the distance to the AP from the first and second walls create an intersecting point.
 - e. Click **Save**.

The AP is placed based on the defined distance between the walls.

Step 6 In the map toolbar, click **Save**.

Note If Cisco Connected Mobile Experiences (CMX) is synchronized with Catalyst Center, you can view the location of clients on the heatmap. See [Create Cisco CMX Settings, on page 324](#).

Reposition an AP on a Map

After you position APs on a map, you can reposition them. This procedure shows you how to reposition an AP on a map.



Note You can perform this task in a 2D or 3D map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 For 2D, do the following:

- a) In the map toolbar, click **2D > Add/Edit**.
- b) On the map, drag and drop the AP to the new position.

Step 4 For 3D, do the following:

- a) In the map toolbar, click **3D > Edit/Clone**.
- b) On the map, right-click the AP and choose **Move**.
- c) On the map, drag and drop the AP to the new position.

Step 5 In the map toolbar, click **Save**.

Edit an AP

This procedure shows you how to change the configuration of a single AP or planned AP. To change the configuration of multiple APs at the same time, see [Edit Multiple APs, on page 191](#).



Note You can perform this task in a 2D or 3D map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 For 2D, do the following:

- a) In the map toolbar, click **2D > Add/Edit**.
- b) On the map, right-click the AP and choose **Edit**.

Step 4 For 3D, do the following:

- a) In the map toolbar, click **3D > Edit/Clone**.
- b) On the map, click the AP that you want to edit.

Step 5 In the slide-in pane, change any of the following AP and planned AP settings, as available:

- **AP Name or Planned AP Name:** Name of the AP.
- **MAC Address:** MAC address of the selected AP.
- **AP Model:** Model of the selected AP.

Note For APs in 3D maps, you can change the **AP Model** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **x (ft):** X-axis coordinate of the AP.
- **y (ft):** Y-axis coordinate of the AP.
- **AP Height (ft):** Height of the AP.
- **Antenna:** Antenna type for this AP.

Note For external APs, you must select an antenna. If you don't select an antenna, the AP will not be present on the map.

- **Channel:** Channel to be used by the AP. Only channels that are supported by the AP model are displayed.

Note For APs in 3D maps, you can change the **Channel** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **Tx Power (dBm)**: Transmit power for the channel. Only power levels that are supported by the channel are displayed.

Note For APs in 3D maps, you can change the **Tx Power (dBm)** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **Azimuth**: Angle of the antenna, measured relative to the x axis, clockwise. The azimuth range is from 0 through 360. In Catalyst Center, pointing right is 0 degrees or 360 degrees; pointing down is 90 degrees.

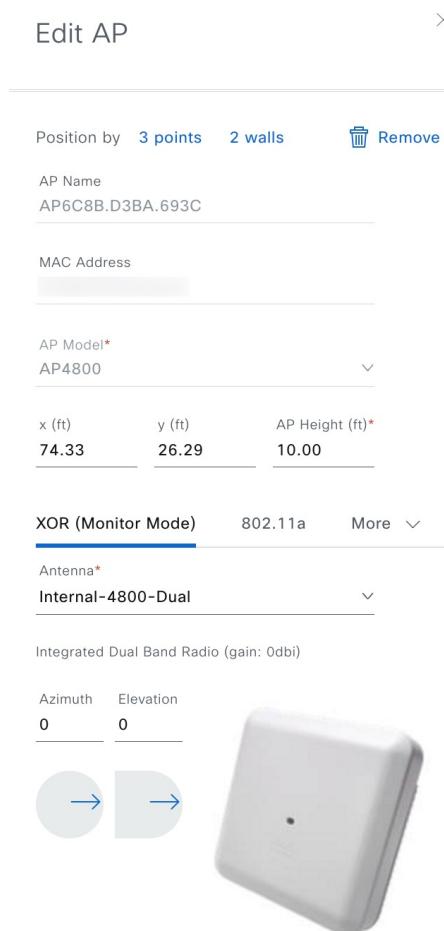
You can manually enter the value or use the blue arrow under the field to change the value.

Note For omnidirectional antennas, the azimuth is not relevant if the elevation is 0.

- **Elevation**: In degrees. You can manually enter the value or use the blue arrow under the field to change the value.

Note For APs and antenna models that are designed to be placed on a ceiling, 0 elevation means pointing down. For APs and antenna models that are designed to be placed on a wall, 0 elevation means pointing horizontally and negative values mean pointing down.

Figure 8: Edit AP Slide-In Pane



Step 6

Do one of the following:

- For 2D, after making the changes, close the slide-in pane.
- For 3D, click **Apply** to apply the changes.

Step 7 In the map toolbar, click **Save**.

Edit Multiple APs

When you select only one AP or planned AP, you can change all editable attributes. However, when you select multiple APs or planned APs, only some attributes are editable, as follows:

- When the selected devices have the same value for an attribute, the value is displayed. Otherwise, the value is blank. In either case, if you change the value, the new value is applied to all the selected devices.
- When the selected APs have the same model number and radios (number of radios and operating band), the antennas are editable. Otherwise, they are not editable.
- You can change the model numbers of planned APs but not added APs. So, if you select an AP, the model number is not editable.
- Because bulk changes affect more devices, they do not take effect immediately. You must click **Apply** to apply your changes.

This procedure shows you how to update the editable attributes for multiple APs at the same time.



Note

You can perform this task in a 2D or 3D map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 Do one of the following:

- For 2D, in the map toolbar, click **2D > Add/Edit**.
- For 3D, in the map toolbar, click **3D > Edit/Clone**.

Step 4 Select the APs, using one of the following methods:

- Click the first device, then press and hold the **Shift** key while you click the rest of the devices.
- In the 2D map navigation controls toolbar, click the select by rectangle icon (). Then click an area of the map and drag the highlighted rectangle to select APs in a contiguous area. All the highlighted APs within the rectangle are selected.

To deselect APs, use one of the following methods:

- To deselect a single AP, press and hold the **Shift** key while you click the AP.
- To deselect all APs except one, click the AP you want to remain selected. All others are deselected.
- To deselect all APs, press the **ESC** key or close the **Edit** pane.

Step 5 In the slide-in pane, configure the settings of the APs, as available:

- **AP Name or Planned AP Name:** Name of the AP.

- **MAC Address:** MAC address of the selected AP.

- **AP Model:** Model of the selected AP.

Note For APs in 3D maps, you can change the **AP Model** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **x:** X-axis coordinate of the AP. You can manually enter the value.

- **y:** Y-axis coordinate of the AP. You can manually enter the value.

- **AP Height:** Height of the AP. You can manually enter the value.

- **Antenna:** Antenna type for this AP.

Note For external APs, you must select an antenna, or the AP will not be present in the map.

- **Channel:** Channel to be used by the AP. Only channels that are supported by the AP model are displayed.

Note For APs in 3D maps, you can change the **Channel** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **Tx Power (dBm):** Transmit power for the channel. Only power levels that are supported by the channel are displayed.

Note For APs in 3D maps, you can change the **Tx Power (dBm)** field to visualize its impact, but the changes aren't saved and don't persist across floors. Instead, you can update this AP field from the **Inventory** window.

- **Azimuth:** Angle of the antenna, measured relative to the x axis, clockwise. The azimuth range is from 0 through 360. In Catalyst Center, pointing right is 0 degrees or 360 degrees; pointing down is 90 degrees.

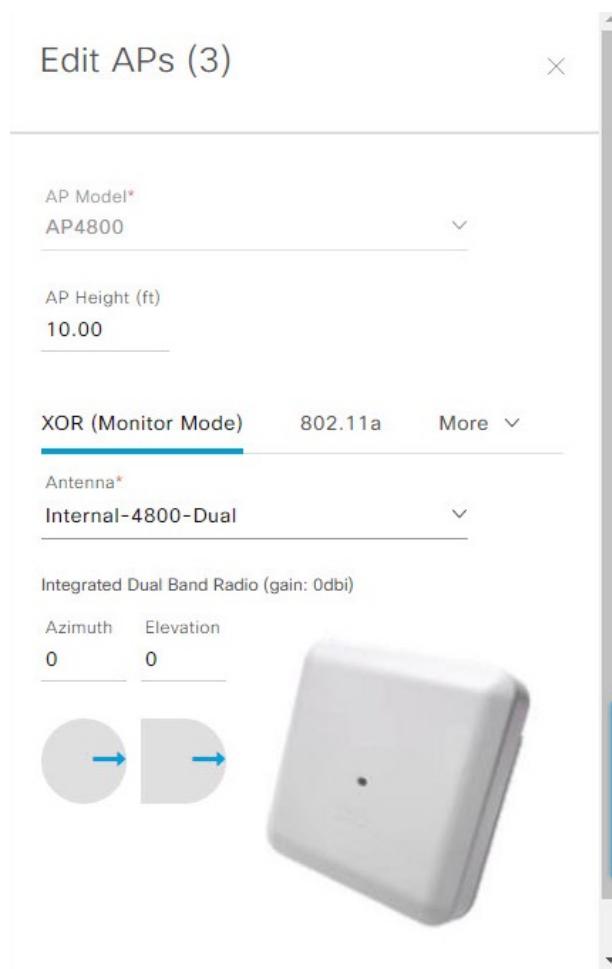
You can manually enter the value or use the blue arrow under the field to change the value.

Note For omnidirectional antennas, the azimuth is not relevant if the elevation is 0.

- **Elevation:** In degrees. You can manually enter the value or use the blue arrow under the field to change the value.

Note For APs and antenna models that are designed to be placed on a ceiling, 0 elevation means pointing down. For APs and antenna models that are designed to be placed on a wall, 0 elevation means pointing horizontally and negative values mean pointing down.

Figure 9: Edit APs Slide-In Pane



Step 6 In the slide-in pane, click **Apply** to apply the changes.

Step 7 In the map toolbar, click **Save**.

Remove APs from a Map

This procedure shows you how to remove APs and planned APs (PAPs) from a map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit**.

Step 4 To remove APs (including planned APs), do the following:

- Click the AP. To select multiple APs, click the first AP and while pressing the **Shift** key, click the rest of the APs.
- In the slide-in pane, click **Remove**.

Work with Sensors on a Floor Map

- Step 5** In the map toolbar, click **Save**.
-

Work with Sensors on a Floor Map

The following topics show you how to add sensors to floor maps and position, reposition, and delete them, if needed.

For more information about sensors, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Add Sensors to a Map

This procedure shows you how to add sensors to a map.

Before you begin

Make sure you have the Cisco AP 1800S sensor in your inventory. The Cisco Aironet 1800s Active Sensor must be provisioned using Plug and Play for it to show up in the Inventory. See the "Provision the Wireless Cisco Aironet 1800s Active Sensor" topic in the [Cisco Catalyst Assurance User Guide](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

- Step 2** From the left hierarchy tree, choose a floor.

- Step 3** In the map toolbar, click **2D > Add/Edit > Sensors**.

- Step 4** In the **Add Sensors** slide-in pane, check the check boxes of the sensors that you want to add. Alternatively, click **Add** next to the sensor row.

Note You can search for specific sensors using the **Filter** field. Search using the name, MAC address, or model of a sensor. The search is not case-sensitive. The results are displayed in the table. Click **Add** to add one or more of these sensors to the floor area.

Newly added sensors are displayed in the **Unpositioned** category in the left pane of the map in edit mode.

- Step 5** In the map toolbar, click **Save**.
-

Position Sensors on a Map

Newly added sensors are displayed in the **Unpositioned** category in the left pane of the map in edit mode. This procedure shows you how to position a sensor after initially adding it.

Before you begin

Sensors must be added to the map before they can be positioned. For information, see [Add Sensors to a Map, on page 194](#)

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

- Step 2** From the left hierarchy tree, choose a floor.

- Step 3** In the map toolbar, click **2D > Add/Edit > Sensors**.

- Step 4** In the left pane of the map, click a sensor in the **Unpositioned** category to position the sensor.

Step 5 On the floor map, click the location where you want to position the sensor.

You can use the **x**, **y**, and **Height** fields in the **Sensor Details** slide-in pane to enter the exact **x**, **y**, and **z** coordinates for the sensor.

Step 6 In the map toolbar, click **Save**.

Reposition a Sensor on a Map

After you position sensors on a map, you can reposition them. This procedure shows you how to reposition a sensor on a map.



Note You can perform this task in a 2D or 3D map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, do one of the following:

- Click **2D > Add/Edit**.
- Click **3D > Edit/Clone**.

Step 4 On the map, drag and drop the sensor to the new position.

Step 5 In the map toolbar, click **Save**.

Remove Sensors from a Map

This procedure shows you how to remove sensors from a floor map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit**.

Step 4 To remove sensors, do the following:

- a) Click the sensor, or to select multiple sensors, click the first sensor and while pressing the **Shift** key, click the rest of the sensors.
- b) In the **Edit** pane, click **Remove**.

Step 5 In the map toolbar, click **Save**.

Add, Edit, and Remove Coverage Areas

This procedure shows you how to mark a nonrectangular or polygon-shaped area as a coverage area on a floor map.

For more information about coverage areas, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit > Overlays > Coverage Areas**.

Step 4 To add a coverage area, do the following:

- In the **Coverage Area** dialog box, enter a name for the coverage area in the field.
- Click **Add Coverage**.
- Click on the map to create a point and initiate the drawing tool.
- Continue creating points to define the coverage area shape.

Note The coverage area shape must have at least three points. Click and drag a point to redefine the coverage area shape.

- Double-click to exit the drawing tool and finalize the coverage area shape.

Step 5 To edit a coverage area, do the following:

- In the map toolbar, click **Add/Edit > Coverage Areas**.
- To redefine the shape of a coverage area, click and drag a point.
- To edit a coverage area name, right-click the coverage area and choose **Edit**.

Step 6 To delete a coverage area, do the following:

- In the map toolbar, click **Add/Edit > Coverage Areas**.
- Right-click the coverage area and choose **Remove**.

Step 7 In the map toolbar, click **Save**.

Add, Edit, Copy, and Remove Openings

Creating an opening is similar to creating an open space or atrium on a floor. On multifloor buildings, typically the opening extends vertically through multiple floors. This procedure shows you how to add, edit, and remove openings on a floor map. It also shows you how to copy openings to other floors.

For more information about openings, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit > Overlays > Openings**.

Step 4 To add an opening, do the following:

- From the left pane of the map, click **Opening**.
- Click on the map to create a point and initiate the drawing tool.

- c) Continue creating points to define the opening shape.

Note The opening shape must have at least three points. Click and drag a point to redefine the opening shape.

- d) Double-click to exit the drawing tool and finalize the shape.

Step 5 To edit an opening, do the following:

- In the map toolbar, click **Add/Edit > Openings**.
- To redefine the shape of an opening, click and drag a point.
- To move an opening, click inside the shaded area. Then, drag and drop the opening where you want to place it.

Step 6 To copy an opening from one floor to another, do the following:

- In the map toolbar, click **Add/Edit > Openings**.
- Right-click the opening and choose **Copy to other floors**.
- In the dialog box, check the check boxes next to the relevant floors.
- Click **Copy**.
- Click **Close**.

Step 7 To remove an opening, do the following:

- In the map toolbar, click **Add/Edit > Openings**.
- Right-click the opening and choose **Remove**.

Step 8 In the map toolbar, click **Save**.

Add, Edit, and Remove Location Regions

Location regions are areas on the map that are either included in or excluded from the heatmap calculation. The following topics show you how to add, edit, and remove location regions.

Add, Edit, and Remove an Inclusion Region

This procedure shows you how to add, edit, and remove an inclusion region. Use the following guidelines to define an inclusion region on a floor map:

- Inclusion regions can be any polygon-shaped area and must have at least three points.
- You can only define one inclusion region on a floor. By default, an inclusion region is defined for each floor area when it is created. The inclusion region is indicated by a solid aqua line, and generally outlines the entire floor area.

For more information about inclusion regions, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit > Overlays > Location Regions**.

Step 4 In the left pane of the map, click the **Inclusion** icon.

Step 5 To create an inclusion region, use the drawing tool:

- Click the map to create a point where you want the inclusion region to begin.
- Move the cursor to the next point and click again.

Add, Edit, and Remove an Exclusion Region

- c) Continue creating points to define the inclusion region shape.
- d) To finalize the shape, double-click the map.

Alternatively, from the left pane of the map, click the **Inclusion** icon.

- e) To exit the drawing tool, double-click the map again.

Step 6 To edit the location of an inclusion region, drag and drop the shape to the new location.

Step 7 To remove an inclusion region, right-click the shape and choose **Remove**.

Step 8 In the map toolbar, click **Save**.

Add, Edit, and Remove an Exclusion Region

This procedure shows you how to add, edit, and remove an exclusion region. Use the following guidelines to define exclusion regions on a floor map:

- Exclusion regions can be any polygon-shaped area and must have at least three points.
- Exclusion regions are defined within the borders of an inclusion region.
- You can define multiple exclusion regions on a floor map.

For more information about exclusion regions, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit > Overlays > Location Regions**.

Step 4 From the left pane of the map, click the **Exclusion** icon.

Step 5 To create an exclusion region, use the drawing tool:

- a) Click the map to create a point where you want the exclusion region to begin.
- b) Move the cursor to the next point and click again.
- c) Continue creating points to define the exclusion region shape.
- d) To finalize the shape, double-click the map.

Alternatively, from the map left pane, click the **Exclusion** icon.

- e) To exit the drawing tool, double-click the map again.

Step 6 To edit the location of an exclusion region, drag and drop the shape to the new location.

Step 7 To remove an exclusion region, right-click the shape and choose **Remove**.

Step 8 In the map toolbar, click **Save**.

Add, Edit, and Remove Walls

This procedure shows you how to add, edit, move, and remove walls on a floor map.

For information about how walls impact RF signal attenuation and heatmap calculation, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit > Overlays > Walls**.
- Step 4** To add walls, do the following:
- In the left pane of the map, click a wall type from the **Others** or **On this floor** category.
- Note** If a wall type isn't listed, click **Add Wall Type** to create a custom wall type.
- Click the map to create a point where you want the wall to begin.
 - Move the cursor to the next point, where you want to end the wall or where you want to create a corner and click again.
 - Continue creating points to define the wall shape.
 - To end a wall, double-click the map.
- Alternatively, from the left pane, click the wall type.
- To exit the drawing tool, double-click the map again.
- Step 5** To change a wall type, and depending on the wall type also configure its parameters, do the following:
- Click the wall that you want to change.
- The **Wall Type** dialog box opens.
- From the **Wall Type** drop-down list, choose the type of wall.
 - Configure any other parameters that are appropriate for the new wall type.
 - Click **Update**.
- Step 6** To move a wall, do the following:
- Hover your cursor over the wall that you want to move.
- The wall turns black, which means it's selected.
- Click the wall and drag and drop it to the new location.
- Step 7** To remove a wall, right-click the wall and choose **Remove**.
- Step 8** In the map toolbar, click **Save**.
-

Add, Copy, Edit, and Remove Shelving Units

This procedure shows you how to add, copy, edit, and remove shelving units on a floor map.

For information about shelving units, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit > Overlays > Shelving Units**.
- Step 4** To add shelving units, do the following:
- In the left pane of the map, click the shelving type you want to add.

Add, Edit, and Remove Markers

- b) In the shelving dialog box, configure the name, dimensions, orientation, and whether the unit is double-sided, or leave the default values. Orientation means the angle of the shelving unit. A shelving unit with an orientation of 0 means that the shelving unit is vertical and parallel to the y-axis.

If a shelving type is not in the list, click **Add Shelving Type** to create a shelving type.

- c) Click **Add Shelving**.

The shelving unit is displayed on the map.

- d) Drag and drop the shelving unit to its location on the map.

Step 5 To create a copy or an array of a shelving unit, do one of the following:

- To create a copy, right-click the shelving unit and choose **Clone**.
- To create an array, right-click the shelving unit and choose **Array**. Then specify the number of units and the distance between them.

Step 6 To edit the name, dimensions, orientation, and whether it is two-sided, right-click the shelving unit and choose **Edit**.

Step 7 To remove a shelving unit, right-click the shelving unit and choose **Remove**.

Step 8 In the map toolbar, click **Save**.

Add, Edit, and Remove Markers

The following procedure shows you how to add, edit, and remove markers.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D > Add/Edit > Overlays > Markers**.

Step 4 In the left pane of the map, click the **Markers** icon.

Step 5 In the **Place Markers** dialog box, enter the name for the marker, and click **Add Marker**.

Step 6 To place the marker, click the map where you want to place the marker.

Step 7 To move a marker, hover your cursor over the marker until it turns blue. Then drag and drop it in the new location.

Step 8 To edit a marker, right-click the marker and choose **Edit**.

Step 9 To remove a marker, right-click the marker and choose **Remove**.

Step 10 In the map toolbar, click **Save**.

Add, Edit, and Remove GPS Markers

This procedure shows you how to add, edit, and remove GPS markers. For more information about GPS markers, see [2D Floor Map Devices and Overlay Objects, on page 179](#).



Note The GPS marker is an attribute of the building. You can apply it to all the floors of the building.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit > Overlays > GPS Markers**.
- Step 4** To add a GPS marker, do the following:
- In the left pane of the map, click the **GPS Markers** icon.
 - On the map, click the location where you want to place the GPS marker.
- GPS markers must be positioned inside the outer-perimeter walls, typically at the building corners.
- In the **Place Markers** dialog box, enter the name, latitude, longitude, and the x and y coordinates in the appropriate fields.
- The latitude and longitude coordinates of the GPS marker located in the northwest corner of a floor must match the building coordinates.
- Click **Add GPS Marker**.
- Step 5** To edit a GPS marker, right-click the GPS marker and choose **Edit**.
- Step 6** To remove a GPS marker, right-click the GPS marker and choose **Remove**.
- Step 7** In the map toolbar, click **Save**.
-

Add, Edit, and Remove Align Points

This procedure shows you how to add, edit, and remove align points. For more information about align points, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D > Add/Edit > Overlays > Align Points**.
- Step 4** To add an alignment point, do the following:
- In the left pane of the map, click the **Align Points** icon.
 - On the map, click the location where you want to place the alignment point.
- Step 5** To edit the name of an alignment point, do the following:
- Right-click the alignment point and choose **Edit**.
 - Change the name and click **Edit Marker**.
- Step 6** To change the location of an alignment point, do the following:
- Right-click the alignment point and choose **Edit**.
 - Click **Edit Marker**.
 - Drag and drop the alignment point to the new location.
- Step 7** To remove an alignment point, right-click the alignment point and choose **Remove**.
- Step 8** In the map toolbar, click **Save**.
-

View a 2D Wireless Heatmap

View a 2D Wireless Heatmap

Use the 2D heatmap to view information about your wireless network.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D**.

The wireless 2D map opens.

Step 4 To display specific details about devices, do the following, based on the device type:

- **APs:** The AP icon indicates the number of radios, their frequency and health, overall health score of the device, and the AP name and mode. For more information about interpreting the AP icon, see [About the AP Icon and Planned AP Icon, on page 209](#).

To display device details, hover your cursor over an AP icon. Information, such as the AP's Rx neighbors, clients, interferers, and health score, is displayed.

For more details about an AP, in the dialog box, click the **Device 360** link.

Note For **Device 360**, the *Assurance - Base* package is required.

- **Mesh APs:** To display device details, hover your cursor over a mesh AP icon. Information, such as mesh, backhaul, and access data, is displayed.

- **Clients:** To display client information, including a link to its associated AP, hover your cursor over or click a client. For more details about a client, in the dialog box, click the **Client 360** link.

- **Sensors:** To view the status and test results of a sensor, click a sensor icon.

- **Switches and Switch Stacks:** To display the member switches of a switch stack, click the arrow next to the switch stack icon. To display the connections between a switch and its associated APs, hover your cursor over the switch or switch stack icon. The map displays a line showing the connections from the switch and its associated APs. You can also identify switch and AP associations by color. APs connected to one specific switch have labels that match the color code on the switch icon.

Using Cisco Discovery Protocol (CDP), Catalyst Center can detect and display unmanaged switches that are connected to managed APs. An unmanaged switch is depicted as a typical switch icon with a "U" for unmanaged ().

To display device details, click a switch or switch stack icon. A slide-in pane opens and displays the device details and options for the heatmap display. Under **Select Heatmap**, you can click any of the following radio buttons:

- **All visible switches:** Computes and displays the heatmap for all the switches in the visible map area.
- **This switch:** Computes and displays the heatmap for the selected switch only.
- **Rest of visible switches:** Computes and displays the heatmap for all of the visible switches, except for the selected switch.
- **None:** Does not include any switch in the heatmap computation and heatmap display.

Step 5 To display information about a link, click the link. Depending on the type of link, information such as link health and other statistics are displayed.

For a mesh link, you can perform a link test between two mesh APs.

Step 6 Use the tools and options shown in the following figure to gain insights about your wireless network.

Figure 10: 2D Wireless Map Showing Tools and Options



Callout	Description
1	Map Toolbar: In above the map, use the toolbar options to control what's displayed on the heatmap. For details, see 2D Map Toolbar, on page 203 .
2	View Options Slide-In Pane: In the slide-in pane, use the view options to customize the heatmap display. For details, see 2D Map View Options, on page 206 .
3	Navigation Controls: From the bottom-right corner of the map, use the map navigation controls to manage the heatmap display. For details, see 2D Map Navigation Controls, on page 208 .

2D Map Toolbar

To access the 2D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **2D**.

The map toolbar consists of two bars and is located above the map. Use the map toolbar for the following actions and settings:

Item	Description
2D 3D	Click 2D to view the wireless map in 2D, or click 3D to view it in 3D.
5 GHz ▼	Wi-Fi Band Filter: Hover your cursor over the Wi-Fi band filter, and from the drop-down list, choose a Wi-Fi band.

Item	Description
Add/Edit	<p>Click this button to add, edit, and remove the following devices and overlay objects:</p> <ul style="list-style-type: none"> • Devices <ul style="list-style-type: none"> • Access points: For details, see Work with APs on a Floor Map, on page 180. • Sensors: For details, see Add Sensors to a Map, on page 194. • Overlay Objects <ul style="list-style-type: none"> • Coverage areas: For details, see Add, Edit, and Remove Coverage Areas, on page 196. • Openings: For details, see Add, Edit, Copy, and Remove Openings, on page 196 • Location regions: For details, see Add, Edit, and Remove Location Regions, on page 197. • Walls: For details, see Add, Edit, and Remove Walls, on page 198. • Shelving Units: For details, see Add, Copy, Edit, and Remove Shelving Units, on page 199. • Markers: For details, see Add, Edit, and Remove Markers, on page 200. • GPS markers: For details, see Add, Edit, and Remove GPS Markers, on page 200. • Align points: For details, see Add, Edit, and Remove Align Points, on page 201.
Data/Filters	<p>Click Data/Filters to open the Data/Filters slide-in pane that displays a device type list. Choose a device type to view and filter the device data that displays in the wireless map. For details, see Filter Device Data on a Floor, on page 212.</p>
View Options	<p>Click View Options to open the View Options slide-in pane, which contains the options for controlling the display of the map, devices, and overlay objects. For details, see 2D Map View Options, on page 206.</p>

Item	Description
 More	<p>Hover your cursor over More, and from the drop-down list, choose one of the following options:</p> <ul style="list-style-type: none"> • Recompute: Recompute the heatmap. • Export: Export the floor map to a PDF or CSV file format. • Edit Floor: Change the floor details, such as its name. • Set Scale: Change the map scale by providing a known measurement on the map: <ol style="list-style-type: none"> 1. Click the map to specify the starting point of the measurement. 2. Click the map again to specify the ending point of the measurement. 3. In the New line length (ft) field, enter the length of the measurement. 4. Click OK. The floor map dimensions are recalculated based on the new measurement. • Measure Distance: Measure a distance on the floor map. Click the map to specify a starting point. Click the map again to specify an ending point. The distance of the measurement is displayed. • CMX/Cisco Spaces Sync History: Display a log that shows when Cisco Connected Mobile Experiences (CMX) and Cisco Spaces synchronized data. The log entries include the request received time, start and end times, status, and failure message (if the operation failed). • Floor Import History: Display the floor import history logs of importing map archive files. The logs detail the successfully and unsuccessfully imported APs, planned APs, and overlay objects.
 Area or Site / Building / Floor	Full Hierarchy Path : Displays the full navigational path of the floor, including its associated building and area or site. Click the down arrow to navigate to a different floor.
 Refresh	Refresh : Click this icon to update the device and map data. To the left of the icon is the timestamp for the last refresh
 Cisco Spaces Connector	Cisco Spaces Connector : Click this icon to display information, such as the IP address, status, and version, about the Cisco Spaces Connector.
 Map Notification	Map Notification : Hover your cursor over this icon to display map information, such as the number of unpositioned APs or planned APs and filters applied to the map. To remove the filters, click Click to clear .
 Search	<p>Search: Use the Search field to find specific floor map elements such as APs, sensors, clients, and so on. The results of your search are listed in a slide-in pane below the Search field.</p> <p>When you hover your cursor over an element in the list, an indicator points to the element on the map. If the element is outside the field of view, the indicator is displayed as a broken red line. Reorient the map to see the element.</p>

2D Map View Options

To access the 2D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **2D > View Options**.

The **View Options** slide-in pane opens. Expand the categories to view the settings:

- **Map:** Contains various floor map and heatmap settings:

Item	Description
Show Grid	Click this toggle button to enable or disable a grid on the floor map. The grid provides the dimensions of the floor map.
Map Opacity %	Use this slider to customize the opacity or transparency of the floor map.
Heatmap Type	<p>The heatmap provides a graphical representation of Radio Frequency (RF) wireless data where the values taken by a variable are represented in maps as colors. RSSI heatmaps are computed based on a floor's RSSI prediction model, antenna type, and its orientation.</p> <p>2D heatmaps use fixed transmit powers: 18 dB for 2.4-GHz; 15 dB for 5-GHz; and 5 dB for 6-GHz.</p> <p>3D heatmaps use real-time transmit power of operational APs and 11 dB for planned APs.</p> <p>Use the drop-down list to choose the heatmap type:</p> <ul style="list-style-type: none"> • Operational RSSI: Coverage heatmap, which identifies the wireless signal strength of operational APs. • Planned RSSI: Hypothetical heatmap that shows the coverage that planned APs would have on a floor. • Operational + Planned (3D-only): (Visible only if the legacy heatmap generator is enabled.) In the 2D map, only operational APs are used to compute the heatmap. To use operational and planned APs in the heatmap computation, you can either enable the 3D-computed heatmap generator or navigate to the 3D map. For information, see the Disable 3D-Computed Heatmap field in this topic. • Operational + Planned: (Visible only if the 3D-computed heatmap generator is enabled.) Coverage heatmap created using both operational and planned APs. • Client Density: Density of associated clients. • IDS: Heatmap that shows the monitor mode AP coverage provided to the wireless clients on a floor map.
RSSI Cut off (dBm)	Use this slider to set the threshold for the RSSI value to appear on the heatmap. RSSI values that do not meet the threshold are faded.
Heatmap Opacity %	Use this slider to customize the opacity or transparency of the heatmap.
Heatmap Color Scheme	Customize the color scheme of the power level for the heatmap. The options are Legacy , Natural , and Monochrome . Note that Monochrome only supports the Contour option for the Heatmap Shape .
Heatmap Shape	Customize the color progression of the power level on the heatmap. The options are Contour and Gradient .

- **Access Points:** Click this toggle button to enable or disable the AP icons on the floor map.

Expand this category to configure the type of label to display with each AP. Valid label types are **Name**, **MAC address**, **IP address**, **Bridge Group Names**, and so on. From the **Display Label** drop-down list, choose a label type.

To display other details about APs, see [View a 2D Wireless Heatmap, on page 202](#).

- **Planned Access Points:** Click this toggle button to enable or disable the appearance of planned AP icons on the floor map.

Expand this category to display labels with the planned AP name. From the **Display Label** drop-down list, choose a label type.

- **Switches:** Click this toggle button to enable or disable the appearance of switch or switch stack icons on the floor map. Using Cisco Discovery Protocol (CDP), Catalyst Center can detect and display unmanaged switches that are connected to managed APs. An unmanaged switch is depicted as a typical switch icon with a "U" for unmanaged.

Expand this category to display labels with the switch name, MAC address, or AP count. (For unmanaged switches, only the switch name and AP count are available.) From the **Display Label** drop-down list, choose a label type.

To display other details about switches, see [View a 2D Wireless Heatmap, on page 202](#).

- **Sensors:** Click this toggle button to enable or disable the appearance of sensor icons on the floor map.

Expand this category to display labels with the sensor name, MAC address, or AP count. From the **Display Label** drop-down list, choose a label type.

To display other details about sensors, see [View a 2D Wireless Heatmap, on page 202](#).

- **Mesh:** Click this toggle button to enable or disable the appearance of mesh APs on the floor map.

Expand this category to configure options that control how the mesh AP-to-root AP link relationships are displayed:

- **Link Label:** To disable link labels, click the **None** radio button. To display labels for link signal-to-noise ratios, click the **Link SNR** radio button. To display labels for packet error rates, click the **Packet Error Rate** radio button. The link label setting is reflected on the map immediately.

- **Link Color:** To disable link color, click the **None** radio button. To display link signal-to-noise ratios in color, click the **Link SNR** radio button. To display packet error rates in color, click the **Packet Error Rate** radio button.

The link color settings are reflected on the map immediately. See the following table for color definitions.

Link Color	Link Signal Noise Ratio (SNR)	Packet Error Rate (PER)
●	Represents an SNR above 25 dB (high value)	Represents a PER of one percent (1%) or lower
○	Represents an SNR between 20 dB and 25 dB (acceptable value)	Represents a PER that is less than ten percent (10%) and greater than one percent (1%)
●	Represents an SNR below 20 dB (low value)	Represents a PER that is greater than ten percent (10%)

2D Map Navigation Controls

- **Mesh Parent-Child Hierarchical View:** Choose which mesh APs to display. From this drop-down list, choose **Select Only Root APs**, **Select up to 1st hops**, **Select up to 2nd hops**, **Select up to 3rd hops**, **Select up to 4th hops**, or **Select All**.
- **Overlay Objects:** Expand this category and click any of the overlay objects to enable or disable the overlay objects on the floor map.
- **Clients:** Click this toggle button to enable or disable the appearance of client icons on the floor map. Expand this category to display labels with the client name, MAC address, or AP count. From the **Display Label** drop-down list, choose a label type. To enable or disable clients in close proximity to be grouped together, click the **Show Client Clusters** toggle button.
- **Interferers:** Click this toggle button to enable or disable the appearance of client icons on the floor map. Expand this category to enable or disable the appearance of a zone of impact from interferers. Click the **Show Zone of Impact** toggle button.
- **Map Properties:** Expand this category to configure the following settings on the map:
 - **Auto Refresh:** From this drop-down list, choose a time interval for the map display to be refreshed.
 - **Heatmap Walls Limit:** (Available only with the 3D-computed heatmap generator.) Enter the number of walls to be used in the heatmap computation. The more walls included, the longer it takes to compute the heatmap. The default and recommended limit is 3000.
 - **Mesh SNR Colors and Mesh PER Colors:** (Available only when mesh devices are present.) Enter the threshold ranges and their corresponding colors.
- **Global Map Properties:** Expand this category to configure the following settings for all wireless maps:
 - **Units of Measure:** From the drop-down list, choose either **Feet** (imperial system) or **Meters** (metric system).
 - **Disable 3D-Computed Heatmap:** Click this toggle button to disable the default 3D-computed heatmap generator and enable the legacy heatmap generator. Be aware that computation and rendering using the legacy heatmap generator is not as fast as the 3D-computed heatmap, and you can't configure a limit on the number of walls to be included to compute the heatmap. (The **Heatmap Walls Limit** field is removed from the display.) The maximum number of walls using the legacy heatmap generator is 300, after optimization. If your floor map contains more, Catalyst Center alerts you and preserves the 300 most relevant walls (based on the length of the wall multiplied by its attenuation).

The 3D-computed heatmap generator offers several advantages over the legacy heatmap generator. It uses the specialized graphics processing unit (GPU), which allows it to generate the heatmaps substantially faster than the legacy heatmap generator. In addition, you can set a limit to the number of walls that are included in a heatmap computation, which also helps to enhance processing speed.

2D Map Navigation Controls

To access the 2D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **2D**.

The 2D map navigation controls are located at the bottom-right of the map. For details about the map, see [View a 2D Wireless Heatmap, on page 202](#).

Use the map navigation controls for the following functions:

Map Navigation Controls	Description																		
	Select by rectangle: Displays only in editing mode. Use this icon to select multiple APs in a contiguous area on the map. First click this icon, then click an area on the map, and drag the highlighted rectangle. All the highlighted APs within the rectangle are selected.																		
	Alert: This icon displays when you choose to remove a banner notification without first resolving the error by clicking Do not show this alert anymore . When the error is resolved, the system doesn't display this alert icon.																		
	Default Map View: Click to reset the map view to the default.																		
	Zoom In / Zoom Out: Click the zoom in and out icons to enlarge and reduce the size of the map. Alternatively, you can use your mouse wheel to zoom in and out.																		
	Map Legend: Click this icon to view the map legend, which describes the map icons such as the device type, average health score, and AP status. For more information about the AP icon and planned AP icon, see About the AP Icon and Planned AP Icon, on page 209 . <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> LEGEND × <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;">Devices</td> <td style="text-align: center;">Health Score</td> <td style="text-align: center;">AP Status</td> <td style="text-align: center;">AP Mode</td> <td style="text-align: center;">Radio Status</td> <td style="text-align: center;">Radio Mode</td> </tr> </table> </div>													Devices	Health Score	AP Status	AP Mode	Radio Status	Radio Mode
Devices	Health Score	AP Status	AP Mode	Radio Status	Radio Mode														

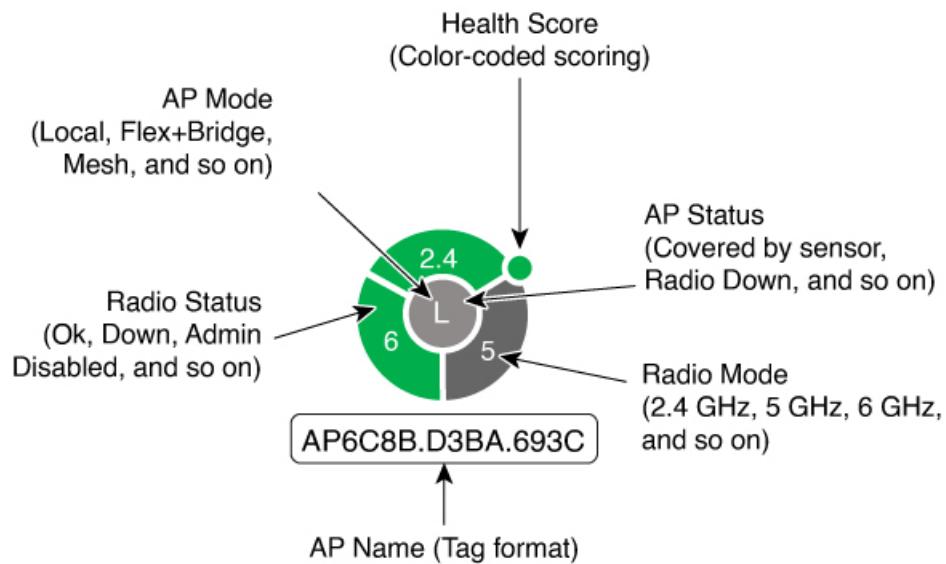
About the AP Icon and Planned AP Icon

AP Icon

AP icons provide information about the configuration and health of the APs in your network. The circular AP icon is divided into radio bands that are color coded to show the radio status. Its center circle displays a letter for the AP mode. The background color of or "X" over its center circle shows the AP status. The color-coded small circle in the upper-right corner of the AP icon displays the health score. For the color-coding details of the radio status, AP status, and the health score, see the map legend in a 2D floor map.

The following diagram shows all the elements of an AP icon:

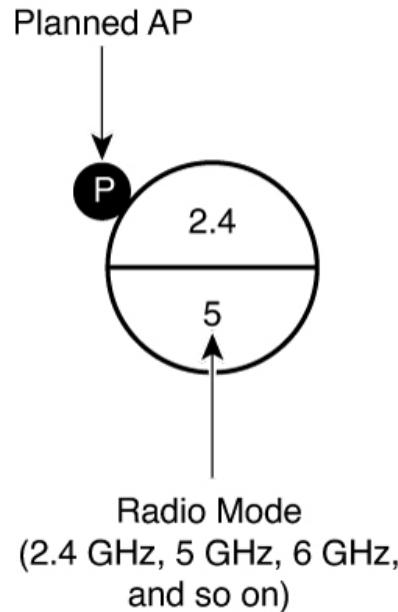
About the AP Icon and Planned AP Icon



Planned AP Icon

Planned AP icons provide information about the configuration of the planned APs in your network. The circular planned AP icon is divided into radio bands and displays a "P" in its upper-left corner. For more information about the radio mode, see the map legend in a 2D floor map.

The following diagram shows all the elements of a planned AP icon:



View an Unmanaged Switch Connected to Managed APs

Catalyst Center can detect the unmanaged switches in your network and the managed APs to which they are connected. The unmanaged switches and their connections to APs can be displayed in a 2D floor map. This capability is helpful if you have switches that you don't want to manage using Catalyst Center, but you still want to view them in relation to your managed APs.



Note This feature is not supported on Cisco AireOS Wireless LAN Controllers.

Before you begin

- Install and configure Catalyst Center Platform. For information, see the [Cisco Catalyst Center Platform User Guide](#).
- Enable Cisco Catalyst Assurance. For information, see the [Cisco Catalyst Assurance User Guide](#).
- Enable Cisco AI Network Analytics data collection. For information, see [Cisco Catalyst Assurance User Guide](#).
- Add wireless controllers to the Catalyst Center Inventory and provision them so that their telemetry data is available to Catalyst Center. For information, see [Provision Embedded Wireless on Cisco Catalyst 9000 Series Switches, on page 529](#) or [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#), as appropriate.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D**.

The wireless 2D map opens and displays the APs that have been added.

Step 4 Add APs to the floor map. For information, see [Add APs to a Map, on page 181](#).

Note If an AP is in Local, Bridge, or FlexConnect mode, connect it to the unmanaged switch and join it to a wireless controller.

After Catalyst Center refreshes the display, any unmanaged switches are listed in the right pane.

An unmanaged switch is depicted as a typical switch icon with a "U" for unmanaged (✉).

Filter Device Data on a Floor



Step 5 (Optional) Hover your cursor over an unmanaged switch to display links between the switch and the APs to which it is connected.

Step 6 (Optional) Click the unmanaged switch to display additional details about the switch in a slide-in pane. All information that is available for managed switches is also available for unmanaged switches, except for the MAC address and its reachability status.

For more information about the elements, tools, and options available on 2D maps, see [View a 2D Wireless Heatmap, on page 202](#).

Filter Device Data on a Floor

For 2D wireless maps, you can apply various filters to network devices such as APs, sensors, and so on. Based on the filter criteria, the search results display in a table. Filtering device data is helpful in locating specific devices on floors with many devices.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **2D**.

Step 4 In the map toolbar, click **Data/Filters**.

Step 5 In the **Data/Filters** slide-in pane, click the device type that you want to apply a filter to.

Step 6 Define the filter rules by using the drop-down lists to choose the parameters.

Step 7 To add more filter rules, click the + icon near the top of the slide-in pane.

Step 8 To customize the columns displayed in the table, do the following:

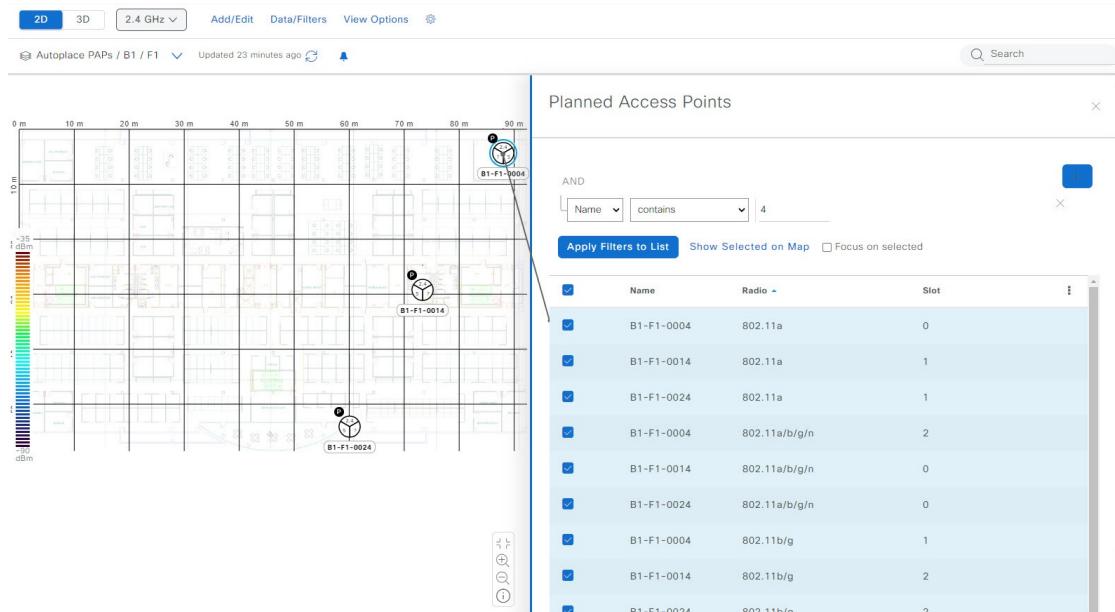
- a. In the top-right corner of the table, click the three vertical dots.
- b. To display a column, check the check box next to the column name.
- c. To hide a column, uncheck the check box next to the column name.
- d. Click **Apply**.

Step 9

When you're done, you can do any of the following:

- To display the results of your filter in the table, click **Apply Filters to List**.
- To display the results of your filter in the map, click **Show Selected on Map**.
- To locate the position of a device on the map, hover your cursor over the device in the table. A line is displayed from the device to its position on the map.

Figure 11: Locating a Device from the Filter Results

**Step 10**

To remove applied filters, in the lower map toolbar, hover your cursor over the notifications icon and click **Click to clear**.

Step 11

To return to the **Data/Filters** slide-in pane, click **Data/Filters** from the navigation path in the top-left corner.

Step 12

To close the slide-in pane and save the filter, click **x**.

Identify Wireless Interferers on the Floor Map

This feature is a 2D map feature.

Catalyst Center can detect interference and disable the interference source for a specific band on a floor map. Any interference in the 2.4-GHz band disrupts the network traffic of the 802.11 wireless network.

Catalyst Center can identify the position, area of impact, and intensity of the interferer.

This procedure shows how to identify network interferers on a floor map.

Before you begin

Ensure that either Cisco Connected Mobile Experiences (CMX) or Cisco Spaces is integrated with Catalyst Center. For information, see [About Cisco Spaces Integration, on page 326](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **2D**.
- Step 4** In the **Network Hierarchy** window, click **View Options**.
- Step 5** In the **View Options** window, scroll down and click the **Interferers** toggle button to enable interferers to be displayed on the floor map.
- Step 6** Expand the **Interferers** category and click the **Show Zone of Impact** toggle button to enable the zone of impact of interferers to appear on the floor map.
- Note** By default, **Zone of Impact** is disabled.
- Step 7** On the floor map, hover your cursor over the interferer icon and click the impacted channel to view the interferer device details.
-

Work with 3D Maps

3D maps are primarily used to plan and analyze a wireless network on a floor. As such, there are minimal configuration and edit functions that you can perform in 3D maps.

With 3D wireless maps, you can view a 3D representation of your wireless network. A near real-time predictive model dynamically updates the 3D map to show changes in RF coverage.

Prerequisite

The system you use to compute and display 3D wireless heatmaps must have a Graphical Processing Unit (GPU) installed and enabled on it. For example, if you're using a Windows virtual machine (VM), you need to make sure that it has a GPU.

3D Maps Features and Functionality

Here are some of the unique features and functionality that 3D wireless maps offers:

- Navigate through your wireless network in a 3D environment with a first person view or third person view.
- Gain insights into the areas in your wireless network where service-level agreements (SLAs) are not being met.
- Run an optimizer tool to compute the best AP layout to meet your SLAs.
- View the RF coverage for different elevations and use the **Scanner** tool to view the RF coverage for specific elevations.
- Crop the Key Performance Indicator (KPI) heatmap with the clipping tools.
- Predict the x, y, z coordinates of a specific point on the floor plan with the pin tool to better plan for placement of APs or sensors.
- Visualize floor plan elements, such as walls, in 3D to see how they affect RF coverage and attenuation.

- Simulate your wireless network in various configurations to see how the wireless coverage on a floor is affected. You can save these simulations and open them later to make more changes.
- Modify KPIs, telemetry, and 3D map element settings to customize your map display.

Configure Floor Map Elements and Overlays in 3D Maps

In 3D maps, you are limited to the following configuration and edit functions:

- [Clone an AP, on page 215](#)
- [Edit an AP, on page 189](#)
- [Edit Multiple APs, on page 191](#)
- [Reposition an AP on a Map, on page 188](#)
- [Reposition a Sensor on a Map, on page 195](#)

To configure other floor map elements or overlays, you need to use the 2D map. For details, see [2D Floor Map Devices and Overlay Objects, on page 179](#).

Clone an AP

You can duplicate an AP with its configuration by cloning it.

Before you begin

You must have actual APs to clone.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **3D**.

Step 4 In the map toolbar, click the **Simulation** toggle button to view the map in simulation mode.

Step 5 In the map toolbar, click **Edit/Clone**.

Step 6 On the map, click an AP.

Step 7 In the **AP Details** slide-in pane, click **Clone**.

A duplicate AP is created and displayed below the original AP. Its name is appended with **-1**. If you keep cloning the same AP, the name continues to be incrementally appended. For example, the first clone for **a-floor1-ap01** is named **a-floor1-ap01-1**, the second clone for the same AP is named **a-floor1-ap01-2**, and so on.

Step 8 On the map, right-click the cloned AP and choose **Move**.

Step 9 Drag and drop the AP to its new position.

Step 10 Click **Save**.

View a 3D Wireless Heatmap

Use this procedure to view a 3D wireless map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **3D**.

The 3D wireless map opens.

Note A 3D heatmap is delimited by its coverage area, which is the full floor width and length, by default. To specify a polygon for the heatmap boundaries, click **2D > Add/Edit > Overlays** and, in the left pane of the map, click **Coverage Area**. You can add and edit the coverage area in the 2D map. However, these boundaries don't apply to the 2D map view because the full floor width and length are used for the 2D map view.

Step 4 To display specific details about devices, hover your cursor over the device icon. Information about the device is displayed in a dialog box.

Note If the *Assurance - Base* package is installed, a link to the **Device 360** window is also displayed in the dialog box.

Step 5 To view the heatmap for one or more APs, select and deselect the APs using one of the following methods:

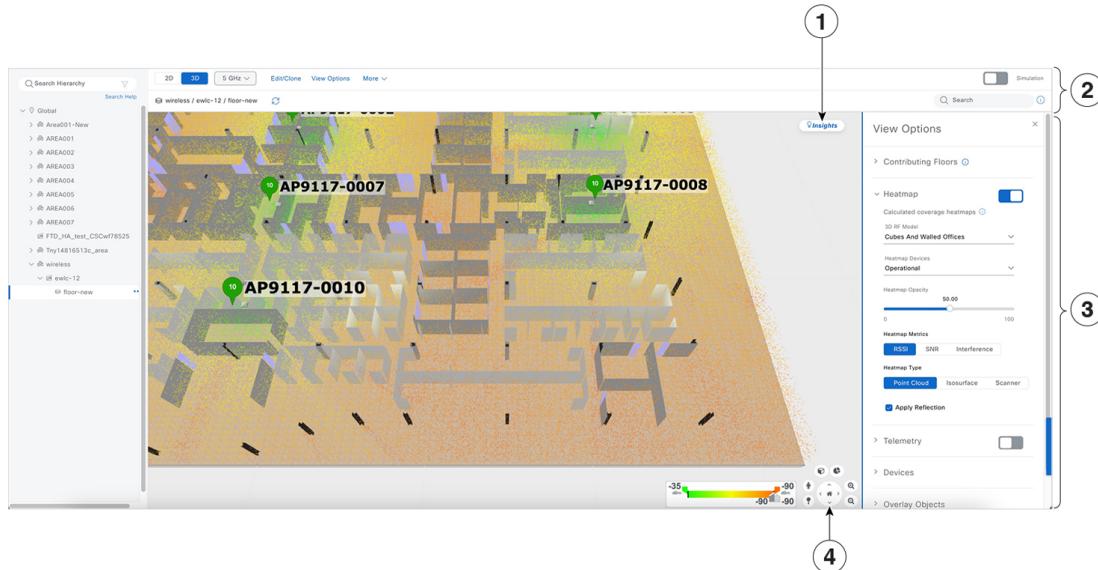
- To select a single AP, click the AP.
- To select multiple APs, press the **Shift** key while clicking each AP, and then release the **Shift** key.
- To deselect a single AP, click the AP.

Note If no APs are selected, the heatmap includes all APs.

- To deselect all APs, press the **Esc** key or double-click an area of the map that doesn't have any APs.

Step 6 Use the tools and options shown in the following figure to gain insights about your wireless network.

Figure 12: 3D Wireless Map Showing Tools and Options



Callout	Description
1	Insights Option: In the top-right corner of the map, click Insights to view and understand potential issues in your wireless network. For details, see Gain Insights from a 3D Wireless Map, on page 227 .
2	Map Toolbar: Above the map, use the toolbar options to control what's displayed on the heatmap. For details, see 3D Wireless Map Toolbar, on page 217 .
3	View Options Slide-In Pane: In the slide-in pane, use the view options to control the heatmap display. You can manipulate elements, such as which floors are displayed, heatmap coverage and metrics, telemetry thresholds, devices and clients, overlay objects, and the depiction of a floor and sky. For details, see 3D Map View Options, on page 218 .
4	Navigation Controls: In the bottom-right corner of the map, use the map navigation controls to view the heatmap from various perspectives. For details, see 3D Map Navigation Controls, on page 221 .

3D Wireless Map Toolbar

To access the 3D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **3D**.

The map toolbar consists of two bars and is located above the map. Use the map toolbar for the following actions and settings:

Item	Description
2D 3D	Click 3D to view the wireless map in 3D, or click 2D to view it in 2D.

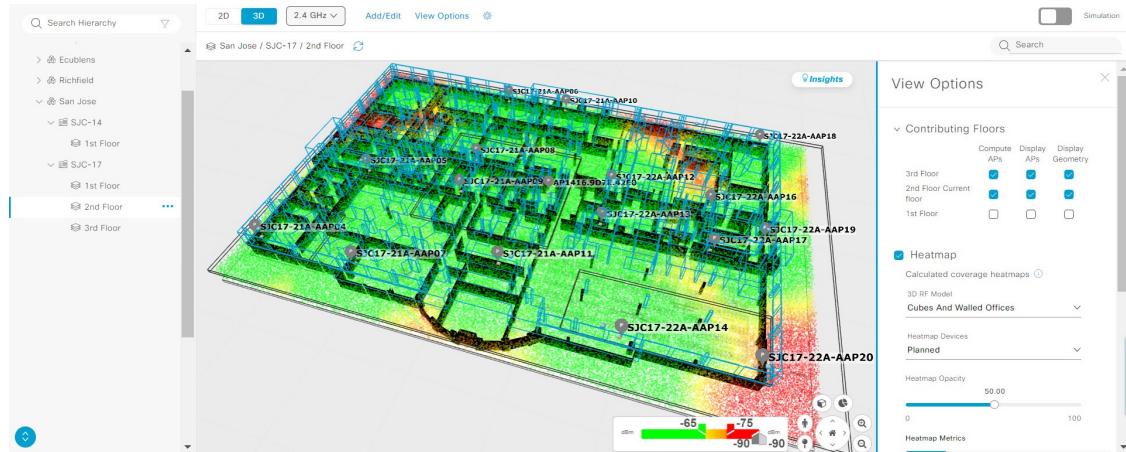
Item	Description
 5 GHz ▾	Wi-Fi Band Filter: Hover your cursor over the Wi-Fi band filter, and from the drop-down list, choose a Wi-Fi band.
Edit/Clone	Click Edit/Clone to edit or clone existing or planned APs. For details, see Clone an AP, on page 215 . Note Adding operational APs from the inventory is not available in the 3D map. To add operational APs, click Add/Edit in the 2D map toolbar.
View Options	Click View Options to open the View Options slide-in pane, which contains the options for controlling the display of the contributing floors, map, telemetry, devices, overlay objects, and floor geometry. For details, see 3D Map View Options, on page 218 .
More	Hover your cursor over More , and click Insights Configuration to customize the conditions for insights. For details, see Gain Insights from a 3D Wireless Map, on page 227 .
Simulation	Click the Simulation toggle button to view the map in simulation mode. When the 3D wireless map enters simulation mode, the lower map toolbar displays the message: "You are in Simulation Mode". For details, see Create Simulations for 3D Wireless Maps, on page 229 . Note Simulation mode is available only in 3D maps, not in 2D maps.
	Full Hierarchy Path: Displays the full navigational path of the floor, including its associated building and site.
	Refresh: Click the refresh icon to update the device and map data.
 <input type="text" value="Search"/> ⓘ	Search: Use the Search field to find specific floor map elements such as APs, sensors, clients, and so on. The results of your search are listed in a slide-in pane below the Search field. When you hover your cursor over an element in the list, an indicator points to the element on the map. If the element is outside the field of view, the indicator is displayed as a broken red line. Reorient the map to see the element.

3D Map View Options

To access the 3D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **3D > View Options**.

The **View Options** slide-in pane opens. Expand the categories to view the settings:

- **Contributing Floors:** Expand this option to include more floors in the heatmap computation. When including a floor, you can choose to add its APs in the heatmap computation and display its APs and floor geometry. Click **Apply** to generate the heatmap with your settings.

Figure 13: 3D Map of Multiple Floors

Item	Description
Compute APs	Check this check box to include a floor's APs when computing the heatmap.
Display APs	Check this check box to display a floor's APs in the heatmap.
Display Geometry	Check this check box to display a floor's physical attributes in the heatmap.

- **Heatmap:** Click the **Heatmap** toggle button to display the heatmap, and expand this option to configure the settings using the following table:

Item	Description
3D RF Model	Use this drop-down list to choose the RF model. The RF model determines how RF is calculated based on the floor geometry. Available models include drywall offices, cubes and walled offices, free space, outdoor open space, and indoor high ceiling. Note We recommend that you choose Free Space if you manually placed the walls or imported them from a CAD file or Ekahau project. If you didn't manually place the walls, use an RF model other than Free Space .
Heatmap Devices	Use this drop-down list to choose whether to display operational devices, operational and planned devices, or only planned devices on the heatmap.
Heatmap Opacity	Use this slider to customize the opacity or transparency of the heatmap.

Item	Description
Heatmap Metrics	<p>Choose the type of metrics to display on the heatmap:</p> <ul style="list-style-type: none"> • RSSI: Displays the Received Signal Strength Indicator (RSSI) values. • SNR: Displays the signal-to-noise ratio (SNR) values. • Interference: Displays the SNR that is caused by co-channel interference (CCI) or adjacent channel interference. • Leakage: Displays signal leakage between floors. For this option to be available, you must compute the heatmap with two or more contributing floors.
Heatmap Type	<p>Choose the heatmap type:</p> <ul style="list-style-type: none"> • Point Cloud: Provides a collection of data points in space. Each data point has x, y, and z coordinates. • Isosurface: Represents the RSSI with isolines or lines of a contiguous value. • Scanner: Displays the RSSI for a specific elevation.
Apply Reflection	<p>Check this check box to show signal reflection, which can be caused when a signal bounces off materials such as glass, whiteboards, and plastic.</p>

- **Telemetry**: Click the **Telemetry** toggle button to enable and disable telemetry. When telemetry is enabled, click a sensor or AP to view its telemetry:
 - The telemetry for a sensor displays the predicted and measured RSSI values between a sensor AP and other APs.
 - The telemetry for an AP displays the predicted and measured RSSI values between neighbor APs.

Expand this option to use the **Telemetry Threshold** slider to set the threshold for telemetry sources to be displayed on the heatmap. Telemetry sources with predicted values that do not meet the threshold are faded.

- **Devices**: Expand this option to configure the settings using the following table:

Item	Description
APs	Check this check box to display APs on the map.
Planned APs	Check this check box to display planned APs on the map.
Sensors	Check this check box to display sensors on the map.

Item	Description
Clients	<p>Check this check box to display clients on the map. Additionally, you can do the following:</p> <ul style="list-style-type: none"> Display clients in their default blue color (None) or by their RSSI, SNR, or Health Score. For RSSI, SNR, and Health Score, clients are colored blue, yellow, or red, depending on their current condition. Use the Ball Size slider to change the size of the ball that represents a client on the map.

- **Overlay Objects:** Expand this option to configure the settings using the following table:

Item	Description
Geometry	Check this check box to display the floor geometry.
Height	Use this slider to set the height of walls on the heatmap.

- **Map:** Expand this option to configure the settings using the following table:

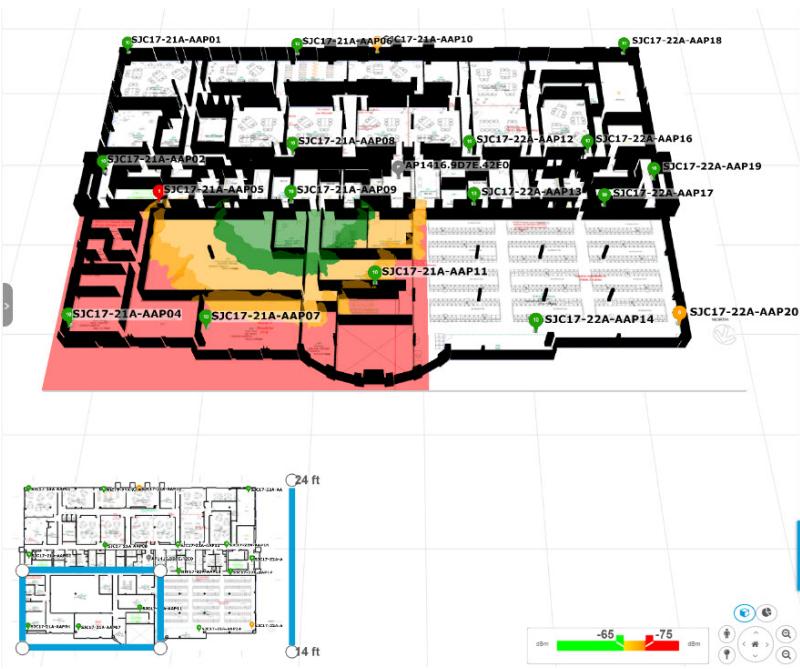
Item	Description
Sky	Check this check box to display the sky in the heatmap.
Floor	Check this check box to display the floor in the heatmap.

3D Map Navigation Controls

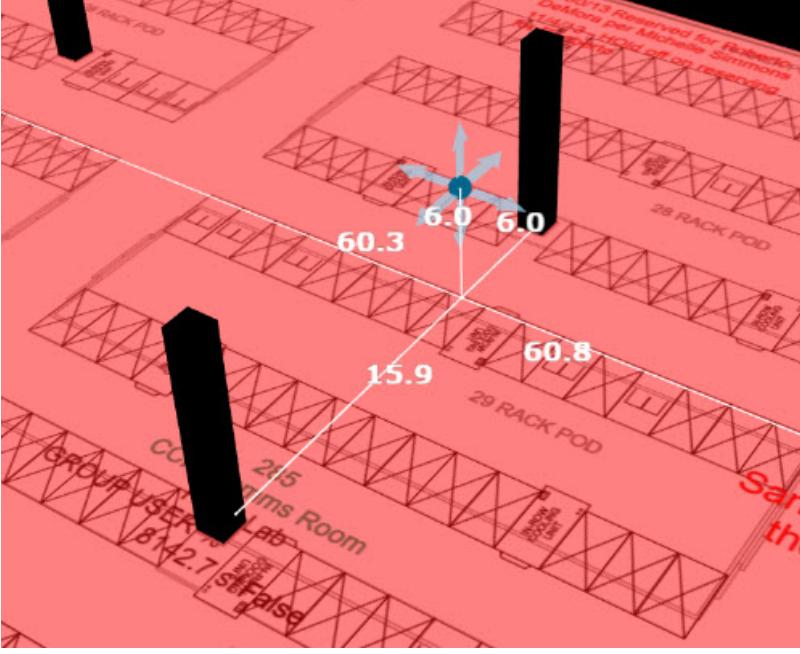
To access the 2D map, from the top-left corner, click the menu icon and choose **Design > Network Hierarchy**. From the left hierarchy tree, choose a floor, and in the map toolbar, click **3D**.

The 3D map navigation controls are located at the bottom-right corner of the map. For details about the map, see [View a 3D Wireless Heatmap, on page 216](#).

Use the map navigation controls at the bottom-right corner of the map to control the map view.

Map Navigation Control	Description
	<p>Use clip box: Click this icon to crop the heatmap using a box shape. Use the clipper at the bottom-left corner of the map to specify the crop:</p> <ul style="list-style-type: none"> Click and drag one of the anchor points to change the size of the crop. Click and drag one of the anchor points on the right vertical slider to specify the height range of the crop. <p>Figure 14: Clip Box</p> 

Map Navigation Control	Description
	<p>Use clip planes: Click this icon to crop the heatmap using a donut shape. Use the clipper at the bottom-left corner of the map to specify the crop:</p> <ul style="list-style-type: none"> Click and drag the anchor point in the center of the donut to reposition the donut. Click and drag the two outer anchor points to change the shape of the crop. <p>Figure 15: Clip Planes in Use</p> 
	<p>First Person View: Click this icon to switch between first-person view and third-person view. The blue sphere indicates your position on the map. As you move throughout the map, your field of view changes. You can use the mini map at the lower-left corner to get an idea of your field of view and orientation.</p> <p>Note If you have more than one floor selected for display, the First Person View automatically positions you on the current floor.</p> <p>For details, such as the controls for view, see Use First-Person and Third-Person Views for 3D Wireless Maps, on page 225.</p>

Map Navigation Control	Description
	<p>Third Person View: Click this icon to switch between first person view and third person view. You can also drag and drop the icon on the map where you want to be positioned.</p> <p>The blue sphere indicates your position on the map. As you move throughout the map, your field of view changes. You can use the mini map at the lower-left corner to get an idea of your field of view and orientation.</p> <p>For details, such as the controls for view, see Use First-Person and Third-Person Views for 3D Wireless Maps, on page 225.</p>
	<p>Place a pin: Click this icon to view a predicted measurement (x, y, and z coordinates) of a specific point on the floor map. By placing a pin, you can view the measurements of the distance from the pin to the end of the yard stick. As you zoom in or zoom out, the position of the measurements is adjusted to stay in your view. Drag and drop the pin to change its position, as follows:</p> <ul style="list-style-type: none"> • To move the pin horizontally: Click the horizontal arrows and drag the pin left, right, forward, or backward. The selected arrows and yard stick are highlighted while active. • To move the pin vertically: Click the vertical arrows and drag the pin up or down. The selected arrows and yard stick are highlighted while active.
	<p>For a video demonstration, click here.</p> <p>Figure 16: Adjusting a Pin</p>  <p>Zoom In: Click this icon to enlarge the view. Alternatively, you can use your mouse wheel to zoom in.</p>

Map Navigation Control	Description
	Zoom Out: Click this icon to reduce the size of the image and to increase your field of view. Alternatively, you can use the scroll wheel on your mouse to zoom out.
	Map Rotation and Default Map View: Click the directional arrows to change the camera angle. Click the Return Home icon to reset the map to the default view.

Use First-Person and Third-Person Views for 3D Wireless Maps

You can use the first-person and third-person views to gain different perspectives of your wireless network.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

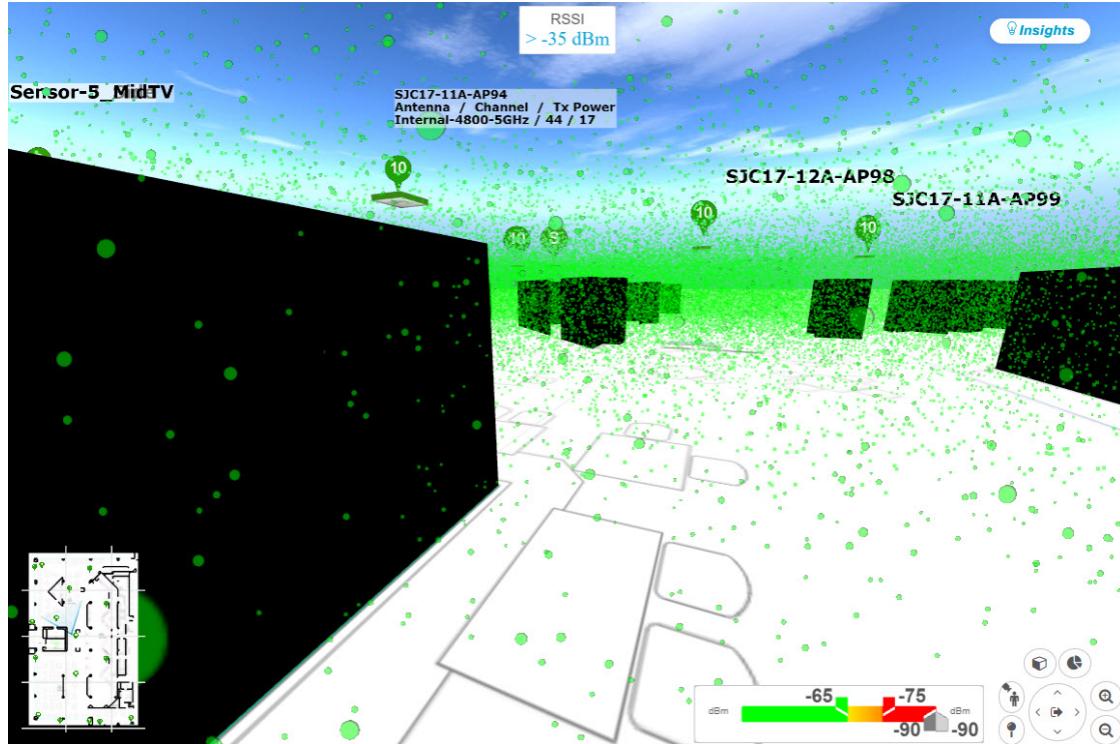
Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **3D**.

Step 4 To use the first-person view, click the first-person view icon in the map navigation controls. Optionally, you can drag and drop the person icon to a specific location on the map.

The map view changes to the first-person view.

Figure 17: First-Person View



Use First-Person and Third-Person Views for 3D Wireless Maps

Step 5

You can control the first-person view by doing the following:

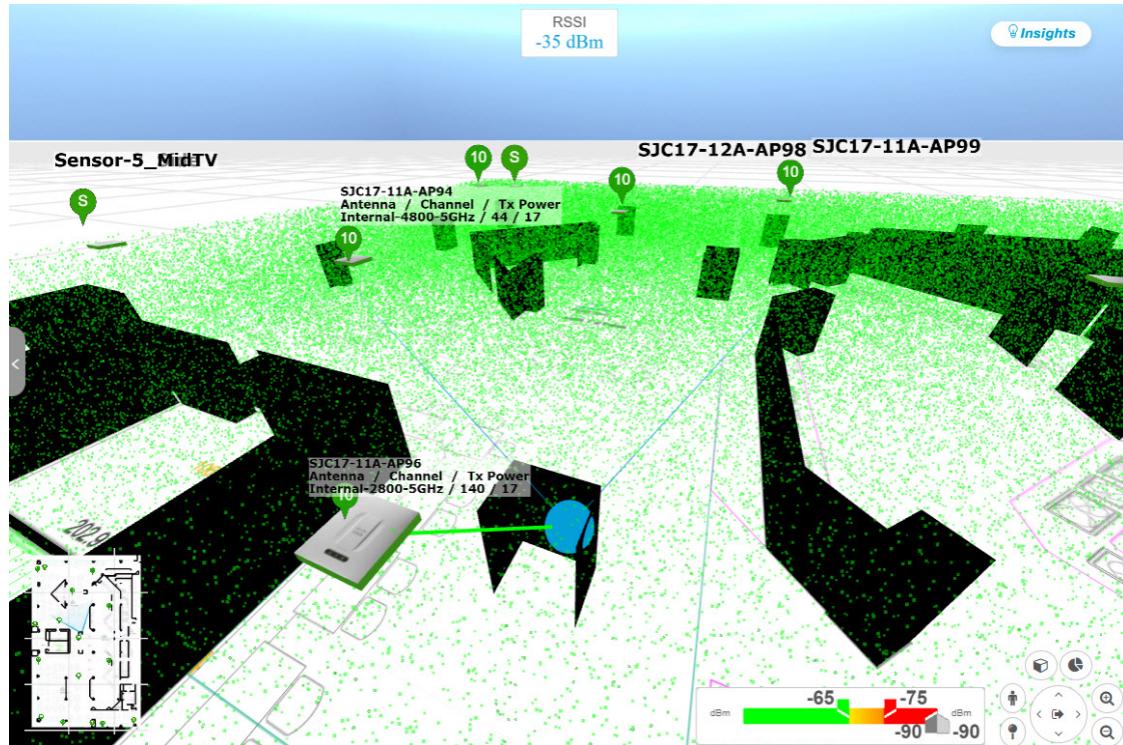
Action	Controls
Move forward/backward and right/left.	Use the W , A , S , and D keys or arrow keys.
Change the camera angle.	Click and hold the left mouse button on the map and move the mouse wheel.
Raise the altitude of the camera angle.	Hold the Spacebar .
Lower the altitude of the camera angle.	Hold Shift + Spacebar .

Step 6

To use the third-person view, click the third-person view icon  from the map navigation controls.

The map view changes to the third-person view.

Figure 18: Third-Person View



Step 7

You can control the third-person view by doing the following:

Action	Controls
Move forward/backward and right/left.	Use the W , A , S , and D keys or arrow keys.
Change the camera angle.	Click and drag on the map.
Raise the altitude of the camera angle.	Hold the Spacebar .

Action	Controls
Lower the altitude of the camera angle.	Hold Shift + Spacebar .

Step 8 To return to the default view, click the return home icon .

Display Details About APs and Clients

If you have a location service, such as Cisco Spaces or Cisco Connected Mobile Experiences (CMX), installed on Catalyst Center, you can view the locations of clients on a floor. Clients are identified as a small blue ball (●) on the map.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose a floor.

Step 3 In the map toolbar, click **3D**.

Note A 3D heatmap is delimited by its coverage area, which is the full floor width and length, by default. To specify a polygon for the heatmap boundaries, edit the **Coverage Area** field value in the 2D map view. However, these boundaries do not apply to the 2D map view because the full floor width and length are used for the 2D map view.

Step 4 To display details about an AP, click the AP.

Step 5 To display information about a client, hover your cursor over the ball (client).

A line is drawn between the client and its associated AP. A dialog box is displayed with information, such as the client's IPv4 address, IPv6 IP address, RSSI value, and so on. To open the **Client 360** window, click the **Client 360** link in the dialog box.

Step 6 To display the client in a color that corresponds to its RSSI, SNR, or health score, do the following:

- Click **View Options > Devices and Clients**.
- Check the **Clients** check box.
- Under the **Clients** check box, click **None** (default blue color), **RSSI**, **SNR**, or **Health Score**.

Step 7 To resize the ball, use the **Ball Size** slider in the **View Options** pane. This feature helps you to view clients in cases where there are many clients or only a few. For example, in cases where there are many clients, you can make the ball smaller, and in cases where there are only a few clients, you can make the ball larger.

Gain Insights from a 3D Wireless Map

Catalyst Center actively monitors the network performance of 3D wireless maps and provides insights into areas where service-level agreements (SLA) are not being met.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.

Run the Wireless Coverage Optimizer

- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **3D**.
- Step 4** At the top-right corner of the map, click **Insights**.

The **Insights** area opens and displays information about the coverage areas that don't meet a specific KPI threshold, for example, RSSI is ≥ -70 dBm.

Figure 19: Insights Area



- Step 5** In the **Insights** area, you can do any of the following actions:

Item	Details
View coverage gaps	Click this link to display the wireless coverage area. Red areas show where the SLA is not being met. Green areas show where it's being met.
Optimizer	Click this link to have Catalyst Center analyze the wireless coverage area. You can indicate the maximum number of APs that you are willing to move and add, and Catalyst Center computes a configuration where the wireless coverage is maximized. For more information, see Run the Wireless Coverage Optimizer, on page 228 .
Mute This Insight	Click this button to exclude an insight from displaying in the Insights dialog box. Muted insights appear at the bottom of the list in the All Insights slide-in pane.
View All Insights	Click this button to display all active and muted insights. For each insight, you can click Mute or Unmute to exclude or include its display in the Insights dialog box. Click Edit Configuration to customize the insight KPI settings. Another way to customize insight KPI settings is from the map toolbar. Hover your cursor over the gear icon in the map toolbar and choose Insights Configurations .

Run the Wireless Coverage Optimizer

For wireless areas that aren't meeting their SLA, the optimizer takes your input of the maximum number of APs that you are prepared to move and add, and computes a configuration where the wireless coverage is maximized.

This procedure shows you how to run the wireless coverage optimizer.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.

- Step 3** In the map toolbar, click **3D**.
- Step 4** At the top-right corner of the map, click **Insights**.
The **Insights** area opens and displays information about the coverage areas that don't meet a specific KPI threshold, for example, RSSI is ≥ -70 dBm.
- Step 5** (Optional) To display the wireless coverage area, click **View**.
Red areas show where the SLA is not being met. Green areas show where the SLA is being met.
- Step 6** (Optional) If there are specific APs that you don't want the optimizer to move, you can right-click them and choose **Lock** to lock their position. To remove the lock, right-click the AP and choose **Unlock**.
- Step 7** Click **Optimizer**.
- Step 8** In the **Coverage Optimizer** dialog box, enter the maximum number of APs that you are prepared to move and add.
If you don't want to move or add APs, leave the corresponding field blank or enter **0**.
- Step 9** Click **Run Optimizer**.
If needed, you can manually move any of the APs to other locations.
- Step 10** When the analysis is complete, click **View Results**.
Catalyst Center displays a proposed layout that increases the wireless coverage to maximize the SLA. If the optimizer recommends moving an AP, the new layout displays a blue line to the recommended new location. Any new APs that have been added to the layout are displayed as blue markers ().
- Step 11** To save the new layout as a simulation, click **Save as a plan**. To exit without saving, click the **x** at the top-right corner of the map.
Later, if you implement the recommended changes to your physical wireless network, you can save the simulation as an operational map. For information, see [Create Simulations for 3D Wireless Maps, on page 229](#).

Create Simulations for 3D Wireless Maps

You can create simulations for 3D wireless maps.

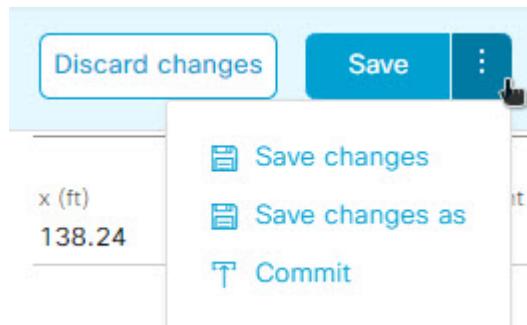


Note Simulation mode is available only in 3D maps, not in 2D maps.

Simulations allow you to change device configurations without actually implementing them. You can create multiple simulations and load them at any time.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Hierarchy**.
- Step 2** From the left hierarchy tree, choose a floor.
- Step 3** In the map toolbar, click **3D**.
- Step 4** In the map toolbar, click the **Simulation** toggle button to view the map in simulation mode.
The lower map toolbar displays the message: "You are in Simulation Mode".

- Step 5** In the map toolbar, click **Edit/Clone**.
In simulation mode, only particular attributes are editable for previewing the impact of changes on the heatmap.
- Step 6** Make any changes to the devices, as needed, for the simulation, and then click **Apply**.
- **APs:** You can change the model, channel, antenna, and more.
 - **PAPs:** You can change the model, channel, antenna, and more.
- Step 7** In the map toolbar, hover your cursor over the vertical ellipsis and choose **Save changes as** to save the configuration as a new simulation.

Figure 20: Saving as a Simulation

- Note** Choose **Save changes** when you want to save any changes to an existing simulation.
Choose **Commit** when you want to commit the simulation to the production environment. Note that you can only commit planned APs.

- Step 8** In the **Save Simulation** dialog box, enter a name for the simulation and click **Save**.
The new simulation is displayed on the map.
- Step 9** (Optional) To display a different simulation, do the following:
- a. Make sure that you are in simulation mode and are not editing any devices.
 - b. From the **Select Simulation** drop-down list, choose a simulation.
If you have no saved simulations, **None available** is displayed instead of the **Select Simulation** drop-down list.
- Step 10** (Optional) To delete a simulation, do the following:
- a. From the **Select Simulation** drop-down list, choose a simulation.
 - b. Click the delete icon next to the **Select Simulation** drop-down list.



CHAPTER 9

Configure Network Settings

- [Network Settings Overview, on page 231](#)
- [Configure the Time Zone for a Site, on page 232](#)
- [Configure the Message of the Day, on page 232](#)
- [Add Cisco ISE or Other AAA Servers, on page 233](#)
- [Configure Global Network Servers, on page 234](#)
- [Configure Global Device Credentials, on page 235](#)
- [Configure IP Address Pools, on page 247](#)
- [Configure Service Provider Profiles, on page 252](#)
- [Configure Global Wireless Settings, on page 252](#)
- [Configure a Certificate Revocation Check, on page 330](#)

Network Settings Overview

You can create network settings that become the default for your entire network. There are two primary areas from which you can define the settings within your network:

- **Global settings:** Settings defined here affect your entire network and include settings for servers such as DHCP, DNS, AAA, NTP, and so on; IP address pools; Device Credential profiles; Telemetry settings such as Syslog, Traps, and NetFlow.
- **Site settings:** Settings define here override global settings and can include settings for servers, IP address pools, and device credential profiles.



Note Changes in network settings that are being used by the active fabric are not supported. These network settings include site hierarchy, renaming IP pools, and several other features.



Note Certain network settings can be configured on devices automatically using the Device Controllability feature. When Catalyst Center configures or updates devices, the transactions are captured in the Catalyst Center audit logs. You can use the audit logs to help you track changes and troubleshoot issues.

Configure the Time Zone for a Site

You can define the following global network settings by choosing **Design > Network Settings** and clicking the appropriate tab.

- Network servers, such as AAA, DHCP, and DNS: For more information, see [Configure Global Network Servers, on page 234](#).
- Device credentials, such as CLI, SNMP, and HTTP(S): For more information, see [Configure Global Device Credentials, on page 235](#).
- IP address pools: For more information, see [Configure IP Address Pools, on page 247](#).
- Wireless settings as SSIDs, wireless interfaces, and wireless radio frequency profiles: For more information, see [Configure Global Wireless Settings, on page 252](#).
- Configure global telemetry settings, such as syslog, SNMP, and NetFlow Collector servers using telemetry.

Configure the Time Zone for a Site

A site's time zone is used primarily for scheduling tasks, like assigning a device to a site, provisioning, or updating telemetry settings.

When scheduling a task for a later time, the site's assigned time zone will be used by default.

To configure the time zone for a site, perform the following steps:

-
- | | |
|---------------|--|
| Step 1 | From the top-left corner, click the menu icon and choose Design > Network Settings . |
| Step 2 | Click the Servers tab. |
| Step 3 | From the left hierarchy tree, choose your desired site. |
| Step 4 | In the Time Zone section, choose your desired time zone from the drop-down list. |
| Step 5 | Click Save . |
-

Configure the Message of the Day

The message of the day is the greeting message that is displayed when logging into a device's CLI. This message applies only to routers, switches, and hubs.

To configure the message of the day, perform the following steps:

-
- | | |
|---------------|---|
| Step 1 | From the top-left corner, click the menu icon and choose Design > Network Settings . |
| Step 2 | Click the Servers tab. |
| Step 3 | From the left hierarchy tree, choose your desired site. |
| Step 4 | In the Message of the Day section, choose one of the following options: <ul style="list-style-type: none"> • Use device's existing message |
- This is the default option.

- **Set custom message**

You can enter your own message, but the message must adhere to the following constraints:

- Cannot contain "#" or "<"
- Cannot contain "MLTCMD" or "mltcmd"
- Maximum line length: 80 characters
- Maximum number of lines: 40

Step 5 Click Save.

Add Cisco ISE or Other AAA Servers

You can define Cisco Identity Services Engine (ISE) servers or other, similar AAA servers for network, client, and endpoint authentication at the site or global level. For network authentication, RADIUS and TACACS protocols are supported. For client and endpoint authentication, only RADIUS is supported. Only one Cisco ISE is supported per Catalyst Center.

You can configure the source interface under the RADIUS or TACACS server group to support multi-ISE configuration, wherein each Cisco ISE cluster has its own server group. The interface that Catalyst Center uses as the management IP is configured as the source interface for RADIUS and TACACS servers.

After you configure a Cisco ISE server for a site, the devices that are assigned to the site are automatically updated on the corresponding Cisco ISE server with a /32 mask. Subsequently, any changes to those devices in Cisco ISE are sent automatically to Catalyst Center.

For FIPS mode of deployment, the shared secret consists of shared secret, keywrap, and message authenticator code key.

Before you begin

- You must have Read permission on **Advanced Network Settings**.
 - You must specify the servers that authenticate Catalyst Center users in **System > Settings** window. For information on how to do it, see **Configure Authentication and Policy Servers** in [Cisco Catalyst Center Administrator Guide](#).
-

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Servers**.

Step 2 Expand the **AAA** area.

Step 3 Check the **Add AAA servers** check box under **Network** and/or **Client/Endpoint** tabs and configure servers and protocols for the AAA server.

Step 4 Choose the **Server Type** for authentication and authorization: **ISE** or **AAA**.

- If you choose **ISE**, configure the following:
 - Choose the **Protocol: RADIUS or TACACS**.

Configure Global Network Servers

- From the **PAN** drop-down list, choose the IP address of the Cisco ISE server. The **PAN** drop-down list contains all the IP addresses of the Cisco ISE servers that are registered on the **System > Settings** window. Selecting a Cisco ISE IP populates the primary and secondary IP address drop-down lists with Policy Service Node (PSN) IP addresses for the selected Cisco ISE. You can either enter an IP address for the AAA server or choose the PSN IP address from the **Primary Server** and **Secondary Server** drop-down lists.
- If you choose **TACACS**, check the **Single Connection** check box to minimize the number of TCP connections opened for duplicate transactions.

Note AAA settings for a physical and managed site for a particular wireless controller must match, or provisioning fails.

- If you choose **AAA**, configure the following:

- Choose the **Protocol: RADIUS or TACACS**.
- From the **Primary Server** drop-down list, choose an IP address for the AAA server. Click the  icon and choose an IP address from the **Secondary Server** drop-down list. Click  icon to delete the server. These drop-down lists contain the non-Cisco ISE AAA servers registered on the **System > Settings** window. Ensure that the AAA server IP address is not part of an existing Cisco ISE cluster.
- If you choose **TACACS**, check the **Single Connection** check box to minimize the number of TCP connections opened for duplicate transactions.

Note If you switch the **Server Type** from ISE (with TACACS) to AAA with TACACS, TACACS will be disabled on the Cisco ISE server because it is no longer used for authentication.

Step 5 Click **Save**.

Configure Global Network Servers

You can define the global network servers that become the default for your entire network.



Note You can override the global network settings on a site by defining site-specific settings.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Servers** tab.

Step 3 Expand the **DHCP** area to specify one or more dedicated Dynamic Host Configuration Protocol (DHCP) servers for managing the client device networking configuration.

Step 4 Check the **Add DHCP servers** check box to view the fields.

Step 5 In the **IP Address** field, enter the IP address of a DHCP server. Click the icon to add an IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

You must define at least one DHCP server in order to create IP address pools.

Step 6 Expand the **DNS** area to configure your network's domain name, and specify Domain Name System (DNS) servers for hostname resolution.

Step 7 Check the **Set a domain name** check box to enter the domain name of a DNS server.

Step 8 Check the **Add DNS servers** check box to enter the IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

You must define at least one DNS server in order to create IP address pools.

Step 9 Expand the **NTP** area to specify one or more Network Time Protocol (NTP) servers to facilitate system clock synchronization for your network.

Step 10 Check the **Add NTP servers** check box to view the fields.

Step 11 In the **IP Address** field, enter the IP address of an NTP server. Click the icon to add an IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

Step 12 Click **Save**.

Configure Global Device Credentials

"Global device credentials" refers to the common CLI, SNMP, and HTTPS credentials that Catalyst Center uses to discover and collect information about the devices in your network. Catalyst Center uses global credentials to authenticate and access the devices in a network that share these configured device credentials.

Configure Global Device Credentials Workflow

To configure global device credentials onto devices in a network, follow these high-level steps:

1. Create the global device credential. See [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).
2. Assign the global device credential to a site. See [Assign Device Credentials to Sites, on page 241](#).
3. Apply the global device credential to all the devices in the selected site. See [Apply Device Credentials to a Site's Devices, on page 242](#).
4. Manage the global device credential. See [Manage Global Device Credentials, on page 242](#).

Add Global CLI Credentials

You can add and save up to 10 global CLI credentials.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 From the left hierarchy tree, choose a site.

Step 4 Do one of the following:

- If you haven't created any credentials yet, click **Create Credentials**.
- If you have created credentials, click **Manage Credentials**.

Step 5 In the **Manage Credentials** slide-in pane, from the **Add** drop-down list, choose **CLI**.

Step 6 Complete the listed fields using the following table:

Table 29: CLI Credentials

Field	Description
Name/Description	Name or phrase that describes the CLI credentials.
Username	Name that is used to log in to the CLI of the devices in your network.
Password	Password that is used to log in to the CLI of the devices in your network. Note Passwords are encrypted for security reasons and are not displayed in the configuration.
Enable Password	Password that is used to move to a higher privilege level in the CLI. Configure this password only if your network devices require it. Note Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 7 (Optional) Check the **Assign credential to site** check box to assign the CLI credential to the selected site.

Step 8 Click **Save**.

A success message is displayed in the bottom-right corner. You can view the credential in the **Manage Credentials** slide-in pane. However, if you didn't assign the credential to a site, only the **System** focus will display the credential.

Add Global SNMPv2c Credentials

You can add global SNMPv2c credentials to monitor and manage your network devices.



Note Catalyst Center does not support SNMPv2c device credentials when FIPS mode is enabled. You must specify SNMPv3 credentials instead.

Before you begin

You must have the SNMP information for your network.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Device Credentials** tab.
- Step 3** From the left hierarchy tree, choose a site.
- Step 4** Do one of the following:
- If you haven't created any credentials yet, click **Create Credentials**.
 - If you have created credentials, click **Manage Credentials**.
- Step 5** In the **Manage Credentials** slide-in pane, from the **Add** drop-down list, choose **SNMPv2c Read** or **SNMPv2c Write**.
- Step 6** Complete the listed fields using the following table:

Table 30: SNMPv2c Credentials

Field	Description
Read	<ul style="list-style-type: none"> • Name/Description: Name or description of the SNMPv2c settings that you are adding. • Read Community: Read-only community string password used only to view SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>
Write	<ul style="list-style-type: none"> • Name/Description: Name or description of the SNMPv2c settings that you are adding. • Write Community: Write community string used to make changes to the SNMP information on the device. <p>Note Passwords are encrypted for security reasons and are not displayed in the configuration.</p>

- Step 7** (Optional) Check the **Assign credential to site** check box to assign the SNMPv2c credential to the selected site.
- Step 8** Click **Save**.
- A success message is displayed in the bottom-right corner. You can view the credential in the **Manage Credentials** slide-in pane. However, if you didn't assign the credential to a site, only the **System** focus will display the credential.
-

Add Global SNMPv3 Credentials

You can add global SNMPv3 credentials to monitor and manage your network devices.

Add Global SNMPv3 Credentials**Before you begin**

You must have your network's SNMP information.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 From the left hierarchy tree, choose a site.

Step 4 Do one of the following:

- If you haven't created any credentials yet, click **Create Credentials**.
- If you have created credentials, click **Manage Credentials**.

Step 5 In the **Manage Credentials** slide-in pane, from the **Add** drop-down list, choose **SNMPv3**.

Step 6 Complete the listed fields using the following table:

Table 31: SNMPv3 Credentials

Field	Description
Name/Description	Name or description of the SNMPv3 settings that you are adding.
Username	Name that is associated with the SNMPv3 settings.
Mode	Security level that an SNMP message requires. Choose one of the following modes: <ul style="list-style-type: none"> • Authentication and Privacy: Provides both authentication and encryption. • Authentication, No Privacy: Provides authentication, but does not provide encryption. • No Authentication, No Privacy: Does not provide authentication or encryption.
Auth Type	Authentication type to be used. (This field displays if you select Authentication and Privacy or Authentication, No Privacy as the authentication mode.) Choose one of the following authentication types: <ul style="list-style-type: none"> • SHA: Authentication based on HMAC-SHA • MD5: Authentication based on HMAC-MD5 <p>Note</p> <ul style="list-style-type: none"> • The MD5 authentication type is not recommended. • Catalyst Center does not support device provisioning if only MD5 authentication type is configured on the device for software image version 17.14.1 and later. <p>If you wish to use MD5 authentication, it is recommended to configure SHA authentication as well for Catalyst Center to discover and manage devices running on software image 17.14.1 and later.</p>

Field	Description
Privacy Type	<p>Privacy type to be used. (This field displays if you select Authentication and Privacy as the authentication mode.) Choose one of the following privacy types:</p> <ul style="list-style-type: none"> • AES128: 128-bit CBC mode AES for encryption. • AES192: 192-bit CBC mode AES for encryption on Cisco devices. • AES256: 256-bit CBC mode AES for encryption on Cisco devices. • DES: DES 56-bit (DES-56) encryption in addition to authentication based on the CBC DES-56 standard. <p>Note The DES privacy type is disabled and not supported.</p>
Auth Password	<p>SNMPv3 password that is used for gaining access to information from devices that use SNMPv3. (This field displays if you select Authentication and Privacy or Authentication, No Privacy as the authentication mode.) These passwords (or passphrases) must be at least eight characters in length and cannot contain spaces or angle brackets (< >).</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.
Privacy Password	<p>SNMPv3 privacy password that is used to generate the secret key for encrypting messages that are exchanged with devices that support DES or AES128 encryption. (This field displays if you select Authentication and Privacy as the authentication mode.) Passwords (or passphrases) must be at least eight characters long and cannot contain spaces or angle brackets (< >).</p> <p>Note</p> <ul style="list-style-type: none"> • Some wireless controllers require that passwords (or passphrases) be at least 12 characters long. Be sure to check the minimum password requirements for your wireless controllers. Failure to ensure these required minimum character lengths for passwords results in devices not being discovered, monitored, or managed by Catalyst Center. • Passwords are encrypted for security reasons and are not displayed in the configuration.

Step 7 (Optional) Check the **Assign credential to site** check box to assign the SNMPv3 credential to the selected site.

Step 8 Click **Save**.

A success message is displayed in the bottom-right corner. You can view the credential in the **Manage Credentials** slide-in pane. However, if you didn't assign the credential to a site, only the **System** focus will display the credential.

Add Global HTTPS Credentials

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Device Credentials** tab.
- Step 3** From the left hierarchy tree, choose a site.
- Step 4** Do one of the following:
- If you haven't created any credentials yet, click **Create Credentials**.
 - If you have created credentials, click **Manage Credentials**.
- Step 5** In the **Manage Credentials** slide-in pane, from the **Add** drop-down list, choose **HTTP(S) Read** or **HTTP(S) Write**.
- Step 6** Complete the listed fields using the following table:

Table 32: HTTP(S) Credentials

Field	Description
Read	<p>You can configure up to 10 HTTPS read credentials:</p> <ul style="list-style-type: none"> • Name/Description: Name or description of the HTTPS credentials that you are adding. • Username: Name that is used to authenticate the HTTPS connection. • Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> • Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).
Write	<p>You can configure up to 10 HTTPS write credentials:</p> <ul style="list-style-type: none"> • Name/Description: Name or description of the HTTPS credentials that you are adding. • Username: Name that is used to authenticate the HTTPS connection. • Password: Password that is used to authenticate the HTTPS connection. Passwords are encrypted for security and are not displayed in the configuration. <p>The password cannot contain spaces or angle brackets (<>). Note that some Cisco IOS XE devices do not allow a question mark (?).</p> <ul style="list-style-type: none"> • Port: Number of the TCP/UDP port that is used for HTTPS traffic. The default is port number 443 (the well-known port for HTTPS).

- Step 7** (Optional) Check the **Assign credential to site** check box to assign the HTTPS credential to the selected site.
- Step 8** Click **Save**.

A success message is displayed in the bottom-right corner. You can view the credential in the **Manage Credentials** slide-in pane. However, if you didn't assign the credential to a site, only the **System** focus will display the credential.

Assign Device Credentials to Sites

You can assign global device credentials to a specific site or all the sites in the hierarchy. If you choose **Global**, all sites under **Global** inherit its assigned global device credentials.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 From the left hierarchy tree, choose the required site.

Step 4 Locate the type of global device credential that you want to assign.

Step 5 Check the corresponding **Assign** check box for the credential.

Step 6 From the **Credential** drop-down list, choose the credential that you want to assign to the selected site.

Step 7 Click **Save**.

The confirmation dialog box is displayed. Do one of the following:

- If you're ready to apply the device credential to the site's devices, click **Yes** and proceed to [Apply Device Credentials to a Site's Devices, on page 242](#).
- If you're not ready to apply the device credential to the site's devices, click **No**.
- If there are no devices in the site, click **OK**. You can apply device credentials to the site's devices after you've added devices to the site.

Step 8 To unassign a device credential from a site, do the following:

- From the left hierarchy tree, choose the required site.
- Uncheck the **Assign** check box for the device credential that you want to unassign.
- Click **Save**.
- In the confirmation dialog box, click **Yes** to proceed with unassigning the credential from the selected site or click **No** to keep the credential assigned to the selected site.

If you chose **Yes**, a successful dialog box is displayed, indicating that the updated site may not be in sync with the device credential applied to the site's devices. Do one of the following:

- If you're ready to apply the device credential to the site's devices, click **Yes** and proceed to [Apply Device Credentials to a Site's Devices, on page 242](#).
- If you're not ready to apply the device credential to the site's devices, click **No**.
- If there are no devices in the site, click **OK**. You can apply device credentials to the site's devices after you've added devices to the site.

Manage Global Device Credentials

- Note** Unassigning a device credential from a site doesn't change the credential currently applied to all the devices in that site. To update the device credential on all the devices in a site, see [Update Device Credentials on Devices, on page 246](#).
-

Manage Global Device Credentials

You can manage global device credentials in the **Manage Credentials** slide-in pane. Depending on the focus of the data (**Current site** or **System**), you can perform specific actions to manage your global device credentials. The **Current site** focus displays only global device credentials that are assigned to the selected site. In this focus, you can add and apply global device credentials to only the currently selected site. The **System** focus displays the system's pool of global device credentials. In this focus, you can add, edit, and delete global device credentials. Also, from this focus, you can apply a device credential to all the sites in the hierarchy.

Apply Device Credentials to a Site's Devices

With the **Focus** drop-down list, you can apply a global device credential either to devices in all sites or a specific site. If you apply a device credential using the **System** focus, Catalyst Center checks if any of the sites in the hierarchy are assigned to use this device credential. Then it pushes the change to those devices. If you apply a device credential using the **Current site** focus, Catalyst Center checks if the currently selected site and its child sites are assigned to use this device credential. Then it pushes the change to those devices.

Before you begin

Make sure that you assigned the device credential (that you want to apply) to the required sites. For more information, see [Assign Device Credentials to Sites, on page 241](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
 - Step 2** Click the **Device Credentials** tab.
 - Step 3** From the left hierarchy tree, choose the required site.
 - Step 4** Click **Manage Credentials**.
 - Step 5** In the **Manage Credentials** slide-in pane, from the **Focus** drop-down list, choose a focus (**Current site** or **System**) to define where you want to apply the credential.
 - Step 6** In the credential's corresponding **Actions** column, hover your cursor over ... and choose **Apply**.
 - Step 7** In the **Apply** slide-in pane, schedule when you want to apply the credential (**Now** or **Later**).
 - If you choose **Later**, indicate the time zone that you want to deploy the task in by either checking the **Site Settings** check box or unchecking the **Site Settings** check box and choosing a location.
 - Step 8** Click **Apply**.
- A success message is displayed in the bottom-right corner. To view the task details, go to the **Activities > Tasks** window.
-

Reschedule the Application of Device Credentials

If you want to reschedule a device credential task (applying the device credential to a site's devices), use this procedure.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 Do one of the following:

- If you used the **Current site** focus when you applied the device credential, choose the same site from the left hierarchy tree that you applied the device credential to.
- If you used the **System** focus when you applied the device credential, proceed to [Step 4, on page 243](#).

Step 4 Click **Manage Credentials**.

Step 5 In the **Manage Credentials** slide-in pane, from the **Focus** drop-down list, choose the same focus that you used to apply the device credential.

Step 6 In the **Manage Credentials** table, locate the device credential with the scheduled application that you want to reschedule.

Step 7 In the device credential's corresponding **Actions** column, hover your cursor over ... and choose **Reschedule**.

Note If **Reschedule** is not displayed and instead **Apply** is displayed, make sure that you chose the same focus and same site as you did in the scheduled application of the device credential. Clicking **Apply** creates a new task; it doesn't reschedule the existing task.

Step 8 Reschedule the date and time of the task, and then click **Apply**.

Note You cannot change the time zone.

A success message is displayed in the bottom-right corner, indicating that the device credential was successfully rescheduled.

View the Status of a Device Credential

With the **Current site** focus on the **Manage Credentials** slide-in pane, you can view the status of a device credential.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 From the left hierarchy tree, choose the required site.

Step 4 Click **Manage Credentials**.

Step 5 In the **Manage Credentials** slide-in pane, from the **Focus** drop-down list, choose **Current site**.

Step 6 In the **Manage Credentials** table, locate the relevant credential.

Step 7 In credential's corresponding **Status** column, view the credential's status.

One of the following statuses is displayed:

Guidelines for Editing Global Device Credentials

- **Synced:** The device credential assigned to selected site matches the device credential applied to the selected site's devices.
- **Not Synced:** The device credential assigned to selected site doesn't match the device credential applied to the selected site's devices.
- **Date and time:** This is the scheduled date and time of the device credential's application. For example, Feb 1, 2024 9:00 AM.
- **Partial Success:** The application of the device credential was partially successful.
- **Failed:** Catalyst Center failed to apply the device credential to at least one of the devices assigned to the selected site.
- **Not Applicable:** The device credential is not supported by any of the site's devices.
- **--:** The device credential cannot be applied because either the site has no devices or the child sites use a different credential of the same credential type.

Hover your cursor over the credential's status to view additional details.

Tip To view the latest status in the system, click the refresh icon in the top-right corner of the table.

Step 8

Alternatively, navigate to the **Provision > Inventory** window.

The **Credential Status** column displays one of the following statuses:

- **Success:** Catalyst Center successfully applied the credential change.
- **Failed:** Catalyst Center was unable to apply the credential change. Click **See Details** to view additional information about which credential change failed and why.
- **Not Applied:** The device credential applied to the selected site's device does not match the device credential assigned to the selected site.
- **Not Applicable:** The device credential is not applicable to the device type.

If you edited and saved more than one credential (for example, CLI, SNMP, and HTTPS), the **Credential Status** column displays **Failed** if Catalyst Center was unable to apply *any* of the credentials. Click **See Details** to display additional information about which credential change failed.

Guidelines for Editing Global Device Credentials

The following are guidelines and limitations for editing existing global device credentials:

- Catalyst Center uses the following process when you edit, save, and then apply a global device credential:
 1. Catalyst Center pushes the credential to the device that has local authentication. With local authentication, credential changes are applied and Catalyst Center manages the devices using these credentials.
(Catalyst Center does not push CLI credential changes to a device that is under a site with an inherited or configured AAA server. With AAA authentication, credential changes are not applied. Catalyst Center manages the devices using these credentials only if the same credentials exist on the AAA server.)

2. After successfully pushing the credential to the device, Catalyst Center confirms it can reach the device using the new credential.

**Note**

If this step fails, Inventory uses the old credentials to manage the device even though Catalyst Center pushed the new credentials to the device. In this case, the **Provision > Inventory** window might indicate that the device is Unmanaged if you updated an existing credential.

3. After successfully reaching the device using the new credential, the Catalyst Center Inventory starts managing the device using the new credential.
 - Sites can contain devices that use SNMPv2c and SNMPv3 credentials. When you edit, save, and apply global SNMPv2c or SNMPv3 credentials, Catalyst Center pushes those changes to devices and enables the credentials. For example, if you have a device that uses SNMPv2c, but you edit, save, and apply the SNMPv3 global credential, Catalyst Center pushes the new SNMPv3 credential to all devices in the associated site and enables it. This means that all devices will be managed using SNMPv3, even the devices that previously had SNMPv2c enabled.
 - To avoid any possible disruptions, modify the **User Name** when you edit CLI credentials. This creates a new CLI credential and leaves any existing CLI credentials unchanged.

Edit Global Device Credentials

You can edit and save global device credentials without Catalyst Center applying those credential changes until you're ready. (For more information about applying device credentials, see [Apply Device Credentials to a Site's Devices, on page 242](#).) If you edit a device credential that was previously applied to a site's devices, the device credential status displays **Not Synced** for all the sites that use this device credential. This status displays because the device credential assigned to the site no longer matches the device credential applied to that site's devices.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Device Credentials** tab.

Step 3 Click **Manage Credentials**.

Step 4 In the **Manage Credentials** slide-in pane, from the **Focus** drop-down list, choose **System**.

Step 5 In the **Manage Credentials** table, locate the credential that you want to edit.

Step 6 In the credential's corresponding **Actions** column, hover your cursor over ... and choose **Edit**.

Step 7 In the confirmation dialog box, click **OK** to proceed with editing this credential.

Note If this credential is assigned to other sites, any changes to this credential will impact those sites.

Step 8 In the slide-in pane, make the required changes and then click **Save**.

A success message displays in the bottom-right corner, indicating that the device credential was successfully updated.

Delete Device Credentials

- Note** The CLI password credentials support only *ASCII-printable characters* (character code 32-127; see https://en.wikipedia.org/wiki/ASCII#Printable_characters).

Delete Device Credentials

If you want to delete a device credential, consider first if the device credential is assigned to any sites. If it's not assigned to any sites, you can simply delete the device credential from the system's pool of global device credentials using the **System** focus. If it's assigned to any sites, you must first either unassign the device credential from all sites that use it or delete those sites. Then you can delete the device credential from the system's pool of global device credentials.



- Note** Deleting a device credential only removes it from the system's pool of global device credentials. Catalyst Center never removes any credentials from devices.

Before you begin

If the device credential that you want to delete is assigned to any sites, you must first either unassign the device credential from all the sites that use it or delete those sites. For more information, see [Create, Edit and Delete a Site, on page 167](#) or [Step 8, on page 241](#) in [Assign Device Credentials to Sites, on page 241](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**

Step 2 Click the **Device Credentials** tab.

Step 3 Click **Manage Credentials**.

Step 4 In the **Manage Credentials** slide-in pane, from the **Focus** drop-down list, choose **System**.

Step 5 In the **Manage Credentials** table, locate the credential that you want to delete.

Step 6 In the credential's corresponding **Actions** column, hover your cursor over ... and choose **Delete**.

Step 7 In the **Warning** dialog box, click **Yes**.

A success message is displayed in the bottom-right corner, indicating that the device credential was successfully deleted.

Update Device Credentials on Devices

When a device credential is unassigned from a site, the credential currently applied on that site's devices isn't automatically updated. The devices retain the existing credential until a new one is applied, so the device always has credentials configured. You can update the device credentials on all the devices in a site by following these high-level steps.

Step 1 Unassign the device credential from the required site. See [Step 8, on page 241](#) in [Assign Device Credentials to Sites, on page 241](#).

Step 2 Assign the new device credential to the same site. See [Assign Device Credentials to Sites, on page 241](#).

Alternatively, you can unassign and assign in one step by clicking **Save** on the **Device Credentials** window.

- Step 3** Apply the new device credential to that site's devices. See [Apply Device Credentials to a Site's Devices, on page 242](#).
- Step 4** Alternatively, you can log in to the device and manually update the device credential.

Configure IP Address Pools

Catalyst Center supports IPv4 and IPv6 dual-stack IP pools.

You can manually create IPv4 and IPv6 address pools.

You can also configure Catalyst Center to communicate with an external IP address manager. For more information, see the [Cisco Catalyst Center Administrator Guide](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
- Step 2** Click **Add IP Pool** and complete the required fields in the **Add IP Pool** slide-in pane.
- If you have configured Catalyst Center to communicate with an external IP address manager, you cannot create an IP pool that overlaps an existing IP address pool in the external IP address manager.
- Step 3** Click **Save**.
- The newly added pool is displayed in the **IP Address Pools** table. You can click the **IPv4** tab or **IPv6** tab in the **Subnet Type** area if you prefer to view only the IPv4 or IPv6 address pools.
- Note** When you edit an IP address pool and make DHCP changes, you do not need to reprovision devices using that IP address pool.

Import IP Address Pools from an IP Address Manager

You can import IP address pools from Bluecat or Infoblox.



-
- Note** The IP address pools cannot have subpools and cannot have any assigned IP addresses from the IP address pool.

You must configure Catalyst Center to communicate with an external IP Address Manager (IPAM). For more information, see the [Cisco Catalyst Center Administrator Guide](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
- Step 2** From the **Import** drop-down list, choose **Import from IPAM Server**.
- Step 3** In the slide-in pane, enter a CIDR and then click **Retrieve** to get the list of IP pools available to import.
- Step 4** Click **Select All** or choose the IP address pools to import.
- Step 5** Click **Import**.

Import IP Address Pools from a CSV File

You can import IP address pools from a CSV file.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
 - Step 2** From the **Import** drop-down list, choose **Import from CSV File**.
 - Step 3** Click **Download sample template** to download the latest sample file.
 - Step 4** Add the IP address pools to the file and save the file to your local machine.
 - Step 5** Upload the CSV file by doing one of the following actions:
 - a) Drag and drop the file into the drag and drop area.
 - b) Click **Choose a file** and then select the file from your local machine.
 - Step 6** Click **Import**.
-

Reserve an IP Address Pool

Before you begin

Ensure that one or more IP address pools have been created.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
 - Step 2** From the left hierarchy tree, choose the required site.
 - Step 3** Click **Reserve IP Pool**.
 - Step 4** In the slide-in pane, complete the following fields to reserve all or part of an available global IP address pool for the specific site:
 - **IP Address Pool Name:** Unique name for the reserved IP address pool.
 - **Type:** Type of IP address pool. For LAN automation, choose **LAN**. The following options are available:
 - **LAN:** Assigns IP addresses to LAN interfaces for applicable underlays.
 - **Management:** Assigns IP addresses to management interfaces.
 - **Service:** Assigns IP addresses to service interfaces.
 - **WAN:** Assigns IP addresses to WAN interfaces.
 - **Generic:** Used for all other network types.
 - **IP Address Space:** IPv4 and IPv6 address pool from which you want to reserve all or part of the IP addresses.
 - **Prefix length / Number of IP Addresses:** IP subnet and mask address used to reserve all or part of the global IP address pool or the number of IP addresses you want to reserve. If you choose $\backslash 64$ as the **Prefix length** for an IPv6 IP pool, the **SLAAC** option is checked. (When **SLAAC** is selected, the devices automatically acquire IP addresses without the need for DHCP servers.)
 - **Gateway:** Gateway IP address.

- **DHCP Server(s)**: DHCP server IP address(es).
- **DNS Server(s)**: DNS server address(es).

Step 5 Click Reserve.

If you reserve both IPv4 and IPv6 address pools, which means the fabric is provisioned with a dual-stack IP pool, you cannot switch back to a single-stack IP pool if the IPv6 pool is already attached to a VN.

However, if the IPv6 pool is not attached to a VN, you can downgrade it from a dual-stack IPv6 to a single-stack IPv4 pool. To downgrade to a single stack, do the following:

- In the **IP Address Pools** window, from the **Actions** column, hover your cursor over ellipsis icon () and click **Edit** for the dual-stack IP pool.
 - In the **Edit IP Pool** slide-in pane, uncheck the **IPv6** check box.
 - Click **Save**.
-

Edit IP Address Pools

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.

Step 2 From the left hierarchy tree, choose the required site.

Step 3 To edit all the IP address pools in bulk, do the following:

- From the **More Actions** drop-down list, choose **Edit all**.
- In the **Warning** dialog box, click **Yes**.
- In the **Edit IP Pools** slide-in pane, make the desired changes and click **Save**.

Step 4 To edit only specific IP address pools, do the following:

- Check the check box next to the desired IP address pools.
- From the **More Actions** drop-down list, choose **Edit**.

Alternatively, from the **Actions** column, hover your cursor over the ellipsis icon () and click **Edit** for one of the selected IP address pools.

- In the **Edit IP Pools** slide-in pane, make the desired changes and click **Save**.
-

What to do next

If the updated IP address pools are used in a fabric network, you must reconfigure the corresponding fabric on the **Provision > Fabric Sites** window. For more information, see [Reconfigure a Fabric, on page 588](#).

Delete IP Address Pools

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.

Step 2 From the left hierarchy tree, choose the required site.

Clone an IP Address Pool

- Step 3** To delete all the IP address pools in bulk, do the following:
- From the **More Actions** drop-down list, choose **Delete all**.
 - In the **Warning** dialog box, click **Yes**.
- Step 4** To delete only specific IP address pools, do the following:
- Check the check box next to the desired IP address pools.
 - From the **More Actions** drop-down list, choose **Delete**.

Alternatively, from the **Actions** column, hover your cursor over the ellipsis icon () and click **Delete** for one of the selected IP address pools.

- In the **Warning** dialog box, click **Yes**.
-

Clone an IP Address Pool

You can clone an existing IP address pool at the site level. When you clone an IP address pool, the DHCP server and DNS server IP addresses are automatically filled.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
- Step 2** From the left hierarchy tree, choose the required site.
- Step 3** Locate the desired IP address pool and, in the **Actions** area, click **Clone**.
- Step 4** In the **Clone IP Pool** window, do the following:
- Optionally, edit the pool name. (You cannot edit the Type, IP Address Space, or Global Pool values, which are inherited from the pool from which you are cloning.)
 - Edit the CIRD prefix values as necessary.
 - Click **Clone**.
-

Release IP Address Pools

You can release single-stack and dual-stack pools that are reserved at the site level.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
- Step 2** From the left hierarchy tree, choose the required site.
- Step 3** To release all the IP address pools in bulk, do the following:
- From the **Actions** drop-down list, choose **Release All**.
 - Click **Yes** in the **Warning** message.
 - At the prompt, click **Release**.
- Step 4** To release only the desired IP address pools, do the following:
- Choose the desired IP address pools and from the **Actions** drop-down list, click **Release Selected**.
 - At the prompt, click **Release**.
-

View IP Address Pools

This procedure shows how to view 10 or more IP address pools in table view and tree view.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.

Step 2 From the left hierarchy tree, choose the required site.

Step 3 Use the toggle button to switch between the table view and tree view.

- When the view contains 10 or more IP address pools, by default the GUI displays the pools in the table view.
- When the view contains fewer than 10 IP address pools, by default the GUI displays the pools in the tree view.

Note Toggling between the table and tree map view is based on the pool count not on the user selection on the UI.

Tree view applies to the Global pool and site pool.

Step 4 The **IP Address Pools** table view displays a list of IP address pools based on **Name**, **Type**, **IPv4 Subnet**, **IPv4 Used**, **IPv6 Subnet**, **IPv6 Used**, and **Actions**.

- Note**
- Hover your cursor over the **i** icon next to the **IPv4 Used** and **IPv6 Used**. A tooltip displays more information about **IPv4 Used**, **IPv6 Used**, **Free**, **Unassignable**, **Assigned**, and **Default Assigned** IP address pool.
 - In the **IPv4** and **IPv6** columns, hover your cursor over the **i** icon next to the corresponding used percentage of **IPv4** and **IPv6** for a given IP address pool. A tooltip displays the percentage of **Free**, **Unassignable**, **Assigned**, and **Default Assigned** IP addresses.

Step 5 In the table view, click the **IPv4 only** or **Dual-Stack** option in the **Subnet Type** area if you prefer to view only the **IPv4** or **Dual-Stack** address pools.

Step 6 In the tree view, hover your cursor over the IP address pool that you are interested in, and click to view the slide-in pane which contains the following information:

- Subnet type of an IP address pool.
- Percentage of available IP addresses along with **Pool CIDR**, **Gateway**, **DHCP Server(s)**, and **DNS Server(s)** under the respective pool.
- Percentage of used IP addresses under the respective pool.

Step 7 In the **Used** area, click **Assigned** to view the list of assigned IP addresses to a device filtered based on **Device Name**, **IP Address**, and **Site**.

Step 8 Click **Unassignable** to view the list of unassigned IP addresses which cannot be assigned to a device filtered based on **Device Name**, **IP Address**, and **Site**.

Step 9 Click **Edit** to edit an IP address pool.

Step 10 Click **Release** to release an IP address pool.

Configure Service Provider Profiles

- Note**
- In the side bar for a global pool, you can view the usage of a given pool across all the child pool.
 - Global and site IP address pool can have blocklisted IP addresses.
 - Subpools cannot have blocklisted IP addresses.
 - Catalyst Center rejects the IP address pool creation request of a CIDR address pool if it contains blocklisted IP addresses.
 - In the next free IP address pools request, Catalyst Center skips the blocklisted IP addresses to find the next IP address free pool.

Step 11 (Optional) In the side bar click **Export** to export the table data.

Configure Service Provider Profiles

You can create a service provider profile that defines the class of service for a particular WAN provider. You can define 4-class, 5-class, 6-class, and 8-class service models. After you create a service provider profile, you can assign it to an application policy and to the WAN interfaces in the application policy scope, including setting the subline rate on the interface, if needed.

Step 1 From the top-left corner, click the menu icon and choose **Design > Service Provider Profiles**.

Step 2 If there are no existing service provider profiles, click **Create**.

Step 3 Click the plus icon (⊕).

Step 4 In the **Profile Name** field, enter a name for the service provider profile.

Step 5 In the **WAN Provider** field, enter a name for the WAN provider.

Step 6 From the **Model** drop-down list, choose a class model: **4 class**, **5 class**, **6 class**, or **8 class**.

For a description of these classes, see [Service Provider Profiles, on page 723](#).

Step 7 Click **Save**.

Note You cannot create duplicate service provider profiles.

Configure Global Wireless Settings

Global wireless network settings include settings for the following:

- Service Set Identifiers (SSIDs)
- RF profiles
- Wireless interfaces and VLAN groups
- AP profiles

- FlexConnect
- Anchor groups
- Security
- Power profiles
- Antenna radio profiles
- Cisco Spaces and Cisco Connected Mobile Experiences (CMX) servers
- Remote teleworker



Note You can create a wireless sensor device profile for only Cisco Aironet 1800s Active Sensor devices.

You can use the **Search All Settings** field in the wireless network settings dashboard to find specific wireless network settings. You can customize the wireless network settings dashboard using **Edit Dashboard**. For more information about customizing the wireless network settings dashboard, see [Customize the Wireless Network Settings Dashboard, on page 253](#).

Customize the Wireless Network Settings Dashboard

You can customize the wireless network settings dashboard to update the priorities of the network settings displayed in the dashboard using the **Edit Dashboard** option. Catalyst Center applies the dashboard customizations to all the sites in the wireless network settings dashboard.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Edit Dashboard**.

Step 5 In the **Customize Wireless Settings Dashboard** slide-in pane, drag and drop the required network settings to the new positions to change their priority in the dashboard.

Step 6 Click **Save**.

Create SSIDs for an Enterprise Wireless Network

The following procedure describes how to configure SSIDs for an enterprise wireless network.



Note The SSIDs are created at the global level. Sites, buildings, and floors inherit settings from the global level.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Create SSIDs for an Enterprise Wireless Network

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **SSIDs**.

Step 5 In the **SSID** table, hover your cursor over **Add**, and choose **Enterprise**.

Step 6 In the **Wireless SSID** workflow, complete the **Basic Settings** setup:

- If the **Sensor** toggle button is available, ensure that it's disabled.
- In the **Wireless Network Name (SSID)** field, enter a unique name for the wireless network.
- In the **WLAN Profile Name** field, enter a name for the WLAN profile.

Based on the WLAN profile name, Catalyst Center autopopulates the policy profile name for Cisco Catalyst 9800 Series Wireless Controller.

- In the **Radio Policy** area, do the following:

- Check the **2.4GHz** check box to create the WLAN for 2.4-GHz.
- Check the **5GHz** check box to create the WLAN for 5-GHz.
- Check the **6GHz** check box to create the WLAN for 6-GHz. This band is supported for devices running Cisco IOS XE Release 17.7 or later.
- From the **802.11b/g Policy** drop-down list, choose a policy.

Note This drop-down list is available only when you check the **2.4GHz** check box.

- Check the **Band Select** check box to choose the required band.

Note This check box is available only when you check both the **2.4GHz** and **5GHz** check boxes.

- Check the **6 GHz Client Steering** check box to enable client steering.

Note This check box is available only when you check the **6GHz** check box.

- In the **Quality of Service(QoS)** area, do the following:

- From the **Egress** drop-down list, choose an egress QoS.
- From the **Ingress** drop-down list, choose an ingress QoS.

Note Ingress QoS is applicable only for Cisco IOS XE wireless controllers.

The QoS selection isn't applicable when **Fast Lane** is enabled. For Cisco IOS XE wireless controllers, QoS (both egress and ingress) is set to empty. For Cisco AireOS Wireless Controllers, the egress QoS is set to **VoIP (Platinum)**.

- In the **SSID STATE** area, click the toggle buttons to enable or disable the following settings:

- **Admin Status:** Use this toggle button to turn on or turn off the radios on the APs. When the **Admin Status** is disabled, the APs remain associated with the wireless controller and are accessible, and the APs still require licenses.
- **Broadcast SSID:** Use this toggle button to enable or disable the visibility of the SSID to all the wireless clients within range.

Step 7 Complete the **Security Settings** setup:

- a) For **Level of Security**, choose the encryption and authentication type for the network. The sites, buildings, and floors inherit settings from the Global hierarchy. You can override the level of security at the site, building, or floor level.

- **Enterprise:** You can configure both **WPA2** and **WPA3** security authentication by checking the respective check boxes.

Note Wi-Fi Protected Access (WPA2) uses the stronger Advanced Encryption Standard encryption algorithm using Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (AES-CCMP).

WPA3 is the latest version of WPA, which is a suite of protocols and technologies that provide authentication and encryption for Wi-Fi networks. WPA3-Enterprise provides higher-grade security protocols for sensitive data networks. WPA3 is supported on Cisco AireOS Wireless Controllers running Release 8.10 and later, and Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 16.12 and later.

For multiband operation using only 2.4-GHz and 5-GHz bands, you must enable WPA2 (WPA3 is optional). For multiband operation using 2.4-GHz, 5-GHz, and 6-GHz bands, you must enable WPA3 and disable WPA2 for the 6-GHz band to be operational on the devices running Cisco IOS XE Release 17.7 and later. WPA2 isn't supported for the 6-GHz band.

- **Personal:** You can configure both **WPA2** and **WPA3** security authentication by checking the respective check boxes. By default, the **WPA3** check box is enabled. If you choose **Personal**, in the **Pass Phrase** field, enter the passphrase key. This key is used as the pairwise master key (PMK) between the clients and authentication server.

Note WPA3-Personal brings better protection to individual users by providing a more robust password-based authentication. This authentication makes the brute-force dictionary attack more difficult and time-consuming.

For WPA2-Personal, you can override a preshared key (PSK) at the site, building, or floor level. If you override a PSK at the building level, the subsequent floors inherit the new settings. For more information, see [Configure Site-Level Overrides for an SSID for Enterprise Networks, on page 260](#).

For multiband operation using only 2.4-GHz and 5-GHz bands, you must enable WPA2 (WPA3 is optional). For multiband operation using 2.4-GHz, 5-GHz, and 6-GHz bands, you must enable WPA3 and disable WPA2 for the 6-GHz band to be operational on the devices running Cisco IOS XE Release 17.7 and later. WPA2 isn't supported for the 6-GHz band.

(Optional) For WPA2-Personal, do the following to configure multi-preshared key (MPSK) support:

1. Click **Configure MPSK**.
2. In the **Configure MPSK** dialog box, click **Add** to add an MPSK.
You can add up to five MPSKs.
3. From the **Priority** drop-down list, choose a priority.

Note If the priority 0 key isn't configured in the central web authentication (CWA) Flex mode, client connection to the WLAN may fail.

4. From the **Passphrase Type** drop-down list, choose a passphrase type.
5. In the **Passphrase** field, enter a passphrase.

6. Click Save.

MPSK isn't supported on Cisco AireOS Wireless Controllers. MPSK applies to Layer 2 security configuration for WPA2-Personal.

- **Open Secured:** From the **Select existing Open SSID** drop-down list, choose an open SSID to redirect the clients to an open-secured SSID. The open-secured policy provides the least security.

Note Fast Transition isn't applicable for open-secured SSID.

Because an open-secured SSID depends on an open SSID, you must have enabled anchor on an open SSID before enabling it on an open-secured SSID.

- **Open:** The open policy provides no security. It allows any device to connect to the wireless network without authentication.

Note If you chose only the **6GHz** radio policy in the **Basic Settings** window, the **Open** option is dimmed.

- b) For **Authentication, Authorization, and Accounting Configuration**, click **Configure AAA** to add and configure the AAA servers for the enterprise wireless network SSID.

For more information, see [Configure AAA Server for an Enterprise Wireless Network, on page 263](#).

- c) Check the **AAA Override** check box to enable the AAA override functionality.

By default, this check box is dimmed. You must configure an AAA server using the **Configure AAA** option to use this check box.

- d) Check one or more of the following check boxes:

- **Fast Lane:** Check this check box to enable fastlane capabilities on the network. When fastlane capabilities are enabled, QoS selection isn't applicable. For Cisco IOS XE wireless controllers, QoS (both egress and ingress) is set to empty. For Cisco AireOS Wireless Controllers, the egress QoS is set to **VoIP (Platinum)**.

Note By enabling fastlane, you can set the iOS devices to receive an optimized level of wireless connectivity and enhanced QoS.

- **Identity PSK** (for Personal Layer 2 Security): Check this check box to enable the creation of unique preshared keys for individuals or groups of users in the SSID. If you check this check box, the **Enable Posture** check box is displayed.

- **MAC Filtering:** Check this check box to enable MAC-based access control or security on the wireless network.

Note When MAC filtering is enabled, only the MAC addresses that you add to the wireless LAN are allowed to join the network.

- **Deny RCM Clients:** Check this check box to deny clients with randomized MAC addresses. This option is supported for Cisco AireOS Wireless Controllers running Release 8.10 MR5 and later, and Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.5 and later.

- **Enable Posture:** Check this check box to enable posture assessment. The **Pre-Auth ACL List Name** drop-down list is displayed when you enable posture. Posture is a service in Cisco Identity Services Engine (Cisco ISE) that allows you to check the state, also known as posture, of all the endpoints that are connecting to a network for compliance with corporate security policies. This allows you to control clients' access to protected areas of a network.

Pre-Auth ACL List Name: From the drop-down list, choose the ACL list name that you already created to map with the SSID.

Note AAA configuration is mandatory for posturing. Click **Configure AAA** to add AAA servers for the enterprise wireless network SSID.

- e) Click **Next**.

Step 8 Complete the **Advance Settings** setup:

- a) For **Fast Transition (802.11r)**:

- Choose a mode: **Adaptive**, **Enable**, or **Disable**.

Note 802.11r allows wireless clients to quickly roam from one AP to another AP. Fast transition ensures less disrupted connectivity when a wireless client roams from one AP to another AP. We recommend that you disable fast transition for WLANs using open authentication. Cisco AireOS Wireless Controllers don't support the **Adaptive** fast transition mode.

- Check the **Over the DS** check box to enable fast transitions over a distributed system. By default, fast transition over a distributed system is disabled.

- b) For **MFP Client Protection**, choose **Optional**, **Required**, or **Disabled**.

Note Management Frame Protection (MFP) increases the security of management frames. It provides security for the otherwise unprotected and unencrypted 802.11 management messages that are passed between APs and clients. MFP provides both infrastructure and client support.

By default, **Optional** is selected. If you choose **Required**, the clients are allowed to associate only if the MFP is negotiated (that is, if WPA2 is configured on the wireless controller, and the client is also configured for WPA2 and supports CCXv5 MFP).

MFP client protection is supported only on Cisco AireOS Wireless Controllers. MFP client protection isn't supported for the 6-GHz band.

- c) For **Protected Management Frame (802.11w)**, choose the required option.

Note The options available under **Protected Management Frame (802.11w)** vary based on the settings that you chose under **Level of Security**. The following options may be available:

- Optional**
- Required**
- Disabled**

- d) Under **WPA2 Encryption** or **WPA3 Encryption** or **WPA2/WPA3 Encryption**, choose an available option.

The options available under this section vary based on the settings that you chose under **Level of Security**. The following options may be available: **AES(CCMP128)**, **GCMP128**, **CCMP256**, and **GCMP256**

Note This section is not available for the **Open** security under **Level of Security**.

- e) Under **Auth Key Management**, check the check box next to the required options.

Note This section is not available for the **Open** security under **Level of Security**.

The options available under this section vary based on the fast transition settings. The following options may be available:

- For **AES(CCMP128)**: OWE, 802.1x (802.1X-SHA1), FT + 802.1x, CCKM, 802.1x-SHA256 (802.1X-SHA2), PSK, FT + PSK, Easy-PSK, PSK-SHA256 (PSK-SHA2), SAE, and FT + SAE
- For **GCMP128**: SUITEB-1X
- For **CCMP256**: SUITEB192-1X
- For **GCMP256**: SUITEB192-1X
- **Timestamp Tolerance (in milliseconds)** (for CCKM): Enter the CCKM tolerance level in milliseconds. The valid range is from 1000 through 5000. The default value is 1000. Authenticated client devices can roam from one AP to another AP without any perceptible delay during reassociation. CCKM tolerance level isn't applicable for Cisco AireOS Wireless Controllers.

f) For 11K:

- **Neighbor List**: Check this check box to configure all the 11k-capable clients to request a neighbor report about the known neighboring APs that are candidates for roaming.
- Note** To facilitate roaming, a 11k-capable client that is associated with an AP sends a request to a list of neighboring APs. The request is sent in the form of an 802.11 management frame, which is known as an action frame. The AP responds with a list of neighbor APs on the same WLAN with the Wi-Fi channel numbers. The response is also an action frame. The client identifies the AP candidates for the next roam from the response frame.
- **Session Timeout**: Check this check box to set the maximum time for a client session to remain active before reauthorization.
- Note** By default, **Session Timeout** is enabled with a timeout of 1800 seconds.
- **Client Exclusion**: Check this check box to set the client exclusion timer.
- Note** When a user fails to authenticate, the wireless controller denies the client connection. The client isn't allowed to connect to the network until the exclusion timer expires. By default, **Client Exclusion** is enabled with a timeout of 180 seconds.

g) For 11v BSS Transition Support:

- **BSS Max Idle Service**: Check this check box to set the idle period timer value. The idle period timer value is transmitted using the association and reassociation response frame from APs to the client.
- Note** The BSS Max idle period is the timeframe during which an AP doesn't disassociate a client because of nonreceipt of frames from the connected client.
- **Client User Idle Timeout**: Check this check box to set the user idle timeout for a WLAN.
- Note** If the data sent by the client is more than the threshold quota specified by the user idle timeout, the client is considered to be active, and the wireless controller begins another timeout period.
- By default, **Client User Idle Timeout** is enabled with a user idle timeout of 300 seconds.
- **Directed Multicast Service**: Check this check box to enable directed multicast service.

- Note** By default, **Directed Multicast Service** is enabled. Using the Directed Multicast Service (DMS), the client requests APs to transmit the required multicast packets as unicast frames. This allows clients to sleep for a longer period and saves the battery power.
- h) For **Radius Client Profiling**, use this toggle button to enable or disable RADIUS profiling on a WLAN.
- Note** At least one AAA or PSN server is required to enable this feature.
- i) (Optional) For **NAS-ID**:
1. From the **NAS-ID Opt** drop-down list, choose the required type of network access server identifier (NAS ID). To specify a custom script for the NAS ID, from the **NAS-ID Opt** drop-down list, choose **Custom Option** and enter the custom script in the corresponding **Custom Script for Opt** field. You can enter up to 31 alphanumeric characters, special characters, and spaces for the custom script. Catalyst Center doesn't support the special characters ? < and trailing spaces for the custom script.
- Note** Catalyst Center supports NAS ID with custom script only for Cisco Catalyst 9800 Series Wireless Controllers that run Cisco IOS XE Release 17.7 or later.
2. (Optional) Click + to add another NAS ID. You can add up to three NAS IDs.
- Note** Catalyst Center applies only one NAS ID for Cisco AireOS Wireless Controllers. You can overwrite the NAS ID at the site-level from the **Design > Network Settings > Wireless** window.
- j) (Optional) Under **Configure Client Rate Limit**, enter a value for the client rate limit in bits per second. The valid range is from 8000 through 100000000000. The value must be a multiple of 500.
- Note** This configuration is applicable for Cisco AireOS Wireless Controllers. To configure client rate limit for Cisco AireOS Wireless Controllers, click the menu icon and choose **Design > Feature Templates > Wireless > Advanced SSID Configuration**. For more information, see [Create a Model Config Design for Advanced SSID](#), on page 385.
- The following lists the valid ranges for client rate limit on Cisco IOS XE devices:
- The valid range for Cisco Catalyst 9800-L Wireless Controller, Cisco Catalyst 9800-40 Wireless Controller, and Cisco Catalyst 9800-80 Wireless Controller is from 8000 through 67000000000 bits per second.
 - The valid range for Cisco Catalyst 9800-CL Wireless Controllers is from 8000 through 10000000000 bits per second.
 - The valid range for Cisco Embedded Wireless Controller on Catalyst Access Points is from 8000 through 2000000000 bits per second.
 - The valid range for Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches is from 8000 through 100000000000 bits per second.
- k) (Optional) Use the **Coverage Hole Detection** toggle button to enable or disable the coverage hole detection functionality.
- l) Click **Next**.
- Step 9** (Optional) Complete the **Associate Model Config to SSID** setup:
- a) Check the check box next to the required model configuration design.

Configure Site-Level Overrides for an SSID for Enterprise Networks

If you want to create a model configuration design, click **Add** and configure the required settings. For more information, see [Create a Model Config Design for Advanced SSID](#), on page 385.

- b) Click **Next**.

Step 10 Complete the **Associate SSID to Profile** setup:

- a) From the left pane, choose a profile and click **Associate Profile**.

If you don't have a profile, click **Add Profile** and configure the profile settings. For more information, see [Create Network Profiles for Wireless](#), on page 339.

- b) Click **Next**.

Step 11 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 12 Click **Save**.

The SSID is created.

Configure Site-Level Overrides for an SSID for Enterprise Networks

You can create SSIDs at the Global hierarchy. The areas, buildings, and floors inherit settings from the Global hierarchy. You can override the following settings at the area, building, or floor level:

- **WLAN Profile Name**
- **Level of Security**
- **Configure AAA**
- **Mac Filtering**
- **Fast Transition (802.11r)**
- **Protected Management Frame (802.11w)**
- **WPA2 Encryption, WPA3 Encryption, or WPA2/WPA3 Encryption**
- **Auth Key Management**
- **NAS-ID**
- **Configure Client Rate Limit**

For more information about configuring these settings, see [Create SSIDs for an Enterprise Wireless Network](#), on page 253.

If you override a setting at the building level, the subsequent floor inherits the new setting. The following procedure describes how to configure site-level overrides for an SSID for enterprise networks.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Wireless**.

Step 2 From the left hierarchy tree, choose the site, building, or floor for which you want to configure the overrides.

Hover your cursor over the inherit icon  next to the SSID to view the origin of this setting.

Step 3 Check the check box next to the SSID, and click **Edit**.

Step 4 In the **Basic Settings** window, update the name for the WLAN profile in the **WLAN Profile Name** field.

Note While configuring site-level overrides for the SSID, we recommend that you enter a unique name for the WLAN profile. If the same WLAN profile name is already configured in the wireless controller that manages the selected sites, provisioning fails.

Step 5 (Optional) In the **Security Settings** window, do the following:

- a) To update the encryption and authentication type for the network, under **Level of Security**, choose the required settings.
- b) To update the AAA server configuration, under **Authentication, Authorization, and Accounting Configuration**, click **Configure AAA**.
- c) To enable the AAA override functionality, check the **AAA Override** check box.

By default, this check box is dimmed. You must configure an AAA server using the **Configure AAA** option to use this check box.

- d) To enable MAC-based access control or security on the wireless network, check the **MAC Filtering** check box.

Note When you enable MAC filtering, only the MAC addresses that you add to the wireless LAN are allowed to join the network.

Step 6 (Optional) In the **Advanced Settings** window, do the following:

- a) For **Fast Transition (802.11r)**, do the following:

- Choose a mode.
- To enable fast transitions over a distributed system, check the **Over the DS** check box.

- b) For **Protected Management Frame (802.11w)**, choose the required option.

- c) Under **WPA2 Encryption** or **WPA3 Encryption** or **WPA2/WPA3 Encryption**, choose an available option.

The options available under this section vary based on the settings that you chose under **Level of Security**.

Note This section is not available for the **Open** security under **Level of Security**.

- d) Under **Auth Key Management**, check the check box next to the required options.

Note This section is not available for the **Open** security under **Level of Security**.

The options available under this section vary based on the fast transition settings.

• **Timestamp Tolerance (in milliseconds)** (for CCKM): Enter the CCKM tolerance level in milliseconds. The valid range is from 1000 through 5000. The default value is 1000. CCKM tolerance level isn't applicable for Cisco AireOS Wireless Controllers.

- e) For **NAS-ID**, choose the required NAS ID.

- f) Under **Configure Client Rate Limit**, enter a value for the client rate limit in bits per second.

Step 7 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 8 Click **Save**.

Site-level overrides are configured for the SSID.

Create Preauthentication Access Control Lists

Using the Preauthentication ACL feature, you can create a preauthentication ACL for web authentication to allow certain types of traffic before authentication is complete. This ACL is referenced in the access-accept of Cisco Identity Services Engine (ISE) and defines the traffic that is permitted and the traffic that is denied by the ACL. After the ACLs are configured on the Cisco Wireless Controller, they can be applied to the management interface, the AP-manager interface, any of the dynamic interfaces, or a WLAN to control data traffic to and from wireless clients or to the controller central processing unit (CPU) to control all traffic destined for the CPU. You can configure both IPv4 and IPv6 ACLs.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Security Settings**.

Step 5 Click the **Pre-Auth ACLs** tab.

Step 6 Under the **Pre-Auth Access Control Lists** area, click **Add** to create a preauthentication ACL.

Step 7 In the **New Pre-Auth ACL** slide-in pane, do the following:

- In the **Pre-Auth ACL List Name** field, enter a name for the ACL list to be used on Catalyst Center.
- In the **Pre-Auth ACL Name** field, enter a name for the ACL to be configured on wireless controller.

Step 8 Click the **IP Addresses** tab and do the following:

- Choose the ACL type that you're creating: **IPv4** or **IPv6**.

Note IPv6 isn't supported for the custom preauthentication ACLs.

- Use the **Include auto rules generated by Catalyst Center** toggle button to enable or disable pushing the Catalyst Center-generated rules to the applicable SSIDs.

By default, this toggle button is enabled. When this toggle button is enabled, Catalyst Center pushes the autogenerated rules to the applicable SSIDs. Autogenerated rules include allowing DHCP, DNS, AAA, and other applicable ports and IPs that are created as part of the default preauthentication rule.

Note If you disable this toggle button, you must ensure that the custom preauthentication ACL rule includes all the DHCP, DNS, and AAA servers that are mapped to WLANs.

- From the **Protocol** drop-down list, choose the protocol ID of the IP packets to be used for this ACL.
- In the **Source Port** field, enter the source port number. The valid range is from 0 through 65535.

The port options are used by applications that send and receive data to and from the networking stack. Some ports are designated for certain applications such as Telnet, SSH, HTTP, and so on.

- In the **Source IP Address** field, enter the IP address and netmask of the source. If you're configuring an IPv6 ACL, enter the IPv6 address and prefix length of the source in the **Source IP Address** field.
- From the **Source Subnet** drop-down list, choose a value for the source subnet.
- In the **Destination Port** field, enter the destination port number.
- In the **Destination IP Address** field, enter the IP address and netmask of the destination. If you're configuring an IPv6 ACL, enter the IPv6 address and prefix length of the destination.

- i. From the **Destination Subnet** drop-down list, choose a value for the destination subnet.

- j. To add multiple rules, click the plus icon (+). You can add up to 256 rules.

Note For Cisco AireOS Wireless Controller, you can configure up to 64 rules.

Step 9

Click the **Walled Garden URLs** tab to add specific URLs to the allowed list for the web authentication of captive portal and walled garden.

Authentication isn't required to access the allowed list of URLs. When you try to access sites that aren't in the allowed list, you're redirected to the login window.

- a. In the **URL** field, enter the URL and click the plus icon (+) to add the URL to the allowed list for web authentication. You can add up to 32 URL entries.
 - For Cisco AireOS Wireless Controller: A valid URL must have at least one period (.). Other special characters aren't supported. For example, cisco.com and www.cisco.com.
 - For Cisco Catalyst 9800 Series Wireless Controller: A valid URL must have at least one period (.). The special characters . * - _ are supported. For example, www.cisco.com, *.cisco.com, and www.cisco-.com.

Step 10

Click **Save**.

What to do next

Map the ACL with the SSID while creating SSIDs. For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) and [Create SSIDs for a Guest Wireless Network, on page 264](#).

Configure AAA Server for an Enterprise Wireless Network

Before you begin

- Make sure you have defined the AAA server under **System Settings > External Services > Authentication and Policy Servers**.
 - You must have either administrator (ROLE_ADMIN) or policy administrator (ROLE_POLICY_ADMIN) permissions, and the appropriate RBAC scope to perform this procedure.
-

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

Step 3

From the left hierarchy tree, choose **Global**.

Step 4

Click **SSIDs**.

Step 5

From the **SSID** table, in the **AAA Servers** column, click **Configure AAA** for the SSID for which you want to configure the AAA server.

Step 6

From the **Configure Authentication and Authorization Server** drop-down list of the **Configure AAA Server** slide-in pane, you can either search for a server IP address by entering its name in the **Search** field or choose the AAA IP address.

Create SSIDs for a Guest Wireless Network

- Note**
- The **Configure AAA** option is not supported for the Mobility Express (ME) devices.
 - You must configure an AAA server for an SSID to push the authentication configuration for the SSID. If an AAA server is not configured for the SSID, Catalyst Center pushes the **aaa authentication dot1x default local** command to the wireless controller and the default method list that points to local authentication is mapped to the SSID.

Step 7 Click + to add an **Additional Server**.

Note You can configure a maximum of six AAA servers for an SSID of enterprise wireless network.

Step 8 From the **Additional Server** drop-down list, choose the server IP address.

Step 9 To use the AAA server for accounting, check the **Copy Same Servers for Accounting** check box.

Note You must configure an accounting server for an SSID to push the accounting configuration for the SSID.

Step 10 To configure a different accounting server for an SSID, do the following:

- From the **Configure Accounting Server** drop-down list, you can either search for a server IP address by entering its name in the **Search** field or choose the accounting server IP address.
- Click + to add an **Additional Server**.

Note You can configure a maximum of six accounting servers for an SSID of enterprise wireless network.

- From the **Additional Server** drop-down list, choose the server IP address.

Step 11 Click **Configure**.

Note Catalyst Center allows you to override the set of AAA server configurations for the SSID at the site level. For each set of overridden AAA settings per SSID, Catalyst Center creates a new WLAN profile with the corresponding AAA servers mapped to it. If an SSID is overridden for different floors, and you make changes in the AAA servers, Catalyst Center creates the new WLAN profiles equal to the number of floors.

You must reprovision the device to override the AAA servers at the site level. See [Wireless Device Provisioning Overview](#), on page 469.

Create SSIDs for a Guest Wireless Network

This procedure explains how to create SSIDs for a guest wireless network.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **SSIDs**.

Step 5 In the **SSID** table, hover your cursor over **Add**, and choose **Guest**.

Step 6 In the **Wireless SSID** workflow, complete the **Basic Settings** setup:

- In the **Wireless Network Name (SSID)** field, enter a unique name for the wireless network.
- In the **WLAN Profile Name** field, enter a name for the WLAN profile.

Based on the WLAN profile name, Catalyst Center autopopulates the policy profile name for Cisco Catalyst 9800 Series Wireless Controller.

c) In the **Radio Policy** area, do the following:

- Check the **2.4GHz** check box to create the WLAN for 2.4-GHz.
- Check the **5GHz** check box to create the WLAN for 5-GHz.
- Check the **6GHz** check box to create the WLAN for 6-GHz. This band is supported for devices running Cisco IOS XE Release 17.7 or later.
- From the **802.11b/g Policy** drop-down list, choose a policy.

Note This drop-down list is available only when you check the **2.4GHz** check box.

- Check the **Band Select** check box to choose the required band.

Note This check box is available only when you check both the **2.4GHz** and **5GHz** check boxes.

- Check the **6 GHz Client Steering** check box to enable client steering.

Note This check box is available only when you check the **6GHz** check box.

d) In the **Quality of Service(QoS)** area, do the following:

- From the **Egress** drop-down list, choose an egress QoS.
- From the **Ingress** drop-down list, choose an ingress QoS.

Note Ingress QoS is applicable only for Cisco IOS XE wireless controllers.

The QoS selection isn't applicable when **Fast Lane** is enabled. For Cisco IOS XE wireless controllers, QoS (both egress and ingress) is set to empty. For Cisco AireOS Wireless Controllers, the egress QoS is set to **VoIP (Platinum)**.

e) In the **SSID STATE** area, toggle the toggle buttons to enable or disable the following settings:

- **Admin Status:** Use this toggle button to turn on or turn off the radios on the APs. When the **Admin Status** is disabled, the APs remain associated with the wireless controller and are accessible, and the APs still require licenses.
- **Broadcast SSID:** Use this toggle button to enable or disable the visibility of the SSID to all the wireless clients within range.

Step 7 Complete the **Security Settings** setup:

a) For the **L2 SECURITY** area, choose the L2 encryption and authentication type:

- **Enterprise:** You can configure either the **WPA2** or the **WPA3** security authentication type by checking the respective check boxes. By default, the **WPA2** check box is enabled.

Note Wi-Fi Protected Access (WPA2) uses the stronger Advanced Encryption Standard encryption algorithm using Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (AES-CCMP). Fast transition is applicable for enterprise WPA2 SSID.

WPA3 security authentication is the latest version of WPA, which is a suite of protocols and technologies that provide authentication and encryption for Wi-Fi networks. WPA3-Enterprise provides higher grade security protocols for sensitive data networks.

For multiband operation using only 2.4-GHz and 5-GHz bands, you must enable WPA2 (WPA3 is optional). For multiband operation using 2.4-GHz, 5-GHz, and 6-GHz bands, you must enable WPA3 and disable WPA2 for the 6-GHz band to be operational on the devices running Cisco IOS XE Release 17.7 and later. WPA2 isn't supported for the 6-GHz band.

- **Personal:** You can configure both **WPA2** and **WPA3** or configure **WPA2** and **WPA3** individually by checking the respective check boxes.

Note WPA3-Personal security authentication brings better protection to individual users by providing more robust password-based authentication. This makes the brute-force dictionary attack more difficult and time-consuming.

Enter the passphrase key in the **Pass Phrase** field. This key is used as the pairwise master key (PMK) between the clients and the authentication server.

For multiband operation using only 2.4-GHz and 5-GHz bands, you must enable WPA2 (WPA3 is optional). For multiband operation using 2.4-GHz, 5-GHz, and 6-GHz bands, you must enable WPA3 and disable WPA2 for the 6-GHz band to be operational on the devices running Cisco IOS XE Release 17.7 and later. WPA2 isn't supported for the 6-GHz band.

(Optional) For WPA2-Personal, do the following to configure multi-preshared key (MPSK) support:

1. Click **Configure MPSK**.
2. In the **Configure MPSK** dialog box, click **Add** to add an MPSK.
You can add up to five MPSKs.
3. From the **Priority** drop-down list, choose a priority.

Note If the priority 0 key is not configured in central web authentication (CWA) Flex mode, client connection to the WLAN may fail.

4. From the **Passphrase Type** drop-down list, choose a passphrase type.
5. In the **Passphrase** field, enter a passphrase.
6. Click **Save**.

MPSK is not supported on Cisco AireOS Wireless Controllers. MPSK applies to Layer 2 security configuration for WPA2- Personal.

- **Open Secured:** From the **Select existing Open SSID** drop-down list, choose an open SSID to associate with the open SSID. Associating secures the open SSID. You must have an open SSID created before associating it with the open secured SSID.

Note Fast Transition is not applicable for open-secured SSID.

Because open-secured SSID depends on open SSID, you must have enabled anchor on open SSID before enabling it on open-secured SSID.

- **Open:** The open policy provides no security. It allows any device to connect to the wireless network without authentication.

Note If you chose only the **6GHz** radio policy in the **Basic Settings** window, the **Open** option is dimmed.

- b) For the **L3 Security** setting, choose the L3 encryption and authentication type:

- **Web Policy:** Provides a higher level of L3 security.

For **Authentication Server**, configure these authentication server settings:

Authentication Server Type	Description
Central Web Authentication	<p>Use AAA server for central web authentication (CWA).</p> <p>(Optional) If you choose Cisco ISE for CWA, from the What kind of portal are you creating today? drop-down list, choose the type of portal you want to create:</p> <ul style="list-style-type: none"> • Self Registered: The guests are redirected to the self-registered guest portal to register by providing information to automatically create an account. • HotSpot: The guests can access the network without providing any credentials. <p>(Optional) If you choose Cisco ISE for CWA, from the Where will your guests redirect after successful authentication? drop-down list, choose where you want to redirect the guests after successful authentication:</p> <ul style="list-style-type: none"> • Success Page: The guests are redirected to the Authentication Success window. • Original URL: The guests are redirected to the URL that they had originally requested. • Custom URL: The guests are redirected to the custom URL that is specified here. Enter a redirect URL in the Redirect URL field.
<ul style="list-style-type: none"> • Web Authentication Internal • Web Authentication External 	<p>Web authentication or Web Auth is a Layer 3 security method that allows a client to pass Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) traffic only until they have passed some form of authentication.</p> <p>For web authentication internal, the client is redirected to a window that is constructed by the Cisco Wireless Controller.</p> <p>For web authentication external, the client is redirected to the specified URL. Enter a redirect URL in the Web Auth Url field.</p>

Authentication Server Type	Description
<ul style="list-style-type: none"> • Web Passthrough Internal • Web Passthrough External 	Web passthrough is used for guest access and doesn't require authentication credentials. In web passthrough authentication, wireless users are redirected to the Usage Policy window when they use the internet for the first time. After accepting the policy, users are allowed to use the internet.

- **Open:** There is no security at the Layer 3 level and any device can connect to the SSID.
- c) If you choose **Web Authentication Internal**, **Web Authentication External**, **Web Passthrough Internal**, or **Web Passthrough External**, In the **Timeout Settings for sleeping clients** area, choose an authentication setting for sleeping clients:
- **Always authenticate:** Enables authentication for sleeping clients.
 - **Authenticate after:** Enter how many minutes you want sleeping clients to be remembered for before reauthentication becomes necessary. The valid range is from 10 minutes through 43200 minutes, and the default duration is 720 minutes.

Note Clients with guest access and web authentication are allowed to sleep and wake up without having to reauthenticate through the login window. You can configure how long a client is remembered on a WLAN and a user group policy that is mapped to the WLAN. The sleeping timer becomes effective after the idle timeout. If the client timeout is less than the time configured on the sleeping timer of the WLAN, the lifetime of the client is used as the sleeping time.

- d) For **Authentication, Authorization, and Accounting Configuration**, click **Configure AAA** to add and configure the AAA servers for the guest wireless network SSID.

For more information, see [Configure AAA Server for a Guest Wireless Network, on page 273](#).

- e) Check the **AAA Override** check box to enable the AAA override functionality.

By default, this check box is dimmed. You must configure an AAA server using the **Configure AAA** option to use this check box.

- f) Check one or more of the following check boxes:

- **Fast Lane:** Check this check box to enable fastlane capabilities on the network. When fastlane capabilities are enabled, QoS selection isn't applicable. For Cisco IOS XE wireless controllers, QoS (both egress and ingress) is set to empty. For Cisco AireOS Wireless Controllers, the egress QoS is set to **VoIP (Platinum)**.

Note By enabling fastlane, you can configure the iOS devices to receive an optimized level of wireless connectivity and enhanced QoS.

- **Identity PSK** (for Personal L2 Security): Check this check box to enable the creation of unique preshared keys for individuals or groups of users in the SSID.

- **MAC Filtering:** Check this check box to enable MAC-based access control or security in the wireless network.

Note When MAC filtering is enabled, only the MAC addresses that you add to the wireless LAN are allowed to join the network.

- **Deny RCM Clients:** Check this check box to deny clients with randomized MAC addresses. This option is supported for Cisco AireOS Wireless Controllers running Release 8.10 MR5 and later, and Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.5 and later.
- **Pre-Auth ACL List Name:** From the drop-down list, choose the ACL list name that you already created to map with the SSID.

g) Click **Next**.

Step 8 Complete the **Advance Settings** setup:

a) For **Fast Transition (802.11r):**

- Choose a mode: **Adaptive, Enable, or Disable.**

Note 802.11r allows wireless clients to quickly roam from one AP to another AP. Fast transition ensures less disrupted connectivity when a wireless client roams from one AP to another AP. We recommend that you disable fast transition for WLANs using open authentication. Cisco AireOS Wireless Controllers don't support the **Adaptive** fast transition mode.

- Check the **Over the DS** check box to enable fast transitions over a distributed system. By default, fast transition over a distributed system is disabled.

b) For **MFP Client Protection**, choose **Optional, Required, or Disabled.**

Note Management Frame Protection (MFP) increases the security of management frames. It provides security for the otherwise unprotected and unencrypted 802.11 management messages that are passed between APs and clients. MFP provides both infrastructure and client support.

By default, **Optional** is selected. If you choose **Required**, the clients are allowed to associate only if MFP is negotiated (that is, if WPA2 is configured on the wireless controller, and the client is also configured for WPA2 and supports CCXv5 MFP).

MFP client protection is supported only on Cisco AireOS Wireless Controllers. MFP client protection isn't supported for the 6-GHz band.

c) For **Protected Management Frame (802.11w)**, choose the required option.

Note The options available under **Protected Management Frame (802.11w)** vary based on the settings that you chose under **Level of Security**. The following options may be available:

- **Optional**
- **Required**
- **Disabled**

d) Under **WPA2 Encryption** or **WPA3 Encryption** or **WPA2/WPA3 Encryption**, choose an available option.

The options available under this section vary based on the settings that you chose under **Level of Security**. The following options may be available: **AES(CCMP128), GCMP128, CCMP256, GCMP256**

Note This section is not available for the **Open** security under **Level of Security**.

e) Under **Auth Key Management**, check the check box next to the required options.

Note This section is not available for the **Open** security under **Level of Security**. The following options may be available:

- For **AES(CCMP128)**: **OWE, 802.1x (802.1X-SHA1), FT + 802.1x, CCKM, 802.1x-SHA256 (802.1X-SHA2), PSK, FT + PSK, Easy-PSK, PSK-SHA256 (PSK-SHA2), SAE, FT + SAE**
- For **GCMP128**: **SUITEB-1X**
- For **CCMP256**: **SUITEB192-1X**
- For **GCMP256**: **SUITEB192-1X**

The options available under this section vary based on the fast transition settings.

- **Timestamp Tolerance (in milliseconds)** (for CCKM): Enter the CCKM tolerance level in milliseconds. The valid range is from 1000 through 5000. The default value is 1000. Authenticated client devices can roam from one AP to another AP without any perceptible delay during reassociation. CCKM tolerance level isn't applicable for Cisco AireOS Wireless Controllers.

f) For **11K**:

- **Neighbor List**: Check this check box for all the 11k-capable clients to request a neighbor report about the known neighboring APs that are candidates for roaming.

Note To facilitate roaming, a 11k-capable client that is associated with an AP sends a request to a list of neighboring APs. The request is sent in the form of an 802.11 management frame, which is known as an action frame. The AP responds with a list of neighbor APs on the same WLAN with the Wi-Fi channel numbers. The response is also an action frame. The client identifies the AP candidates for the next roam from the response frame.

- **Session Timeout**: Check this check box to set the maximum time for a client session to remain active before reauthorization.

Note By default, **Session Timeout** is enabled with a timeout of 1800 seconds.

- **Client Exclusion**: Check this check box to set the client exclusion timer.

Note When a user fails to authenticate, the wireless controller denies the client connection. The client is not allowed to connect to the network until the exclusion timer expires. By default, **Client Exclusion** is enabled with a timeout of 180 seconds.

g) For **11v BSS Transition Support**:

- **BSS Max Idle Service**: Check this check box to set the idle period timer value. The idle period timer value is transmitted using the association and reassociation response frame from the APs to the client.

Note The BSS Max idle period is the timeframe during which an AP doesn't disassociate a client because of nonreceipt of frames from the connected client.

- **Client User Idle Timeout**: Check this check box to set the user idle timeout period for a WLAN.

Note If the data sent by the client is more than the threshold quota specified as the user idle timeout period, the client is considered to be active and the wireless controller refreshes for another timeout period.

By default, **Client User Idle Timeout** is enabled with a user idle timeout of 300 seconds.

- **Directed Multicast Service:** Check this check box to enable directed multicast service.

Note By default, **Directed Multicast Service** is enabled. Using the Directed Multicast Service (DMS), the client requests APs to transmit the required multicast packets as unicast frames. This allows clients to sleep for a longer period of time and saves the battery power.

h) (Optional) For **NAS-ID**:

1. From the **NAS-ID Opt** drop-down list, choose the required type of network access server identifier (NAS ID).

(Optional) To specify a custom script for the NAS ID, choose **Custom Option** from the **NAS-ID Opt** drop-down list and enter the custom script in the corresponding **Custom Script for Opt** field. You can enter up to 31 alphanumeric characters, special characters, and spaces for the custom script. Catalyst Center doesn't support the special characters ? " < and trailing spaces for the custom script.

Note Catalyst Center supports NAS ID with custom script only for Cisco Catalyst 9800 Series Wireless Controllers that run Cisco IOS XE Release 17.7 or later.

2. (Optional) Click + to add another network access server identifier. You can add up to three NAS IDs.

Note Catalyst Center applies only one NAS ID for Cisco AireOS Wireless Controllers. You can overwrite the NAS ID at the site-level from the **Design > Network Settings > Wireless** window.

- i) (Optional) Under **Configure Client Rate Limit**, enter a value for the client rate limit in bits per second. The valid range is from 8000 through 100000000000. The value must be a multiple of 500.

Note This configuration is not applicable for Cisco AireOS Wireless Controllers. To configure client rate limit for Cisco AireOS Wireless Controllers, click the menu icon and choose **Design > Feature Templates > Wireless > Advanced SSID Configuration**. For more information, see [Create a Model Config Design for Advanced SSID, on page 385](#).

The following lists the valid ranges for client rate limit on Cisco IOS XE devices:

- The valid range for Cisco Catalyst 9800-L Wireless Controller, Cisco Catalyst 9800-40 Wireless Controller, and Cisco Catalyst 9800-80 Wireless Controller is from 8000 through 67000000000 bits per second.
- The valid range for Cisco Catalyst 9800-CL Wireless Controller is from 8000 through 10000000000 bits per second.
- The valid range for Cisco Embedded Wireless Controller on Catalyst Access Points is from 8000 through 2000000000 bits per second.
- The valid range for Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches is from 8000 through 100000000000 bits per second.

- j) (Optional) Use the **Coverage Hole Detection** toggle button to enable or disable the coverage hole detection functionality.

- k) Click **Next**.

Step 9

(Optional) Complete the **Associate Model Config to SSID** setup:

- a) Check the check box next to the required model configuration design.

If you want to create a model configuration design, click **Add** and configure the required settings. For more information, see [Create a Model Config Design for Advanced SSID, on page 385](#).

Configure Site-Level Overrides for an SSID for Guest Networks

- b) Click **Next**.

Step 10 Complete the **Associate SSID to Profile** setup:

- a) From the left pane, choose a profile and click **Associate Profile**.

If you don't have a profile, click **Add Profile** and configure the profile settings. For more information, see [Create Network Profiles for Wireless, on page 339](#).

- b) Click **Next**.

Step 11 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 12 Click **Save** to save the SSID settings.

The SSID is created.

Configure Site-Level Overrides for an SSID for Guest Networks

You can create SSIDs at the Global hierarchy. The areas, buildings, and floors inherit settings from the Global hierarchy. You can override the following settings at the area, building, or floor level:

- **WLAN Profile Name**
- **Level of Security**
- **Configure AAA**
- **Mac Filtering**
- **Fast Transition (802.11r)**
- **WPA2 Encryption, WPA3 Encryption, or WPA2/WPA3 Encryption**
- **Auth Key Management**
- **NAS-ID**
- **Configure Client Rate Limit**

For more information about configuring these settings, see [Create SSIDs for a Guest Wireless Network, on page 264](#).

If you override a setting at the building level, the subsequent floor inherits the new setting. The following procedure describes how to configure site-level overrides for an SSID for guest networks.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Wireless**.

Step 2 From the left hierarchy tree, choose the site, building, or floor for which you want to configure the overrides.

Hover your cursor over the inherit icon  next to the SSID to view the origin of this setting.

Step 3 Check the check box next to the SSID, and click **Edit**.

Step 4 In the **Basic Settings** window, update the name for the WLAN profile in the **WLAN Profile Name** field.

Note While configuring site-level overrides for the SSID, we recommend that you enter a unique name for the WLAN profile. If the same WLAN profile name is already configured in the wireless controller that manages the selected sites, provisioning fails.

- Step 5** (Optional) In the **Security Settings** window, do the following:
- To update the encryption and authentication type for the network, under **Level of Security**, choose the required settings.
 - To update the AAA server configuration, under **Authentication, Authorization, and Accounting Configuration**, click **Configure AAA**.
 - To enable the AAA override functionality, check the **AAA Override** check box.
- By default, this check box is dimmed. You must configure an AAA server using the **Configure AAA** option to use this check box.
- To enable MAC-based access control or security on the wireless network, check the **MAC Filtering** check box.
- Note** When you enable MAC filtering, only the MAC addresses that you add to the wireless LAN are allowed to join the network.
- Step 6** (Optional) In the **Advanced Settings** window, do the following:
- For **Fast Transition (802.11r)**, do the following:
 - Choose a mode.
 - To enable fast transitions over a distributed system, check the **Over the DS** check box.
 - Under **WPA2 Encryption** or **WPA3 Encryption** or **WPA2/WPA3 Encryption**, choose an available option. The options available under this section vary based on the settings that you chose under **Level of Security**.
- Note** This section is not available for the **Open** security under **Level of Security**.
- Under **Auth Key Management**, check the check box next to the required options.
- Note** This section is not available for the **Open** security under **Level of Security**.
- The options available under this section vary based on the fast transition settings.
- Timestamp Tolerance (in milliseconds)** (for CCKM): Enter the CCKM tolerance level in milliseconds. The valid range is from 1000 through 5000. The default value is 1000. CCKM tolerance level isn't applicable for Cisco AireOS Wireless Controllers.
 - For **NAS-ID**, choose the required NAS ID.
 - Under **Configure Client Rate Limit**, enter a value for the client rate limit in bits per second.
- Step 7** In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
- Step 8** Click **Save**. Site-level overrides are configured for the SSID.

Configure AAA Server for a Guest Wireless Network

Before you begin

- Make sure you have defined the AAA server under the **System Settings > External Services > Authentication and Policy Servers** window.

Configure AAA Server for a Guest Wireless Network

- You must have either administrator (ROLE_ADMIN) or policy administrator (ROLE_POLICY_ADMIN) permissions and the appropriate RBAC scope to perform this procedure.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **SSIDs**.
- Step 5** From the **SSID** table, in the **AAA Servers** column, click **Configure AAA** for the SSID for which you want to configure the AAA server.
- Step 6** From the **Server** drop-down list of the **Configure AAA Server** slide-in pane, you can either search for a AAA IP address by entering its name in the **Search** field or choose AAA IP address.

- Note**
- You must configure at least one AAA or Policy Service Node (PSN) server for Central Web Authentication (CWA) SSIDs of guest wireless network.
 - Catalyst Center-generated preauthentication ACLs are created only for the configured AAA or PSN servers for CWA SSIDs of guest wireless networks. If you upgrade from an earlier release, to ensure that there is no compliance mismatch, you must reprovision the wireless controller.
 - Catalyst Center allows you to map AAA server in any combination of identity services engine PSNs and third-party AAA IPs.
 - In the **Server** drop-down list, the AAA IP addresses and the PSN IP addresses are grouped in the corresponding sections.
 - The **Configure AAA** option is not supported for Mobility Express (ME) devices.
 - You must configure an AAA server for an SSID to push the authentication configuration for the SSID. If an AAA server is not configured for the SSID, Catalyst Center pushes the **aaa authentication dot1x default local** command to the wireless controller and the default method list that points to local authentication is mapped to the SSID.

- Step 7** Click + to add an **Additional Server**.
- Note** You can configure a maximum of six AAA servers for an SSID of guest wireless network.
- Step 8** From the **Additional Server** drop-down list, choose the server IP address.
- Step 9** (Optional) To delete a server or an additional server, click the delete icon next to each server.
- Step 10** To use the AAA server for accounting, check the **Copy Same Servers for Accounting** check box.
- Note** You must configure an accounting server for an SSID to push the accounting configuration for the SSID.
- Step 11** To configure a different accounting server for an SSID, do the following:
- From the **Configure Accounting Server** drop-down list, you can either search for a server IP address by entering its name in the **Search** field or choose the accounting server IP address.
 - Click + to add an **Additional Server**.
- Note** You can configure a maximum of six accounting servers for an SSID of enterprise wireless network.
- From the **Additional Server** drop-down list, choose the server IP address.

Step 12 Click **Configure**.

Note Catalyst Center allows you to override the set of AAA server configurations for the SSID at the site level. For each set of overridden AAA settings per SSID, Catalyst Center creates a new WLAN profile with the corresponding AAA servers mapped to it. If an SSID is overridden for different floors, and you make changes in the AAA servers, Catalyst Center creates the new WLAN profiles equal to the number of floors.

You must reprovision the device to override the AAA servers at the site level. See [Wireless Device Provisioning Overview, on page 469](#).

Create SSID Scheduler

You can create an SSID scheduler to enable or disable WLAN based on time zone.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **SSIDs**.

Step 5 In the **SSID** table, click **SSID Scheduler**.

Step 6 In the **SSID Scheduler** window, click **Add**.

Step 7 In the **Create Scheduler** slide-in pane, do the following:

- a) Enter a unique name for the SSID scheduler that you want to create.
- b) Click the **Client Deny** radio button for denying clients from joining SSID.
- c) Click the **Enable SSID** radio button to schedule SSID broadcasting.
- d) Choose the **Scheduler Type Daily, Weekly, or Monthly** and complete the required settings.
- e) From the **Time Zone** drop-down list, choose the time zone.
- f) Click **Save**.

The created SSID scheduler appears in the **SSID Scheduler** table.

Step 8 To edit the SSID scheduler, do the following:

- a) From the **SSID Scheduler** table, choose the SSID scheduler and click **Edit**.
- b) In the **Edit SSID Scheduler** slide-in pane, make the required changes and click **Save**.

Step 9 To delete the SSID scheduler, choose the SSID scheduler and click **Delete**.

Step 10 To view the details of the SSID scheduler, choose the SSID scheduler and click **Scheduler History**.

Note To view the **Scheduler History**, you must install the Assurance package.

What to do next

Enable the SSID scheduler for wireless controller. For more details, see [Add SSIDs to a Network Profile, on page 339](#).

Create a Wireless Interface

You can create wireless interfaces only in nonfabric deployments.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
 - Step 2** Click the **Wireless** tab.
 - Step 3** From the left hierarchy tree, choose **Global**.
 - Step 4** Click **Interfaces & VLAN Groups**.
 - Step 5** Click the **Interfaces** tab.
 - Step 6** From the **Wireless Interfaces** table, click **Add**.
 - Step 7** Configure the wireless interface settings in the **Create a Wireless Interface** slide-in pane:
 - a) In the **Interface Name** field, enter the dynamic interface name.
 - b) In the **VLAN ID** field, enter the VLAN ID for the interface.

For Cisco AireOS Wireless Controllers, the valid range is from 1 through 4094. For Cisco Catalyst 9800 Series Wireless Controllers, the valid range is from 2 through 4094.
 - Step 8** Click **Save**.
- The wireless interface is created and displayed in the **Wireless Interfaces** table.
-

Design and Provision Interface/VLAN Groups for Nonfabric Deployments

Catalyst Center allows you to configure networks with multiple broadcast domains through different VLANs. When the same set of APs broadcast the same WLAN, the broadcast domains are controlled through multiple VLANs on the same WLAN through interface groups.

Catalyst Center interface groups are logical groups of interfaces that facilitate user configuration, where the same interface group can be configured on multiple WLANs or while overriding a WLAN interface per AP group. An interface can be part of multiple interface groups. A WLAN can be associated with an interface or interface group.



Note The interface group name and the interface name cannot be the same.

The Catalyst Center VLAN group feature maps a WLAN to a single VLAN or multiple VLANs using VLAN groups. VLAN groups can be associated to policy profiles.

The following procedure explains how to design and provision the interface or VLAN groups for nonfabric deployments.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
 - Step 2** Click the **Wireless** tab.
 - Step 3** From the left hierarchy tree, choose **Global**.
 - Step 4** Click **Interfaces & VLAN Groups**.

- Step 5** Click the **VLAN Groups** tab.
- Step 6** From the **VLAN Group** table, click **Add**.
- Step 7** In the **Add VLAN Group** slide-in pane, do the following:
- Enter a valid **VLAN Group Name**
 - Select single or multiple interfaces from the list.
 - Click **Save**.
- Note** If you select more than 15 interfaces, the selected interfaces might not be displayed correctly onscreen.
- Step 8** In the **Edit Network Profile** window, the VLAN group is associated with the SSID.
- For information on how to create an SSID, see [Create SSIDs for an Enterprise Wireless Network](#).
- Step 9** To add more SSIDs to the VLAN group, click **Add SSID**.
- Step 10** Choose **Interface** or **VLAN** group.
- Step 11** Click the add icon to create a new interface or VLAN group.
- Note** Interface or VLAN group is not applicable for FlexConnect local switching.
- Step 12** Click **Save**.
- Step 13** In **Configure Interface and VLAN**, you can view the list of interface names, interface groups names, and other parameters required to configure the interface and VLAN.
- Note** An interface group cannot contain more than 64 interfaces.
- Step 14** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Step 15** Select the device.
- Step 16** From the **Actions** drop-down menu, choose **Provision > Provision Device**.
- Step 17** Review the details in the **Assign Site**, **Configuration**, **Model Configuration**, **Advanced Configuration**, and **Summary** screens. From each screen, click **Next** to advance to the next screen.
- Step 18** Click **Deploy**.
- The **Provision Device** dialog box opens.
- Step 19** Choose **Now** and click **Apply**.
- The message **Task Scheduled view status in Tasks** is displayed.

Create a Wireless Radio Frequency Profile

You can either use the default radio frequency profiles (LOW, TYPICAL, HIGH), or create custom radio frequency profiles.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **RF Profiles**.
- Step 5** In the **Wireless Radio Frequency Profile** area, hover your cursor over **Add**, and choose **Basic RF Profile**.

Create a Wireless Radio Frequency Profile

Step 6

In the **Profile Name** field of the **Create Wireless Radio Frequency Profile** window, enter the RF profile name.

Step 7

Configure the following in the **2.4 GHz** tab:

- Ensure that the **2.4 GHz** toggle button is enabled.

Note

- For Cisco Catalyst 9800 Series Wireless Controller, if you disable the **2.4 GHz** toggle button, Catalyst Center disables the Admin status of the **2.4 GHz** RF profile.
- For Cisco AireOS Wireless Controller, if you disable the **2.4 GHz** toggle button and reprovision the wireless controller or AP, Catalyst Center creates the RF profile for the corresponding band and maps it to the AP group (instead of configuring it as **None**) and disables the Admin status of the corresponding radios on the APs.
- For Cisco AireOS Wireless Controller, when you disable the Admin status for the 2.4-GHz band on the RF profile, Catalyst Center changes the XOR radio on the APs using that RF profile to manual 5-GHz mode. If you enable the Admin status later and reprovision the AP, Catalyst Center changes the radio to automatic mode enabling the usage of 2.4-GHz and 5-GHz bands, and monitor mode. So, if you want to disable the Admin status for the 2.4-GHz band on XOR-capable APs, we recommend that you disable the Admin status of the XOR radio using the **Configure Access Points** workflow. The Admin status configured using the **Configure Access Points** workflow isn't overwritten when the wireless controller or APs are reprovisioned. For more information, see [Configure APs, on page 851](#).

- Under **Parent Profile**, click **High**, **Medium (Typical)**, **Low**, or **Custom**. (The available data rates and power configuration values change depending on the parent profile chosen. For example, if you choose **High**, it populates the profile configurations available in the device for 2.4-GHz. If you change any settings in the populated data rates and power configurations, the **Parent Profile** automatically changes to **Custom**.) A new RF profile is created only for the selected custom profiles.

Note

Low, **Medium (Typical)**, and **High** are the default RF profiles. If you choose a default RF profile, the respective RF profile on the device is used, and the new RF profile isn't created on wireless controller.

- DCA Channel** dynamically manages the channel assignment for an RF group and evaluates the assignments on a per-AP radio basis.

- Check the **Select All** check box to select DCA channels **1**, **6**, and **11**. Alternatively, check the individual check boxes next to the channel numbers.
- If the individual channel numbers aren't already displayed, click **Show Advanced** to select the channel numbers under the **Advanced Options**.
- Check the **Select All** check box to select DCA channels that are under **Advanced Options**, or check the check box next to the individual channel numbers. The available channel numbers are **2**, **3**, **4**, **5**, **7**, **8**, **9**, **10**, **12**, **13**, and **14**.

Note

- For Cisco AireOS Wireless Controller, Catalyst Center automatically configures the selected DCA channels in the global RRM DCA channel list.
- Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.

- Under **Supported Data Rate**, configure the following:

- Check the **Enable 802.11b data rates** check box to enable the 802.11b data rates.
 - Use the slider to set the rates at which data can be transmitted between an access point and a client. The available data rates are **1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48**, and **54**.
- e) Under **Mandatory Data Rates**, check the check boxes next to the individual data rates. You can choose up to two data rates. The available data rates are **6, 9, 12, 18, 24, 36, 48**, and **54**.
The available data rates change depending on the data rates set under **Supported Data Rate**.
- f) Under **Tx Power Configuration**, set the power level and power threshold for an AP.
- **Power Level**: Determines whether the power of an AP needs to be reduced. Reducing the power of an AP helps mitigate co-channel interference with another AP on the same channel or in close proximity. Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm to 30 dBm, and the default is -10 dBm.
 - **TPC Power Threshold**: Is the cutoff signal level used by Radio Resource Management (RRM) to determine whether to reduce the power of an AP. Use the **Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmission power rates. The range is from -50 dBm to 80 dBm, and the default threshold is -70 dBm.
 - **RX SOP Threshold (dBm)**: Receiver Start of Packet Detection Threshold (RX SOP) determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High**, **Medium**, **Low**, **Auto**, or **Custom** threshold value.
If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 2.4-GHz band, the high threshold value is -79 dBm, the medium threshold value is -82 dBm, and the low threshold value is -85 dBm.
- g) Under **Coverage Hole Detection**, configure the following:
- Note** You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).
- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
 - In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
 - In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
 - In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.
- h) Under **Client Limit**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.

- Note** A maximum client limit isn't supported on Cisco AireOS Wireless Controllers.
- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7, the maximum client limit is 200.
 - If the wireless controller is running Cisco IOS XE Release 17.7 or later and earlier than Cisco IOS XE Release 17.9, the maximum client limit is 400.
 - If the wireless controller is running Cisco IOS XE Release 17.9 or later, the maximum client limit is 500.

- i) Under **802.11ax**, configure the following spatial reuse parameters:

Note 802.11ax is supported only on wireless controllers that run Cisco IOS XE Release 17.6.1 and later.

- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
 - In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
 - Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality.
- SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
 - In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 8

Configure the following in the **5 GHz** tab:

- a) Ensure that the **5 GHz** toggle button is enabled.

Note

- For Cisco Catalyst 9800 Series Wireless Controller, if you disable the **5 GHz** toggle button, Catalyst Center disables the Admin status of the **5 GHz** RF profile.
- For Cisco AireOS Wireless Controller, if you disable the **2.4 GHz** toggle button and reprovision the wireless controller or AP, Catalyst Center creates the RF profile for the corresponding band and maps it to the AP group (instead of configuring it as **None**) and disables the Admin status of the corresponding radios on the APs.
- For Cisco AireOS Wireless Controller, when you disable the Admin status for the 5-GHz band on the RF profile, Catalyst Center changes the XOR radio on the APs using that RF profile to manual 2.4-GHz mode. If you enable the Admin status later and reprovision the AP, Catalyst Center changes the radio to automatic mode enabling the usage of 2.4-GHz and 5-GHz bands, and monitor mode. So, if you want to disable the Admin status for the 5-GHz band on XOR-capable APs, we recommend that you disable the Admin status of the XOR radio using the **Configure Access Points** workflow. The Admin status configured using the **Configure Access Points** workflow isn't overwritten when the wireless controller or APs are reprovisioned. For more information, see [Configure APs, on page 851](#).

- b) Under **Parent Profile**, click **High**, **Medium (Typical)**, **Low**, or **Custom**. (The available data rates and power configuration values change depending on the parent profile chosen. For example, if you choose **High**, it populates

the configurations available in the device for 5 GHz. If you change any settings in the populated data rates and power configurations, the **Parent Profile** automatically changes to **Custom**.) A new RF profile is created only for select custom profiles.

Note **Low**, **Medium (Typical)**, and **High** are the default RF profiles. If you choose a default RF profile, the respective RF profile that is already present in the device is used and the new RF profile isn't created on wireless controller.

- c) From the **Channel Width** drop-down list, choose a channel bandwidth option: **20 MHz**, **40 MHz**, **80 MHz**, or **160 MHz**, or **Best**.
- d) Check the **Zero Wait DFS** check box to allow APs with 5-GHz radio band to switch to a new channel without any waiting time.

Note Catalyst Center supports Zero Wait DFS for Cisco Wireless Controllers running Cisco IOS XE Release 17.9.1 and later.

- e) Under **DCA Channel**, configure the following to manage the channel assignments:

Note For Cisco AireOS Wireless Controller, Catalyst Center automatically configures the selected DCA channels in the global RRM DCA channel list.

Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.

- Check the **Select All** check box to select DCA channels **UNII-1 36-48**, **UNII-2 52-144**, and **UNII-3 149-173**. Alternatively, check the individual check boxes next to the channel numbers.
 - If the individual channel numbers aren't already displayed, click **Show Advanced** to choose the channel numbers for each band.
 - **UNII-1 36-48**: The channels available for UNII-1 band are **36**, **40**, **44**, and **48**. Check the **UNII-1 36-48** check box to include all channels, or check an individual check box.
 - **UNII-2 52-144**: The channels available for UNII-2 band are **52**, **56**, **60**, **64**, **100**, **104**, **108**, **112**, **116**, **120**, **124**, **128**, **132**, **136**, **140**, and **144**. Check the **UNII-2 52-144** check box to include all channels, or check an individual check box.
 - **UNII-3 149-173**: The channels available for UNII-3 band are **149**, **153**, **157**, **161**, **165**, **169**, and **173**. Check the **UNII-3 149-173** check box to include all channels, or check an individual check box.
- f) Use the **Supported Data Rate** slider to set the rates at which data can be transmitted between an access point and a client. The available data rates are **6**, **9**, **12**, **18**, **24**, **36**, **48**, and **54**.
 - g) Under **Mandatory Data Rates**, check the check boxes next to the individual data rates. You can choose up to two data rates. The available data rates are **6**, **9**, **12**, **18**, **24**, **36**, **48**, and **54**.

The available data rates change depending on the data rates set under **Supported Data Rate**.

- h) Under **Tx Power Configuration**, set the power level and power threshold for an AP.

- **Power Level**: Determines whether the power of an AP needs to be reduced. Reducing the power of an AP helps mitigate co-channel interference with another AP on the same channel or in close proximity. Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm to 30 dBm, and the default is -10 dBm.

- **TPC Power Threshold:** Is the cutoff signal level used by Radio Resource Management (RRM) to determine whether to reduce the power of an AP. Use the **Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmission power rates. The range is from -50 dBm to 80 dBm, and the default threshold is -70 dBm.
- **RX SOP Threshold (dBm):** RX SOP determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High**, **Medium**, **Low**, **Auto**, or **Custom** threshold value.

If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 5-GHz band, the high threshold value is -76 dBm, the medium threshold value is -78 dBm, and the low threshold value is -80 dBm.

- i) Under **Coverage Hole Detection**, configure the following:

Note You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
- In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.

- j) Under **Client Limit**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.

Note A maximum client limit isn't supported on Cisco AireOS Wireless Controllers.

- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7, the maximum client limit is 200.
- If the wireless controller is running Cisco IOS XE Release 17.7 or later and earlier than Cisco IOS XE Release 17.9, the maximum client limit is 400.
- If the wireless controller is running Cisco IOS XE Release 17.9 or later, the maximum client limit is 500.

- k) Under **Flexible Radio Assignment (FRA)**, check the **Client Aware** check box to enable the Client Aware feature.

This feature monitors the dedicated 5-GHz radio. When the client load passes the threshold, it automatically changes the FRA from a monitor role into a 5-GHz role, effectively doubling the capacity of the cell on demand. Once the capacity crisis is over and Wi-Fi load returns to normal, the radios resume their previous roles.

Note You must enable FRA in **Design > Feature Templates > Wireless > RRM FRA Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM FRA parameters, see [Create a Model Config Design for RRM FRA Parameters, on page 400](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

If you enable the Client Aware feature, configure the following:

- In the **Client Select (%)** field, enter a value for client selection. The valid range is from 0 through 100 percent. The default value is 50 percent.
- In the **Client Reset (%)** field, enter a reset value for the client. The valid range is from 0 through 100 percent. The default value is 5 percent.

I) Under **802.11ax**, configure the following spatial reuse parameters:

Note 802.11ax is supported only on wireless controllers that run Cisco IOS XE Release 17.6.1 and later.

- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
 - In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
 - Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality.
- SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
 - In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 9 Configure the following in the **6 GHz** tab:

a) Ensure that the **6 GHz** toggle button is enabled.

Note

- The 6-GHz radio is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- For Cisco Catalyst 9800 Series Wireless Controller, if you disable the **6 GHz** toggle button, Catalyst Center disables the Admin status of the **6 GHz** RF profile.

b) Enable the **Enable PSC Enforcing** toggle button to allow Preferred Scanning Channel (PSC) enforcement.

PSC enforcement improves the connectivity of 6-GHz devices by prioritizing PSC-enabled channels.

Note If you enable PSC enforcement, the check boxes next to the non-PSC channels are dimmed.

c) Under **DCA Channel**, configure the following to manage channel assignments.

- Check the **Select All** check box to include all DCA channels, or check an individual check box to select an individual DCA channel.

• **UNII-5 1-93**

- **UNII-6 97-113**

- **UNII-7 117-185**

- **UNII-8 189-233**

- If the channel numbers aren't already displayed, click **Show Advanced** to select the channel numbers for each band.

Note Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.

- d) Use the **Supported Data Rate** slider to set the rates at which data can be transmitted between an access point and a client. The available data rates are **6, 9, 12, 18, 24, 36, 48**, and **54**.
- e) Under **Mandatory Data Rates**, check the check boxes next to the individual data rates. You can choose up to two data rates. The available data rates are **6, 9, 12, 18, 24, 36, 48**, and **54**.

The available data rates change depending on the data rates set under **Supported Data Rate**.

- f) Under **Tx Power Configuration**, set the power level and power threshold for an AP.

- **Standard Power Service:** For APs with the standard power capability, compliance with FCC regulations requires the activation of Automatic Frequency Coordination (AFC). AFC uses the AP location and height data to determine the optimal channel and transmission power, ensuring noninterference with the licensed incumbent users on the 6-GHz band. You can use the Standard Power Service feature on Catalyst Center to activate AFC. By default, this feature is disabled. To enable this feature, click the **Standard Power Service** toggle button.

This feature is applicable only for Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.12.3 or later. When this feature is disabled, the 6-GHz dual-power mode APs are restricted to operate only in the low-power indoor mode, and the standard-power mode only APs have the radios disabled completely.

Note To ensure proper functioning of this feature, you must configure the AP height, AP height uncertainty, and external antenna cable length on the corresponding wireless controller. For the standard power-capable APs to operate on standard power, you must ensure that you select at least one supported DCA channel based on your country-specific regulations.

- **Power Level:** Determines whether the power of an AP needs to be reduced. Reducing the power of an AP helps mitigate co-channel interference with another AP on the same channel or in close proximity. Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm to 30 dBm, and the default is -10 dBm.
- **TPC Power Threshold:** Is the cutoff signal level used by Radio Resource Management (RRM) to determine whether to reduce the power of an AP. Use the **Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmission power rates. The range is from -50 dBm to 80 dBm, and the default threshold is -70 dBm.
- **RX SOP Threshold (dBm):** RX SOP determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High**, **Medium**, **Low**, **Auto**, or **Custom** threshold value.

If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 6-GHz band, the high threshold value is -76 dBm, the medium threshold value is -78 dBm, and the low threshold value is -80 dBm.

g) Under **Coverage Hole Detection**, configure the following:

Note You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
- In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.

h) Under **Client Limit**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.

Note

- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7, the maximum client limit is 200.
- If the wireless controller is running Cisco IOS XE Release 17.7 or later and earlier than Cisco IOS XE Release 17.9, the maximum client limit is 400.
- If the wireless controller is running Cisco IOS XE Release 17.9 or later, the maximum client limit is 500.

i) Under **Flexible Radio Assignment (FRA)**, complete the following:

Note

- You must enable FRA in **Design > Feature Templates > Wireless > RRM FRA Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM FRA parameters, see [Create a Model Config Design for RRM FRA Parameters, on page 400](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).
- FRA is supported only on wireless controllers that run Cisco IOS XE Release 17.9.1 and later.

- In the **Client Reset Count** field, enter a reset count value for the client. The valid range is from 0 through 10. The default value is 1.
- In the **Client Utilization Threshold (%)** field, enter a utilization threshold value for the client. The valid range is from 0 through 100 percent. The default value is 5 percent.

j) Under **802.11ax**, configure the following multiple basic service set identifier (BSSID) and spatial reuse parameters:

Create a Wireless Radio Frequency Profile

- From the **6 GHz Discovery Frames** drop-down list, choose the required option from **None**, **Broadcast Probe Response**, and **FILS Discovery**.
6-GHz discovery frames are needed if the 6-GHz band is the only operational band. For more information about the 6-GHz discovery frames, click **Learn More**.
- In the **Broadcast Probe Response Interval (msec)** field, enter the broadcast probe response interval, in msec. The valid range is from 5 msec through 25 msec. The default value is 20 msec.
- Under **MULTI BSSID**, check the check boxes to enable the following parameters:
 - Downlink OFDMA
 - Uplink OFDMA
 - Downlink MU-MIMO
 - Uplink MU-MIMO
 - Target wake time
 - TWT Broadcast Support

Note

You must enable multiple BSSID in **Design > Feature Templates > Wireless > Dot11ax Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for Dot11ax, see [Create a Model Config Design for Dot11ax Configuration, on page 392](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
- In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
- Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality.
SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
- In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 10

Click **Save**.

Step 11

(Optional) To mark a profile as the default RF profile, check the **Profile Name** check box and click **Mark Default**. In the **Warning** window, click **OK**.

What to do next

You must provision the APs to apply the RF profile settings on the device. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

Edit or Delete a Basic Radio Frequency Profile

The following procedure describes how to edit or delete a basic RF profile.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **RF Profiles**.
- Step 5** In the **Wireless Radio Frequency Profile** area, click the **Basic RF Profile** tab.
- Note** The **Basic RF Profile** table lists the number of created basic RF profiles based on **Profile Name**, **Type**, **2.4 GHz Data Rates**, **5 GHz Data Rates**, **6 GHz Data Rates**, **Channel Width**, and **Profile Type**.
- Step 6** Check the check box next to the basic profile name that you want to edit.
- Step 7** From the **Action** drop-down list, choose **Edit/View**.
- Note** You can edit one basic RF profile at a time.
- Step 8** In the **Edit Wireless Radio Frequency Profile** window, configure the basic RF profile settings. For more information, see [Create a Wireless Radio Frequency Profile, on page 277](#).
- Step 9** Click **Save**.
- Step 10** To delete a basic RF profile, check the check box next to the basic RF profile name.
- Step 11** From the **Action** drop-down list, choose **Delete** and then click **Yes**.
- Step 12** To mark a basic RF profile as the default, check the check box next to a basic RF profile name.
- Step 13** From the **Action** drop-down list, choose **Mark Default** and then click **Yes**.
-

What to do next

For Cisco AireOS Wireless Controllers, if you modify the DCA channels or data rates for an RF profile that is already provisioned on a wireless controller, Catalyst Center resets the corresponding radio.

If you update an RF profile that is already provisioned on a wireless controller and AP, you must reprovision either the wireless controller or AP. Wireless controller reprovision also pushes the RF profile updates to the devices and reprovisioning the AP is not necessary. For more information about provisioning a wireless controller, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

Clone a Basic Radio Frequency Profile

You can create a copy of a basic RF profile by cloning it. Cloning allows you to reuse the configurations of an existing RF profile for a new RF profile. You can clone both the system and custom RF profiles.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.

Prerequisites for Configuring AI Radio Frequency Profiles

- Step 4** Click **RF Profiles**.
 - Step 5** In the **Basic RF Profile** tab, check the check box next to the profile name that you want to clone.
 - Step 6** From the Actions drop-down list, choose **Create a Clone**.
 - Step 7** In the **Profile Name** field of the **Create Wireless Radio Frequency Profile** window, enter a unique name for the profile.
 - Step 8** Edit the RF profile configurations as necessary. For more information, see [Create a Wireless Radio Frequency Profile, on page 277](#).
 - Step 9** Click **Save**.
-

Prerequisites for Configuring AI Radio Frequency Profiles

- You must enable Cisco AI Network Analytics under the system settings. For more information, see [Configure Cisco AI Network Analytics Data Collection](#) in the *Cisco Catalyst Center Administrator Guide*.
- You must enable AI-Enhanced RRM. From the top-left corner, click the menu icon and choose **System > Settings > External Services > Cisco AI Analytics**. In the **AI-ENHANCED RRM** area of the **Cisco AI Analytics** window, click the toggle button to enable the AI-Enhanced RRM.
- Cisco AI RF profiles are supported only on Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.7.1 or later.



Note Ensure that the **Group Mode** option for all the three bands (2.4 GHz, 5 GHz, and 6 GHz) is configured as **auto** or **leader** on the wireless controller.

- Cisco AI RF profiles are supported for 6-GHz radio only on wireless controllers that run Cisco IOS XE Release 17.9.1 and later.
- You must be a **Super Admin** or **Network Admin**.

Create an AI Radio Frequency Profile

The following procedure describes how to create an AI radio frequency profile for your building.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **RF Profiles**.
- Step 5** In the **Wireless Radio Frequency Profile** area, hover your cursor over **Add** and choose **AI RF Profile**.
- Step 6** In the **Profile Name** field of the **Create AI Radio Frequency Profile** window, enter the RF profile name.

Step 7 In the **Radio Frequency Settings** area of **Basic Settings**, check the **2.4 GHz**, **5 GHz**, or **6 GHz** check box.

The RF bands are checked by default. If you uncheck a band, Catalyst Center disables the Admin status of the corresponding RF profile.

Note Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.9.1 and later support the AI RF profile for the **6 GHz** band.

Step 8 In the **Busy Hours** area, define the start and end time of the site time zone.

Note Busy hours are dependent upon the time zone of the building. You must configure a time zone for the respective building under network settings.

Step 9 In the **Busy Hour Sensitivity** area, click the **Low**, **Medium**, or **High** radio button to define the threshold of the Radio Resource Management (RRM) sensitivity for the busy hours interval.

Step 10 In the **Enable RF Settings** area, click the toggle buttons under the **2.4 GHz**, **5 GHz**, or **6 GHz** columns to enable or disable RF settings for the corresponding bands.

The supported RF settings are:

- **Flexible Radio Assignment (FRA)**: FRA optimizes the radio coverage per band and determines the best role assignment for redundant radios.
- **Dynamic Channel Assignment (DCA)**: DCA dynamically manages the channel assignment for an RF group and evaluates the assignments on a per-AP radio basis.
- **Transmit Power Control (TPC)**: TPC manages and transmits power for APs. It also maximizes the SNR during the reduction in interference.
- **Dynamic Bandwidth Selection (DBS)**: DBS monitors and adjusts the channel width to balance performance and interference.

Note

- When you disable the **2.4 GHz** band for FRA, it automatically disables the **5 GHz** band for FRA, and conversely.
- When you disable the **5 GHz** band for DCA, it disables the **2.4 GHz** band for FRA and the **5 GHz** band for FRA and DBS.
- You can individually enable the **2.4 GHz** band for DCA and TPC, and the **5 GHz** band for DCA, TPC, and DBS. For the **5 GHz** band, if DCA and DBS are disabled and you enable DBS, DCA is also enabled.
- You can enable or disable the **6 GHz** band together for DCA and DBS RF settings. You can individually enable the **6 GHz** band for TPC.
- FRA is not supported for the **6 GHz** band.

Step 11 In the **Advanced** area, click the **2.4 GHz** toggle button.

- a) In the **DCA Channel** area, check the **Select All** check box to select DCA channels **1**, **6**, and **11**. Alternatively, check the individual check boxes next to the channel numbers.
- b) In the **Advanced Options** area, check the **Select All** check box to select all the DCA channels.
- c) If the individual channel numbers are not already displayed, click **Show Advanced** to select the remaining channel numbers.
- d) Check the check box next to the individual channel numbers. The channel numbers that are available for the profile are **2**, **3**, **4**, **5**, **7**, **8**, **9**, **10**, **12**, **13**, and **14**.

Note Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.

- e) In the **Supported Data Rate** area, configure the following:
 - Check the **Enable 802.11b data rates** check box to enable the 802.11b data rates. This action also enables the 802.11b supported data rate check boxes in the **Mandatory Data Rates** area.
 - Use the slider to set the rates at which data can be transmitted between an AP and a client. The available data rates are **1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48**, and **54**.
- f) In the **Mandatory Data Rates** area, check the check box next to the individual data rates. You can choose up to two data rates. The available data rates are **1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48**, and **54**.
- g) In the **Tx Power Configuration** area, set the following:
 - **Power Level:** Determines whether the power of an AP needs to be reduced. Reducing the power of an AP helps mitigate co-channel interference. Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm through 30 dBm. The minimum default is -10 dBm and maximum default is 30 dBm.
 - **TPC Power Threshold:** Is the cutoff signal level used by RRM to determine whether to reduce the power of an AP. Use the **TPC Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmission power rates. The range is from -50 dBm through 80 dBm, and the default threshold is -70 dBm.
 - **RX SOP Threshold (dBm):** Receiver Start of Packet Detection Threshold (RX SOP) determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High, Medium, Low, Auto**, or **Custom** threshold value.

If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 2.4-GHz band, the high threshold value is -79 dBm, the medium threshold value is -82 dBm, and the low threshold value is -85 dBm.

- h) Under **Coverage Hole Detection**, configure the following:

Note You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
- In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.

- i) Under **CLIENT LIMIT**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.

- Note**
- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7.1, the maximum client limit is 200.
 - If the wireless controller is running Cisco IOS XE Release 17.7.1 or later and earlier than Cisco IOS XE Release 17.9.1, the maximum client limit is 400.
 - If the wireless controller is running Cisco IOS XE Release 17.9.1 or later, the maximum client limit is 500.

- j) Under **802.11ax**, configure the following spatial reuse parameters:

- Note** 802.11ax is supported only on wireless controllers that run Cisco IOS XE Release 17.6.1 and later.

- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
 - In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
 - Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality.
- SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
 - In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 12

In the **Advanced** area, click the **5 GHz** toggle button.

- a) Check the **Zero Wait DFS** check box to allow APs with 5-GHz radio to switch to a new channel without any waiting time.

- Note** Catalyst Center supports Zero wait DFS for Cisco Wireless Controllers running Cisco IOS XE Release 17.9.1 and later.

- b) Use the **DBS Max Width** slider to set the channel width of the AI RF profile.

The available channel width options are **20 MHz**, **40 MHz**, **80 MHz**, or **160 MHz**.

The **Auto Channels Logic** area displays a color-coded representation of channels that are available in the Unlicensed National Information Infrastructure (UNII) radio bands for the available channel widths.

You can select **DBS Max Width** only when DBS is enabled.

When you disable the DBS, Catalyst Center allows you to select the static channel width.

- c) Set the **DCA Channel** to manage the following channel assignments:

- **UNII-1 36-48**: The channels available for UNII-1 band are **36**, **40**, **44**, and **48**.
- **UNII-2 52-144**: The channels available for UNII-2 band are **52**, **56**, **60**, **64**, **100**, **104**, **108**, **112**, **116**, **120**, **124**, **128**, **132**, **136**, **140**, and **144**.
- **UNII-3 149-165**: The channels available for UNII-3 band are **149**, **153**, **157**, **161**, and **165**.

- d) Check the **Select All** check box to include all DCA channels, or check an individual check box to select an individual DCA channel.
- e) Click **Show Advanced** to view and select the individual DCA channel numbers.
 - Check the **UNII-1 36-48** check box to include all channels, or check an individual check box.
 - Check the **UNII-2 52-144** check box to include all channels, or check an individual check box.
 - Check the **UNII-3 149-165** check box to include all channels, or check an individual check box.

Note Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.

- f) Use the **Supported Data Rate** slider to set the rates at which data can be transmitted between an AP and a client. The available data rates are **6, 9, 11, 12, 18, 24, 36, 48**, and **54**.
- g) In the **Mandatory Data Rates** area, check the check box next to the individual data rates. You can choose up to two data rates. The available data rates are **6, 9, 11, 12, 18, 24, 36, 48**, and **54**.
- h) In the **Tx Power Configuration** area, complete the following:
 - Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm through 30 dBm. The minimum default is -10 dBm and maximum default is 30 dBm.
 - Use the **TPC Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmit power rates. The range is from -50 dBm through 80 dBm and the default threshold is -70 dBm.
 - **RX SOP Threshold (dBm)**: RX SOP determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High, Medium, Low, Auto**, or **Custom** threshold value.

If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 5-GHz band, the high threshold value is -76 dBm, the medium threshold value is -78 dBm, and the low threshold value is -80 dBm.

- i) Under **Coverage Hole Detection**, configure the following:

Note You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
- In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
- In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.

- In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.
- j) Under **CLIENT LIMIT**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.
- Note**
- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7.1, the maximum client limit is 200.
 - If the wireless controller is running Cisco IOS XE Release 17.7.1 or later and earlier than Cisco IOS XE Release 17.9.1, the maximum client limit is 400.
 - If the wireless controller is running Cisco IOS XE Release 17.9.1 or later, the maximum client limit is 500.
- k) Under **802.11ax**, configure the following spatial reuse parameters:
- Note**
- 802.11ax is supported only on wireless controllers that run Cisco IOS XE Release 17.6.1 and later.
- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
 - In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
 - Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality.
- SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
 - In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 13

In the **Advanced** area, click the **6 GHz** toggle button.

- a) Use the **DBS Width** slider to set the minimum and maximum channel width of the AI RF profile.

The available channel width options are **20 MHz**, **40 MHz**, **80 MHz**, or **160 MHz**.

The **Auto Channels Logic** area displays a color-coded representation of channels that are available in the UNII radio bands for the available channel widths.

You can select **DBS Width** only when DBS is enabled.

- b) Enable the **Enable PSC Enforcing** toggle button to allow Preferred Scanning Channel (PSC) enforcement.

PSC enforcement improves the connectivity of the 6-GHz devices by prioritizing the PSC-enabled channels.

Note

If you enable PSC enforcement, the check boxes next to the non-PSC channels are dimmed and the check boxes next to the PSC channels are checked by default. If necessary, you can uncheck the check box next to the required PSC channel.

- c) Set the **DCA Channel** to manage the following channel assignments:

- **UNII-5 1-93**: The channels available for the UNII-5 band are **1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61, 65, 69, 73, 77, 81, 85, 89**, and **93**.

- **UNII-6 97-113:** The channels available for the UNII-6 band are **97, 101, 105, 109, and 113**.
 - **UNII-7 117-185:** The channels available for the UNII-7 band are **117, 121, 125, 129, 133, 137, 141, 145, 149, 153, 157, 161, 165, 169, 173, 177, 181, and 185**.
 - **UNII-8 189-233:** The channels available for the UNII-8 band are **189, 193, 197, 201, 205, 209, 213, 217, 221, 225, 229, and 233**.
- d) Check the **Select All** check box to include all DCA channels, or check an individual check box to select an individual DCA channel.
- e) Click **Show Advanced** to select the remaining DCA channel numbers.
- Check the **UNII-5 1-93** check box to include all channels, or check an individual check box.
 - Check the **UNII-7 117-185** check box to include all channels, or check an individual check box.
 - Check the **UNII-8 189-233** check box to include all channels, or check an individual check box.
- Note** Select the DCA channels based on the country code of the device. During provisioning, only the allowed channels for the country configured on the wireless controller are considered and the unsupported channels are ignored. Provisioning may fail if all the channels that you've selected are unsupported as per the country codes configured on the controller.
- f) Use the **Supported Data Rate** slider to set the rates at which data can be transmitted between an AP and a client. The available data rates are **6, 9, 12, 18, 24, 36, 48, and 54**.
- g) In the **Tx Power Configuration** area, configure the following.
- **Standard Power Service:** For APs with the standard power capability, compliance with FCC regulations requires the activation of Automatic Frequency Coordination (AFC). AFC uses the AP location and height data to determine the optimal channel and transmission power, ensuring noninterference with the licensed incumbent users on the 6-GHz band. You can use the Standard Power Service feature on Catalyst Center to activate AFC. By default, this feature is disabled. To enable this feature, click the **Standard Power Service** toggle button.

This feature is applicable only for Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.12.3 or later. When this feature is disabled, the 6-GHz dual-power mode APs are restricted to operate only in the low-power indoor mode, and the standard-power mode only APs have the radios disabled completely.

Note To ensure proper functioning of this feature, you must configure the AP height, AP height uncertainty, and external antenna cable length on the corresponding wireless controller. For the standard power-capable APs to operate on standard power, you must ensure that you select at least one supported DCA channel based on your country-specific regulations.

- Use the **Power Level** slider to set the minimum and maximum power level. The range is from -10 dBm through 30 dBm and the default is -10 dBm.
- Use the **TPC Power Threshold** slider to increase and decrease the power value, which causes the AP to operate at higher or lower transmit power rates. The range is from -50 dBm through 80 dBm and the default threshold is -70 dBm.
- **RX SOP Threshold (dBm):** RX SOP determines the Wi-Fi signal level, in dBm, at which an AP's radio demodulates and decodes a packet. From the **RX SOP Threshold (dBm)** drop-down list, choose **High, Medium, Low, Auto, or Custom** threshold value.

If you choose the **Custom** RX SOP threshold, the **RX-SOP Threshold (dBm) Custom Value** field is displayed. In this field, enter a custom value for the RX SOP threshold in dBm. The value range is from -85 dBm through -60 dBm. For the 6-GHz band, the high threshold value is -76 dBm, the medium threshold value is -78 dBm, and the low threshold value is -80 dBm.

- h) Under **Coverage Hole Detection**, configure the following:

Note You must enable global coverage hole detection in **Design > Feature Templates > Wireless > RRM General Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for RRM general parameters, see [Create a Model Config Design for RRM General Parameters, on page 401](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- In the **Minimum Client Level (clients)** field, enter a value for the minimum number of clients. The valid range is from 1 through 200. The default value is 3.
 - In the **Data RSSI Threshold (dBm)** field, enter the data Received Signal Strength Indication (RSSI) threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
 - In the **Voice RSSI Threshold (dBm)** field, enter the voice RSSI threshold in dBm. The valid range is from -90 dBm through -60 dBm. The default value is -80 dBm.
 - In the **Exception Level (%)** field, enter an exception level. The valid range is from 0 through 100 percent. The default value is 25 percent.
- i) Under **CLIENT LIMIT**, in the **Max Clients** field, enter the maximum client limit value. The valid range is from 0 through 500.

Note

- If the wireless controller is running a version earlier than Cisco IOS XE Release 17.7.1, the maximum client limit is 200.
- If the wireless controller is running Cisco IOS XE Release 17.7.1 or later and earlier than Cisco IOS XE Release 17.9.1, the maximum client limit is 400.
- If the wireless controller is running Cisco IOS XE Release 17.9.1 or later, the maximum client limit is 500.

- j) Under **802.11ax**, configure the following multiple basic service set identifier (BSSID) and spatial reuse parameters:
- From the **6 GHz Discovery Frames** drop-down list, choose the required option from **None**, **Broadcast Probe Response**, and **FILS Discovery**.
6-GHz discovery frames are needed if the **6 GHz** radio is the only operational radio. For more information about the 6-GHz discovery frames, click **Learn More**.
 - In the **Broadcast Probe Response Interval (msec)** field, enter the broadcast probe response interval, in msec. The valid range is from 5 msec through 25 msec. The default value is 20 msec.
 - Under **MULTI BSSID**, check the check boxes to enable the following parameters:
 - Downlink OFDMA
 - Uplink OFDMA
 - Downlink MU-MIMO
 - Uplink MU-MIMO

Edit an AI Radio Frequency Profile

- Target wake time
- TWT Broadcast Support

Note You must enable multiple BSSID in **Design > Feature Templates > Wireless > Dot11ax Configuration** for the corresponding radio band and provision it on the managing wireless controller. For more information about the model configuration design for Dot11ax, see [Create a Model Config Design for Dot11ax Configuration, on page 392](#). For more information about provisioning, see [Provision Wireless Devices, on page 469](#).

- Check the **OBSS PD** check box to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.
- In the **Non-SRG OBSS PD Max Threshold (dBm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.
- Check the **SRG OBSS PD** check box to enable the SRG OBSS-PD functionality. SRG OBSS-PD is supported only on wireless controllers that run Cisco IOS XE Release 17.7.1 and later.
- In the **SRG OBSS PD Min Threshold (dBm)** field, enter a value for the SRG OBSS-PD minimum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -82 dBm.
- In the **SRG OBSS PD Max Threshold (dBm)** field, enter a value for the SRG OBSS-PD maximum threshold, in dBm. The valid range is from -82 dBm through -62 dBm. The default value is -62 dBm.

Step 14 Click **Save**.

What to do next

You must provision the APs to apply the RF profile settings on the device. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

Edit an AI Radio Frequency Profile

The following procedure describes how to edit an AI RF profile.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **RF Profiles**.

Step 5 In the **Wireless Radio Frequency Profile** area, click the **AI RF Profile** tab.

The **AI RF Profile** table lists the number of created AI RF profiles based on **Profile Name**, **Busy Hours**, **Busy Hour Sensitivity**, **FRA**, **DCA**, **DBS**, **TPC**, and **Mapped Buildings**.

- Step 6** Check the check box next to the AI RF profile that you want to edit.
You can edit one AI RF profile at a time.
- Step 7** Click **Edit/View**.
- Step 8** In the **Edit AI RF Profile** window, configure the AI RF profile settings. For more information, see [Create an AI Radio Frequency Profile, on page 288](#).
- Step 9** Click **Save**.

What to do next

If you update an RF profile that is already provisioned on a wireless controller and AP, you must reprovision either the wireless controller or AP. Wireless controller reprovision also pushes the RF profiles updates to the devices and reprovisioning the AP is not necessary. For more information about provisioning a wireless controller, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

Delete an AI Radio Frequency Profile

The following procedure describes how to delete an AI RF profile.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **RF Profiles**.
- Step 5** In the **Wireless Radio Frequency Profile** area, click the **AI RF Profile** tab.
- The **AI RF Profile** table lists the number of created AI RF profiles based on **Profile Name**, **Busy Hours**, **Busy Hour Sensitivity**, **FRA**, **DCA**, **DBS**, **TPC**, and **Mapped Buildings**.
- Step 6** To delete an AI RF profile, check the check box next to the AI RF profile that you want to delete.
- Step 7** Click **Delete** and then click **Yes**.
- Note** Catalyst Center does not allow you to delete an AI RF Profile which is already assigned to a building.

What to do next

If you delete an RF profile that is already provisioned on a wireless controller and AP, you must reprovision the wireless controller. Reprovisioning the AP is not necessary. For more information about provisioning a wireless controller, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

Clone an AI Radio Frequency Profile

You can create a copy of an AI RF profile by cloning it. Cloning allows you to reuse the configurations of an existing AI RF profile for a new AI RF profile.

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- | | |
|----------------|--|
| Step 1 | From the top-left corner, click the menu icon and choose Design > Network Settings |
| Step 2 | Click the Wireless tab. |
| Step 3 | From the left hierarchy tree, choose Global . |
| Step 4 | Click RF Profiles . |
| Step 5 | Click the AI RF Profile tab. |
| Step 6 | Check the check box next to the profile name that you want to clone. |
| Step 7 | Click Create a Clone . |
| Step 8 | In the Profile Name field of the Create AI Radio Frequency Profile window, enter a unique name for the profile. |
| Step 9 | Edit the RF profile configurations as necessary. For more information, see Create an AI Radio Frequency Profile, on page 288 . |
| Step 10 | Click Save . |
-

Configure AI-Enhanced RRM

The following procedure describes how to assign an AI RF profile to a building.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

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- | | |
|---------------|--|
| Step 1 | From the top-left corner, click the menu icon and choose Workflows > Configure AI-Enhanced RRM . |
| Step 2 | In the Configure AI-Enhanced RRM window, click Let's Do it to go directly to the workflow. |
| Step 3 | In the Task Name field of the Get Started window, enter a task name. |
| Step 4 | In the Select Deployment Type window, select the deployment type from the available options. The options are Enable Without Device Provisioning and Enable with Device Provisioning . |
| Step 5 | In the Select Locations to Enable AI-Enhanced RRM window, select the locations where you want to assign the AI-enabled RF profiles. You can either search for a site by entering its name in the Search field, or expand Global and choose the sites. |

The **Site selection summary** table lists the sites based on the site selection in the site hierarchy and displays the **Selected Location**, **Impacted Location**, **Primary WLC**, and **Secondary WLC** of the selected sites.

- **Selected Locations:** A location that is being enabled for the AI RF profile.
- **Impacted Locations:** A location that is being partially managed by the same wireless controller of the selected location.
- **Primary WLC:** The primary wireless controller assigned to the location. Click **Assign** to assign a wireless controller. It's mandatory to assign the primary wireless controller.

- **Secondary WLC:** The secondary wireless controller assigned to the impacted location. It's optional to assign a secondary wireless controller. Click **Assign** to open the **Secondary Wireless Controller** dialog box. Select the deployment type, choose a wireless controller from the **Wireless Controller** table, and click **Confirm**.

Note When a wireless controller manages more than one building and if you enable the AI RF profile only on one building, Catalyst Center automatically enables other buildings with the same AI RF profile.

For example, if two wireless controllers manage three buildings and you enable AI RF profile on one building, Catalyst Center automatically enables the other two buildings with the same AI RF profile.

Step 6 In the **Assign AI RF Profile and Verify Tags** window, the **Building** table lists AI RF profiles based on **Location**, **Floors**, and **Current RF Profiles**.

- a) In the **Building** table, choose an AI-enabled RF profile from the drop-down list under **Select the AI RF profile** for the specific location.
- b) Click the three dots under the Action column to create a new AI RF profile or clone the existing RF profile.
- c) You can also create an AI RF profile from the **Create a new AI RF Profile to apply** link in the **Assign AI RF Profile and Verify Tags** window. For more information, see [Create an AI Radio Frequency Profile, on page 288](#).

Step 7 In the **Details of selected AI RF Profile** window, review the **AI Settings**, **Common Settings**, and **Assignment** details of the AI-enabled RF profiles.

Note AI-enhanced RRM computation occurs every 30 minutes. RRM decisions are updated and pushed to devices after the computation.

Step 8 In the **Summary** window, review the **Task Details**, **Select Deployment Type**, **Select Locations to Enable AI-Enhanced RRM** and **Assign AI RF Profile and Verify Tags**.

Step 9 In the **Schedule Task** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 10 Click **Deploy**.

Step 11 (Optional) In the **Download a backup of current RF settings** dialog box, you can download a backup CSV file that contains the selected buildings' current RF configuration details. When you're ready, click **Confirm** to continue.

Tip If you disable AI-Enhanced RRM later, you can use this backup CSV file to update the RF profile configurations. For more information, see [Unassign a Location from an Existing AI RF Profile, on page 302](#).

Step 12 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

Assign a Location to an Existing AI RF Profile

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 13

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Assign a Location to an Existing AI RF Profile

The following procedure describes how to assign a location to an existing AI RF profile.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

Step 3

From the left hierarchy tree, choose **Global**.

Step 4

Click **RF Profiles**.

- Step 5** In the **Wireless Radio Frequency Profile** area, click the **AI RF Profile** tab. The **AI RF Profile** table lists the number of created AI RF profiles.
- Step 6** Click the three dots under the **Action** column for an AI RF profile.
- Step 7** From the drop-down list, choose **Assign Location**.
The **Manage Location Assignment** window opens.
- Step 8** You can either search for a site by entering its name in the **Search** field, or expand **All Sites** to choose the sites.
- Note**
- The site hierarchy shows the AI-enabled locations.
 - Sites or buildings that are not eligible for the AI profile are disabled.
 - You cannot select a floor under a building. When you select a building for an AI-enabled RF profile, the floors underneath are assigned automatically.
- If the same wireless controller manages other buildings, the **Confirm Impacted Sites** window opens.
- Step 9** Review the confirmation and click **Confirm** to assign the chosen sites to the AI-enabled RF profile.
- Step 10** In the **Schedule Task** window, depending on the Visibility and Control of Configurations settings, choose an available option:
- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
- If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Step 11** Click **Deploy**.
- Step 12** (Optional) In the **Download a backup of current RF settings** dialog box, you can download a backup CSV file that contains the selected buildings' current RF configuration details. When you're ready, click **Confirm** to continue.
- Tip**
- If you disable AI-Enhanced RRM later, you can use this backup CSV file to update the RF profile configurations. For more information, see [Unassign a Location from an Existing AI RF Profile, on page 302](#).
- Step 13** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
 - After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.
- For more information, see [Network Provisioning Prechecks, on page 137](#).
- If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Unassign a Location from an Existing AI RF Profile

Step 14 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

What to do next**Provision Devices of an AI RF Profile-Enabled Building**

The following procedure describes how to provision devices across the locations to deploy the AI RF profile.

- From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
In the **Inventory** window, the **Device** table lists the discovered AI RF profile associated devices.
- Check the check box next to the AI RF profile associated device name that you want to provision.
- From the **Actions** drop-down list, choose **Provision > Provision Device**.
- Proceed through all the steps and in the **Summary** step, click **Deploy**.
- In the **Summary** window, view the remaining network settings that will be pushed to the device. For more information, see [Wireless Device Provisioning Overview, on page 469](#).

Unassign a Location from an Existing AI RF Profile

The following procedure describes how to unassign a location from an existing AI RF profile.

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **RF Profiles**.
- Step 5** In the **Wireless Radio Frequency Profile** area, click the **AI RF Profile** tab.
The **AI RF Profile** table lists the number of created AI RF profiles.
- Step 6** Click the three dots under the **Action** column for an AI RF profile.
- Step 7** From the drop-down list, choose **Unassign Location**.
The **Unassign AI RF Profile** window opens.
- Step 8** Check the check box next to a site to unassign an AI RF profile.
- Step 9** Click the **Select from available RF Profiles** radio button to select an available RF profile that you want to assign to the chosen location.
- Step 10** From the **Select RF Profile to Replace** drop-down list, choose an RF profile.
The **Select RF Profile to Replace** drop-down list shows AI RF profiles and basic RF profiles.
If you select a basic RF profile from the drop-down list, a **Confirm Impacted Sites** window validates whether the same wireless controller manages the other site.
Review the **Confirm Impacted Sites** window and click **Confirm** to assign the chosen sites to the selected RF profile.
- Step 11** Click **Upload a CSV with RF settings back** to upload a backup of the RF settings from your local machine.
- Step 12** Click **Choose a file** to import the CSV file, or drag and drop the CSV file to the drag and drop area.
Note The maximum size of the CSV file is 10 MB.
From the uploaded CSV file, if you find an RF setting based on the selected location name, a **Confirm RF Settings for Selected Locations** window shows the **Location** and **Matched RF Profiles**.
- Step 13** Review the **Confirm RF Settings for Selected Locations** window and click **Confirm**.
- Step 14** In the **Schedule Task** window, depending on the Visibility and Control of Configurations settings, choose an available option:
- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
- If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Step 15** Click **Unassign**.
- Step 16** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

Unassign a Location from an Existing AI RF Profile

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 17 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

What to do next

Provision Devices of an AI RF Profile-Enabled Building

The following procedure describes how to provision the devices across the AI RF profile assigned locations to deploy the AI RF profile.

1. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
In the **Inventory** window, the **Device** table lists the discovered AI RF profile associated devices.
2. Check the check box next to the AI RF profile associated device name that you want to provision.

3. From the **Actions** drop-down list, choose **Provision > Provision Device**.
4. Proceed through all the steps and in the **Summary** step, click **Deploy**.
5. In the **Summary** window, review the remaining network settings that will be pushed to the device. For more information, see [Wireless Device Provisioning Overview, on page 469](#).

Upgrade a Basic Radio Frequency Profile to an AI Radio Frequency Profile

Before you begin

Ensure that the prerequisites are met. For more information, see [Prerequisites for Configuring AI Radio Frequency Profiles, on page 288](#).

To onboard a site in an AI-enhanced RRM service, at least one of the following services must be enabled:

- Flexible Radio Assignment (FRA)
- Dynamic Channel Assignment (DCA)
- Transmit Power Control (TPC)
- Dynamic Bandwidth Selection (DBS)

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **RF Profiles**.

Step 5 Check the check box next to the basic RF profile name that you want to upgrade to an AI RF profile.

Step 6 From the **Action** drop-down list, choose **Upgrade to AI**.

Step 7 In the confirmation window, click **Yes**.

Step 8 In the **Edit AI RF Profile** window, configure the AI RF profile settings. For more information, see [Create an AI Radio Frequency Profile, on page 288](#).

Create an AP Authorization List

Catalyst Center allows you to configure a list of authorized APs. Catalyst Center supports the following types of AP authorization:

- Local authorization uses the AP MAC address, serial number, or both for authorization against the local database.
- AAA authorization uses a list of AAA servers for authorization.

You can choose the AP authorization list while provisioning the Cisco Wireless Controller. Cisco Wireless Controllers respond only to requests from the APs that are present in the AP authorization list.

**Note**

- If both MAC address and serial number are required for AP authorization, ensure that both are added to the AP authorization list. If one of these AP entries isn't available in the AP authorization list provisioned for a wireless controller, the corresponding AP can't join the network.
- For a mesh AP (MAP), you must add the MAC address for AP authorization.
- For Cisco AireOS Wireless Controllers, Catalyst Center supports only the MAC address for AP authorization. If you configure both MAC address and serial number, only the MAC address is used for Cisco AireOS Wireless Controllers.
- For Cisco Catalyst 9800 Series Wireless Controllers, Catalyst Center supports the configuration of AP authorization lists only on the wireless controllers running Cisco IOS Release 17.5 and later.

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

Step 3

From the left hierarchy tree, choose **Global**.

Step 4

Click **Security Settings**.

Step 5

Click the **AP Authorization List** tab.

Step 6

In the **AP Authorization List** table, click **Add**.

Step 7

In the **List name** field of the **AP Authorization List** slide-in pane, enter a name for the AP authorization list.

Step 8

To configure local authorization, do the following:

- a) In the **Local Auth** tab, check the **Configure Local Authorization** check box.
- b) In the **Type** area, choose an authorization type:
 - To use the AP MAC address for authorization, click **Mac Address**.
 - To use the AP serial number for authorization, click **Serial Number**.
- c) To enter the AP MAC address or serial number data, do one of the following:
 - To add the MAC address or serial number individually to the authorization list, click **Add**. In the **AP Entry** field, enter the data.
 - To upload the CSV file with the data, click **Upload**. In the dialog box, do the following:
 1. Drag and drop your CSV file into the drag and drop area. Alternatively, click **Choose a file** and browse to select your CSV file stored locally.

Note

If you don't have a CSV file, click **Download** to download a CSV file that you can edit and upload.

2. Click Save.

- d) (Optional) To use both the MAC address and serial number for authorization:

1. Click **Mac Address**, and enter the AP MAC address data ([8.c, on page 306](#)).
2. Click **Serial Number**, and enter the AP serial number data ([8.c, on page 306](#)).

Step 9

To configure AAA authorization, do the following:

- a) In the **AAA Auth** tab, check the **Configure AAA Authorization** check box.
- b) Based on the AP authorization requirement for the AAA server, do one of the following:
 - If the AAA server uses only the MAC address for AP authorization, check the **Authorize AP against MAC Address** check box.
 - If the AAA server uses only the serial number for AP authorization, check the **Authorize AP against Serial Number** check box.
 - If the AAA server uses both the MAC address and serial number for AP authentication, check both the **Authorize AP against MAC Address** and **Authorize AP against Serial Number** check boxes.
- c) To add AP entries to the AP authorization list, do one of the following:
 - Click the plus icon (+) next to the required AP entry.
 - Click the AP entry and click **Add Selected**.
Note To choose multiple AP entries, press **Shift**, click the AP entries, and click **Add Selected**.
 - To add all the AP entries to the AP authorization list, click **Add All**.

You can use the **Search** field to filter the AP entries.

Step 10

Click **Save**.

Edit or Delete an AP Authorization List

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

Step 3

From the left hierarchy tree, choose **Global**.

Step 4

Click **Security Settings**.

Step 5

Click the **AP Authorization List** tab.

Step 6

In the **AP Authorization List** table, check the check box next to the authorization list name that you want to edit or delete.

- To edit the AP authorization list, click **Edit**. In the **AP Authorization List** slide-in pane, edit the configuration as necessary, and click **Save**. For more information, see [Create an AP Authorization List, on page 305](#).
- To delete the AP authorization list, click **Delete**, and then click **Yes**.

Create an Anchor Group

You can create anchor groups with up to three Cisco Wireless Controllers and set the priority for the anchors. You can add the following devices as anchors:

- Cisco Wireless Controllers that are managed by Catalyst Center.

Create an Anchor Group

- Cisco Wireless Controllers that are not managed by Catalyst Center (external wireless controllers).



Note You must add at least one anchor to an anchor group.

Priority order of the anchors determines the traffic sharing across the anchors:

- Equal sharing: When the priority order of all the anchors is the same (for example, 1, 1, and 1).
- Partial sharing: When the priority order of more than one anchor is the same (for example, 1, 1, and 2).
- Sequential sharing: When the priority order of the anchors is sequential (for example, 1, 2, and 3).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Anchor Groups**.

The **Anchor Groups** window opens.

Step 5 In the **Anchor Group** table, click **Add**.

In the **Anchor Group Name** field of the **Anchor Group** slide-in pane, enter the anchor group name.

Step 7 To add a managed wireless controller as an anchor, click **Add Managed WLC** and do the following in the **Add Managed WLC** dialog box:

- Check the check box next to the name of the devices that you want to add as anchors.

To search for a device, in the **Search Table** search field, enter either the partial name or the full name of the device and press **Enter**.

- Click **Add**.

Step 8 (Optional) To add an external wireless controller as an anchor, click **Add External WLC** and do the following in the **Add External WLC** dialog box:

- In the **Device Name** field, enter the device name.
- From the **Device Series** drop-down list, choose a device series.
- In the **Peer IP Address** field, enter the peer IP address.
- (Optional) In the **NAT IP Address** field, enter the Network Address Translation (NAT) IP address.
- In the **MAC Address** field, enter the MAC address of the device.
- In the **Mobility Group Name** field, enter the mobility group name.
- (Optional) In the **Hash** field, enter the hash for the Cisco Catalyst 9800 Series Wireless Controller.

Note This field is available for only the Cisco Catalyst 9800-CL Wireless Controllers.

- Click **Add**.

Step 9 (Optional) To add an existing external wireless controller as an anchor, click **Add Existing External WLC** and do the following in the **Add Existing External WLC** dialog box:

- Check the check box next to the name of the devices that you want to add as anchors.

To search for a device, in the **Search Table** search field, enter either the partial name or the full name of the device and press **Enter**.

- b) Click **Add**.

Step 10 (Optional) To set the priority for an anchor, from the **Priority Order** drop-down list, choose the priority for the anchor wireless controller.

Step 11 Click **Save**.

Edit or Delete an Anchor Group

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Anchor Groups**.

Step 5 In the **Anchor Group** table, check the check box next to the anchor group that you want to edit or delete.

- To edit the anchor group, click **Edit**. In the **Anchor Group** slide-in pane, configure the anchors and click **Save**. For more information, see [Create an Anchor Group, on page 307](#).
 - To delete the anchor group, click **Delete** and then click **Yes**.
-

AP Profiles

AP profiles consolidate the AP authentication settings for Plug and Play (PnP), Cisco Advanced Wireless Intrusion Prevention System (aWIPS), rogue management, and mesh networks. AP profiles allow you to manage and provision APs.

Catalyst Center provides a default AP profile for Cisco IOS XE devices and Cisco AireOS devices. You can edit the default AP profiles, but you can't delete them. Site tags and AP groups generated by Catalyst Center use the default AP profiles.

If your authentication method is EAP-Transport Level Security (EAP-TLS), which uses certificate-based authentication, you cannot use a subordinate CA certificate. With EAP-TLS authentication for AP profiles, you can only use a root CA certificate.



Note

When you upgrade to Release 2.3.7.x from an earlier version, by default, Catalyst Center doesn't push the default AP profile to the wireless controller. To update the default AP profile on the wireless controller, you must explicitly save it on the **AP Profiles** window. For more information, see [Edit or Delete an AP Profile, on page 318](#).

When you save the default AP profile, if there's a difference between the current wireless controller configuration and the AP profile configuration saved on Catalyst Center, Catalyst Center pushes the default AP profile to the wireless controller during subsequent reprovisioning.

After saving the default AP profile, there's no option to prevent Catalyst Center from pushing the default AP profile to the wireless controller during reprovisioning.

Create an AP Profile for Cisco IOS XE Devices

You can also create custom AP profiles for Cisco IOS XE and Cisco AireOS devices. To assign an AP profile to a site, associate it with a wireless network profile.

Create an AP Profile for Cisco IOS XE Devices

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **AP Profiles**.
- Step 5** In the **AP Profile** table, hover your cursor over **Add** and choose **AP Profile for IOS-XE**.
- Step 6** In the **Create Access Point Profile** window, enter a name for the AP profile.
- Step 7** (Optional) Enter a description for the AP profile.
- Step 8** If this AP profile is for remote teleworker APs or Cisco OfficeExtend APs, check the **Remote Teleworker** check box. You can enable or disable the **Remote Teleworker** check box only while creating the AP profile. You can't update this option for existing AP profiles.

Note Remote teleworker-enabled AP profiles don't support the following settings:

- aWIPS application
- Rogue detection
- Mesh
- Power

- Step 9** Configure the required settings in the followings tabs:
 - a) **Management**: For more information, see [Configure Management Settings for an AP Profile for Cisco IOS XE Devices, on page 310](#).
 - b) **Security**: For more information, see [Configure Security Settings for an AP Profile for Cisco IOS XE Devices, on page 312](#).
 - c) **Mesh**: For more information, see [Configure Mesh Settings for an AP Profile for Cisco IOS XE Devices, on page 313](#).
 - d) **Power**: For more information, see [Configure Power Settings for an AP Profile for Cisco IOS XE Devices, on page 314](#).
 - e) **Additional**: For more information, see [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices, on page 315](#).
 - Step 10** Click **Save**.
-

Configure Management Settings for an AP Profile for Cisco IOS XE Devices

Use this procedure to configure the following for an AP profile for Cisco IOS XE devices:

- Authentication settings to onboard APs securely during the PnP claim process. Based on the authentication settings configured at the global-level or site-level hierarchy in Catalyst Center, PnP pushes the 802.1x (Dot1x) supplicant and certificates when claiming an AP. The AP uses the 802.1x supplicant for authenticating with Cisco ISE.

- Authentication settings for day-*n* authentication of APs.
- Credentials for console access, SSH, and Telnet.
- Enabling Cisco Discovery Protocol (CDP) to make an AP discoverable to its neighboring devices.

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for IOS-XE**), click the **Management** tab.

Step 2 In the **Access Points Authentication** area, choose an authentication method.

Note This authentication method is used during the AP PnP claim and day-*n* authentication. Changing the authentication method impacts the service of the APs onboarded through the PnP claim process. If you change the authentication method, perform a factory reset for the APs onboarded through PnP claim process. If an AP joins with a different Extensible Authentication Protocol (EAP) method, the EAP method changes based on the authentication method that you choose.

The following authentication methods are available:

- **NO-AUTH**: Default authentication method.
 - **EAP-TLS**: EAP-Transport Level Security (EAP-TLS) uses certificate-based authentication.
 - **EAP-PEAP**: EAP-Protected Extensible Authentication Protocol (EAP-PEAP) provides mutual authentication, ensures confidentiality and integrity to vulnerable user credentials, protects itself against passive (eavesdropping) and active (man-in-the-middle) attacks, and securely generates cryptographic keying material. EAP-PEAP is compatible with the IEEE 802.1X standard and RADIUS protocol.
- If you choose **EAP-PEAP**, enter a username and password. Catalyst Center generates a certificate and applies it during the PnP claim process.
- **EAP-FAST**: EAP-Flexible Authentication through Secure Tunneling (EAP-FAST) provides mutual authentication and uses a shared secret to establish a tunnel. The tunnel is used to protect weak authentication methods that are based on passwords. The shared secret, referred to as a Protected Access Credentials (PAC) key, is used to mutually authenticate the client and server while securing the tunnel.

If you choose **EAP-FAST**, enter a username and password. Catalyst Center generates a certificate and applies it during the PnP claim process.

Step 3 In the **SSH and Telnet** area, configure the following:

- (Optional) Click the **SSH** toggle button to configure the credentials for SSH.
- (Optional) Click the **Telnet** toggle button to configure the credentials for Telnet.
- In the **Username** field, enter the name used to authenticate the device.

The username can't contain spaces or angle brackets (<>).

Note If you disable SSH and Telnet, the **Username** field is optional.

- In the **Password** field, enter the password used to authenticate the device.

Note If you disable SSH and Telnet, the **Password** field is optional.

- In the **Enable Password** field, enter the password to enable a higher privilege level in the CLI.

Note If you disable SSH and Telnet, the **Enable Password** field is optional.

Configure Security Settings for an AP Profile for Cisco IOS XE Devices

Step 4 In the **Cisco Discovery Protocol (CDP) State** area, click the **CDP State** toggle button to enable or disable CDP.

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Configure Security Settings for an AP Profile for Cisco IOS XE Devices

Use this procedure to configure the following for an AP profile for Cisco IOS XE devices:

- Cisco Advanced Wireless Intrusion Prevention System (aWIPS) and forensic capture to detect intrusion threats and mitigate them. Catalyst Center supports aWIPS for devices running Cisco IOS XE Release 17.3.1 or later.
 - Rogue detection to detect the APs that are installed on the network without explicit authorization from a system administrator. Catalyst Center supports rogue detection for devices running Cisco IOS XE Release 17.4 or later.
-

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for IOS-XE**), click the **Security** tab.

Step 2 In the **aWIPS and Forensic Capture Enablement** area, configure the following:

- a) Click the **aWIPS** toggle button to enable or disable aWIPS.
- b) Click the **Forensic Capture Enablement** toggle button to enable or disable forensic capture.

Note You must enable the **aWIPS** toggle button to use the **Forensic Capture Enablement** toggle button.

Step 3 In the **Rogue Detection** area, configure following:

- a) Click the **Rogue Detection** toggle button to enable or disable rogue detection.
- b) In the **Minimum RSSI** field, enter the valid RSSI value. The valid range is from -128 to -70 dBm. The default value is -90 dBm.
- c) In the **Transient Interval** field, enter a valid transient time interval in seconds. The valid transient interval ranges from 120 to 1800 seconds. The default value is 0.
- d) In the **Report Interval** field, enter a valid report time interval in seconds. The valid report interval ranges from 10 to 300 seconds. The default value is 10 seconds.

Step 4 In the **Rogue Containment** area, click the **PMF Denial** toggle button to enable the containment for rogue AP doing Protected Management Frame (PMF).

Note **PMF Denial** is supported from IOS-XE version 17.12 and above.

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Configure Mesh Settings for an AP Profile for Cisco IOS XE Devices

Use this procedure to configure the mesh settings for an AP profile for Cisco IOS XE devices.

Before you begin

Ensure that you add the MAC address of the mesh access point (MAP) to the AP authorization list. For more information, see [Create an AP Authorization List, on page 305](#).

Step 1 In the **Create Access Point Profile** window (**Design** > **Network Settings** > **Wireless** > **AP Profiles** > **Add** > **AP Profile for IOS-XE**), click the **Mesh** tab.

Step 2 Click the **Mesh** toggle button.

Note If you disable the **Mesh** toggle button, the existing custom mesh settings are deleted, and the AP profile is associated with the default mesh profile on the device.

Step 3 (Optional) In the **Range - Root AP to Mesh AP (in feet)** field, enter the maximum range (in feet) from the root access points (RAP) to the MAPs in the network. The valid range is from 150 feet through 132000 feet.

Step 4 (Optional) To allow wireless client association over the backhaul radio, check the **Backhaul Client Access** check box.

Generally, the backhaul radio is a 5-GHz radio for most of the MAPs. The backhaul radio can carry both backhaul traffic and client traffic.

If you disable the **Backhaul Client Access** check box, Catalyst Center sends only backhaul traffic over the backhaul radio, and client association is only over the secondary radio or radios.

Step 5 (Optional) In the **RAP Downlink Backhaul** area, choose the required option.

If your country prohibits the use of **5 GHz**, choose **2.4 GHz**. Even if your country allows the use of **5 GHz**, consider using **2.4 GHz** because 2.4-GHz radio can cover larger mesh or bridge distances.

Note

- For a mesh AP, when you change the mesh role to RAP and provision the AP, the AP reboots. RAP downlink backhaul mesh settings are effective only after the reboot.
- When you change the RAP configuration from **5 GHz** to **2.4 GHz**, Catalyst Center propagates the update from the RAP to all the MAPs. At this point, the MAPs disconnect from the 5-GHz network and connect to the 2.4-GHz network.

Step 6 (Optional) In the **Backhaul Data Rates** area, from the **5GHz Band Radio Type** and **2.4GHz Band Radio Type** drop-down lists, choose an interface rate.

Valid backhaul interface rates are **802.11abg**, **802.11n**, **802.11ac** (5-GHz band radio only), **802.11ax**, and **Auto**, depending on the AP. Backhaul creates a wireless connection between the APs. The rate selection is important for effective use of the available RF spectrum. The rate can also affect the throughput of client devices.

With the **Auto** data rate, each link can arrive at the best possible rate for its link quality.

We recommend that you configure the mesh backhaul data rate as **Auto**.

Step 7 (Optional) In the **Bridge Group Name** field in the **Bridge Group** area, enter a name of up to 10 characters for the bridge group.

A bridge group name controls the association of MAPs. By grouping radios, two networks on the same channel, but in different bridge group names can't communicate with one another. This setting is also useful if you have more than one RAP in your network in the same sector (area).

Configure Power Settings for an AP Profile for Cisco IOS XE Devices

If you don't enter a bridge group name, Catalyst Center uses the **Default** bridge group name for the mesh profile.

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Configure Power Settings for an AP Profile for Cisco IOS XE Devices

Use this procedure to configure the following for an AP profile for Cisco IOS XE devices:

- AP power profile: If an AP doesn't receive the required power, it functions in a derated state based on the settings in the AP power profile. For more information, see [Create an AP Power Profile, on page 318](#).



Note

The power settings are applicable only for the Cisco Wireless Controllers running Cisco IOS XE Release 17.10.1 and later.

- Calendar power profile: You can create calendar power profiles for APs that are in power save mode. You can map multiple AP power profiles to different calendar schedules as required. Based on the configured schedule, Catalyst Center runs all the rules defined in the AP power profiles simultaneously.

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for IOS-XE**), click the **Power** tab.

Step 2 In the **AP Power Profile** area, from the **Select Value** drop-down list, choose a power profile.

(To create a power profile, click **Create New** and configure the parameters. For more information, see [Create an AP Power Profile, on page 318](#).)

Step 3 In the **Calendar Power Profile** area, do the following:

- To add a calendar power profile, click **Add**. In the **Add Calendar Power Profile** slide-in pane, do the following:
 - From the **Select Power Profile** drop-down list, choose a power profile.
 - To create a power profile, click **Create New** and configure the parameters. For more information, see [Create an AP Power Profile, on page 318](#).
 - Choose the recurrence frequency for applying the power profile rules to the APs:
 - **Daily**: Applies the power profile rules to APs daily.
 - **Weekly**: Applies the power profile rules to APs every week on the selected days. Click the required day to select it.
 - **Monthly**: Applies the power profile rules to APs every month on the selected dates. Click the required date to select it.
 - Specify the start time and end time for the power profile rules.
 - Click **Save**.

- b) (Optional) To edit a power profile rule, check the check box next to the corresponding power profile name and click **Edit**. In the **Edit Power Profile** slide-in pane, edit the required parameters and click **Save**.
 - c) (Optional) To delete a power profile, check the check box next to the corresponding power profile name, click **Delete**, and then click **Yes**.
-

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Configure Additional Settings for an AP Profile for Cisco IOS XE Devices

Use this procedure to configure the following for an AP profile for Cisco IOS XE devices:

- Country code: Set the country code for the Rest of World (ROW) domain APs that don't have a country code configured already.



Note The country code setting doesn't impact the APs that already have a country code configured.

- Time zone: Choose the time zone for the APs.
- Client limit: Specify the maximum number of allowed clients.

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for IOS-XE**), click the **Additional** tab.

Step 2 In the **Country Code** area, from the **Select Value** drop-down list, choose a country for ROW APs that don't have a country code configured.

Step 3 In the **Time Zone** area, choose one of the following options:

- **Not Configured**: APs operate in the UTC time zone.
- **Controller**: APs operate in the Cisco Wireless Controller time zone.
- **Delta from Controller**: APs operate in the offset time from the wireless controller time zone. Configure the following offset values:
 - **HH**: Enter the hour value. The valid range is from -12 through 14.
 - **MM**: Enter the minute value. The valid range is from 0 through 59.

Step 4 In the **Client Limit** area, enter a value for the maximum client limit. The valid range is from 0 through 1200.

What to do next

After configuring all the necessary settings for the AP profile, click **Save**. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Create an AP Profile for Cisco AireOS Devices

For Cisco AireOS devices, AP profiles group the AP-level parameters and configurations. AP profiles can be mapped to custom AP groups. When APs are provisioned, all APs under the corresponding AP group are configured with the settings available in the AP profile.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **AP Profiles**.
- Step 5** In the **AP Profile** table, hover your cursor over **Add** and choose **AP Profile for AireOS**.
- Step 6** In the **Create Access Point Profile** window, enter a name for the AP profile.
- Step 7** (Optional) Enter a description for the AP profile.
- Step 8** If this AP profile is for remote teleworker APs or Cisco OfficeExtend APs, check the **Remote Teleworker** check box. You can enable or disable the **Remote Teleworker** check box only while creating the AP profile. You can't update this option for existing AP profiles.
- Note** Remote teleworker-enabled AP profiles don't support the following settings:
- Rogue detection
 - Mesh
- Step 9** Configure the required settings in the followings tabs:
- Management:** For more information, see [Configure Management Settings for an AP Profile for Cisco AireOS Devices, on page 316](#).
 - Security:** For more information, see [Configure Security Settings for an AP Profile for Cisco AireOS Devices, on page 317](#).
 - Mesh:** For more information, see [Configure Mesh Settings for an AP Profile for Cisco AireOS Devices, on page 317](#).
- Step 10** Click **Save**.
-

Configure Management Settings for an AP Profile for Cisco AireOS Devices

Use this procedure to configure the following for an AP profile for Cisco AireOS devices:

- Credentials for console access, SSH, and Telnet.
- Enable Cisco Discovery Protocol (CDP) to make the AP discoverable to its neighboring devices.

-
- Step 1** In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for AireOS**), click the **Management** tab.
- Step 2** In the **SSH and Telnet** area, configure the following:
- (Optional) Click the **SSH** toggle button to configure the credentials for SSH.
 - (Optional) Click the **Telnet** toggle button to configure the credentials for Telnet.

- c) In the **Username** field, enter the name used to authenticate the device.
Username can't contain spaces or angle brackets (<>).
Note If you disable SSH and Telnet, the **Username** field is optional.
- d) In the **Password** field, enter the password used to authenticate the device.
Note If you disable SSH and Telnet, the **Password** field is optional.
- e) In the **Enable Password** field, enter the password to enable a higher privilege level in the CLI.
Note If you disable SSH and Telnet, the **Enable Password** field is optional.

Step 3 In the **Cisco Discovery Protocol (CDP) State** area, click the **CDP State** toggle button to enable or disable CDP.

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco AireOS Devices, on page 316](#).

Configure Security Settings for an AP Profile for Cisco AireOS Devices

Use this procedure to configure rogue detection for an AP profile for Cisco AireOS devices. Rogue detection allows you to detect the APs that are installed on the network without explicit authorization from a system administrator.

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for AireOS**), click the **Security** tab.

Step 2 In the **Rogue Detection** area, click the **Rogue Detection** toggle button to enable or disable rogue detection.

What to do next

Configure the other necessary settings for the AP profile. For more information, see [Create an AP Profile for Cisco AireOS Devices, on page 316](#).

Configure Mesh Settings for an AP Profile for Cisco AireOS Devices

Use this procedure to configure the mesh settings for an AP profile for Cisco AireOS devices.

Before you begin

Ensure that you add the MAC address of the MAP to the AP authorization list. For more information, see [Create an AP Authorization List, on page 305](#).

Step 1 In the **Create Access Point Profile** window (**Design > Network Settings > Wireless > AP Profiles > Add > AP Profile for AireOS**), click the **Mesh** tab.

Step 2 Click the **Mesh** toggle button.

Step 3 (Optional) In the **RAP Downlink Backhaul** area, click the radio button next to the required option.

Edit or Delete an AP Profile

If your country prohibits the use of **5 GHz**, choose **2.4 GHz**. Even if your country allows the use of **5 GHz**, consider using **2.4 GHz** because 2.4-GHz radio can cover larger mesh or bridge distances.

Note

- For a mesh AP, when you change the mesh role to RAP and provision the AP, the AP reboots. RAP downlink backhaul mesh settings are effective only after the reboot.
- When you change the RAP configuration from **5 GHz** to **2.4 GHz**, Catalyst Center propagates the update from the RAP to all the MAPs. At this point, the MAPs disconnect from the 5-GHz network and connect to the 2.4-GHz network.

Step 4

(Optional) In the **Bridge Group Name** field in the **Bridge Group** area, enter a name of up to 10 characters for the bridge group.

A bridge group name controls the association of MAPs. By grouping radios, two networks on the same channel, but in different bridge group names, can't communicate with one another. This setting is also useful if you have more than one RAP in your network in the same sector (area).

If you don't enter a bridge group name, Catalyst Center uses the **Default** bridge group name for the mesh profile.

What to do next

After configuring all the necessary settings for the AP profile, click **Save**. For more information, see [Create an AP Profile for Cisco AireOS Devices, on page 316](#).

Edit or Delete an AP Profile**Step 1**

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

Step 3

From the left hierarchy tree, choose **Global**.

Step 4

Click **AP Profiles**.

Step 5

In the **AP Profile** table, check the check box next to the AP profile that you want to edit or delete.

- To edit the AP profile, click **Edit**. In the **Edit Access Point Profile** slide-in pane, edit the configuration as necessary, and click **Save**. For more information, see [Create an AP Profile for Cisco AireOS Devices, on page 316](#) and [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).
- To delete the AP profile, click **Delete**, and then click **Yes**.

Create an AP Power Profile

You can create AP power profiles for Cisco Wireless Controllers running Cisco IOS XE Release 17.10.1 and later. Assign an AP power profile to APs by associating it to an AP profile. You can define multiple rules for an AP power profile and specify the sequences of rules.

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2

Click the **Wireless** tab.

- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **Power Profile**.
- Step 5** In the **AP Power Profile** table, click **Add**.
- Step 6** In the **Power Profile Name** field of the **Create Power Profile** slide-in pane, enter a name for the AP power profile.
- Step 7** (Optional) In the **Description** field, enter a description for the AP power profile.
- Step 8** Click **Add** to create a rule for the AP power profile.
- Step 9** In the **Rule** dialog box, configure the following:
- From the **Interface** drop-down list, choose a type of interface.
 - From the **Interface ID** drop-down list, choose an interface ID.

Note If only one interface ID is available, Catalyst Center automatically selects the available interface ID.
 - From the **Parameter** drop-down list, choose a parameter.

Note If only one parameter is available, Catalyst Center automatically selects the available parameter.
 - From the **Parameter Value** drop-down list, choose a parameter value.

Note If only one parameter value is available, Catalyst Center automatically selects the available parameter value.
 - Click **Add**.
- Step 10** (Optional) To create another rule for the AP power profile, repeat [Step 8, on page 319](#) and [Step 9, on page 319](#).
- Step 11** (Optional) To update the sequence of a rule in the **Rules** table, click the corresponding icon, and drag and drop the rule to the required position.
- Step 12** Click **Save**.

What to do next

Associate the AP power profile with an AP profile. For more information, see [Create an AP Profile for Cisco IOS XE Devices, on page 310](#).

Edit or Delete an AP Power Profile

- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings**.
- Step 2** Click the **Wireless** tab.
- Step 3** From the left hierarchy tree, choose **Global**.
- Step 4** Click **Power Profile**.
- Step 5** In the **AP Power Profile** table, check the check box next to the AP power profile that you want to edit or delete.
- To edit the AP power profile, click **Edit**. In the **Edit Power Profile** slide-in pane, edit the description, rules, and sequence as necessary, and click **Save**. For more information, see [Create an AP Power Profile, on page 318](#).
 - To delete the AP power profile, click **Delete**, and then click **Yes**.

Provision a Cisco Sensor SSID for Nonfabric Deployment

- The Catalyst Center sensor uses the Cisco sensor provisioning Service Set Identifier (SSID) to communicate with the Plug and Play (PnP) server and obtain day-zero configurations for running tests.



Note The Cisco sensor provisioning SSID is not applicable for APs working as sensors.

- For fabric deployments, the Cisco sensor provisioning SSID is mapped to an Infrastructure Virtual Network Access Point (INFRA VN-AP) pool to communicate with Catalyst Center.
- The following platforms support the Cisco sensor provisioning SSID:
 - Cisco AireOS Wireless Controller
 - Cisco Catalyst 9800 Series Wireless Controller (both fabric and nonfabric deployments)
- The Cisco sensor provisioning SSID supports the following network controllers:
 - Cisco Catalyst 9800 Series Wireless Controllers for Cloud
 - Cisco Catalyst 9800 Series Wireless Controller
 - Cisco AireOS Wireless Controller

The following procedure enables you to configure the Cisco sensor provisioning SSID for nonfabric deployments.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 Click **SSIDs**.

Step 4 From the **SSID** table, hover over and choose **Enterprise**.

The **Wireless SSID** workflow opens.

Step 5 In the **Basic Settings** window, click the **Sensor** field and then click **Next**.

Note The parameters for the SSID are automatically populated and cannot be edited.

Step 6 In the **Associate SSID to Profile** window, from the left pane, select a profile and do the following:

- Under **Fabric**, select **Yes**.
- Click **Associate Profile**.
- Click **Next**.

Note If you don't have a profile, click **Add Profile** and configure the profile settings.

Step 7 In the **Summary** window, review the configuration settings.

Step 8 Click **Save**.

Step 9 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

Step 10 Check the check box next to a device and from the **Actions** drop-down list, choose **Provision > Provision Device**.

- Step 11** Review the details under **Assign Site**, **Configuration**, **Model Configuration**, **Advanced Configuration**, and **Summary**. Click **Next** after each screen.
- Step 12** Click **Deploy**.
- The **Provision Device** dialog box is displayed.
- Step 13** Choose **Now** and click **Apply**.
- Result:** The message **Task Scheduled view status in Tasks** is displayed at the bottom-right corner.
- Step 14** (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Manage Backhaul Settings

Use this procedure to view, create, and manage backhaul configurations for wireless sensors. A wireless sensor requires a backhaul SSID to communicate with Catalyst Center.

- Step 1** From the top-left corner, click the menu icon and choose **Assurance > Settings > Sensors**.
The **Sensor List** window appears.
- Step 2** Hover your cursor over the **Settings** tab and choose **Backhaul Settings**.
- Step 3** You can add and manage backhaul SSIDs by doing the following:
- Click + **Add Backhaul**.
The **Create Sensor Backhaul SSID Assignment** window appears with two areas: **Wired Backhaul** and **Wireless Backhaul**.
 - In the **Settings Name** field, enter a name for the backhaul SSID.
 - In the **Wired Backhaul** area, configure the following:
 - Level of Security:** Displays the encryption and authentication type used by the selected SSID. The available security options are:
 - 802.1x EAP:** Standard used for passing Extensible Authentication Protocol (EAP) over wired LAN.
 - Open:** No security or authentication is used.
 - EAP Method:** If you choose **802.1x EAP**, you must choose one of the following EAP methods for user authentication from the drop-down list:
 - EAP-FAST:** Enter the username and password in the fields provided.
 - PEAP-MSCHAPv2:** Enter the username and password in the fields provided.
 - EAP-TLS:** Choose **Enroll Using Certificate Bundle** or **Enroll Using SCEP**.
If you choose **Enroll Using Certificate Bundle**, click the drop-down arrow under **Certificate Bundle**, click + **Add New Certificate Bundle**, and enter the username and certificate bundle password.
 - PEAP-TLS:** Choose **Enroll Using Certificate Bundle** or **Enroll Using SCEP**.

Create an Antenna Radio Profile

If you choose **Enroll Using Certificate Bundle**, click the drop-down arrow under **Certificate Bundle**, click **+ Add New Certificate Bundle**, and enter the username and certificate bundle password.

- d) In the **Wireless Network Name (SSID)** area, select the wireless network (SSID) and configure the following.
 - **Level of Security:** Displays the encryption and authentication type used by the selected SSID. The available security options are:
 - **WPA2 Enterprise:** Provides a higher level of security using Extensible Authentication Protocol (EAP) (802.1x) to authenticate and authorize network users with a remote RADIUS server.
 - **WPA2-Personal:** Provides a good security using a passphrase or a preshared key (PSK). This allows anyone with the passkey to access the wireless network.
 - If you select **WPA2 Personal**, enter the passphrase in the **Passphrase** text box.
 - **PSK Format:** The available preshared key formats are:
 - **ASCII:** Supports ASCII PSK passphrase.
 - **HEX:** Supports 64-character HEX key PSK password.
 - **Open:** No security or authentication is used.

- e) Click **Save**.

Step 4

You can edit the existing backhaul configurations by doing the following:

- a) Check the check box of the backhaul configuration.
- b) Hover your cursor over the **Actions** drop-down list and choose **Edit**.

Step 5

You can delete a backhaul configuration by doing the following:

- a) Check the check box of the backhaul configuration.
- b) Hover your cursor over the **Actions** drop-down list and choose **Delete**.

Create an Antenna Radio Profile

Catalyst Center supports the C-ANT9104 antenna, which integrates with the Cisco Catalyst 9130AXE Unified Access Point to provide dual 5-GHz 4x4 radios with high gain, steerable, and switchable functions. With Catalyst Center, you can select the beam steering (direction) for the antennae. The following modes are available:

- Wide beam
- Narrow beam
- Narrow beam with 10 degrees of tilt
- Narrow beam with 20 degrees of tilt

You can configure wide and narrow beamwidth states for installations where high user density, precise pattern control, and long-range performance in the 5-GHz band are required.

The beam steering configuration is available for antenna combinations ABCD (left antennae) and EFGH (right antennae). The antenna pattern names are set based on the selected beam. You can visualize the heatmaps on Catalyst Center floor maps.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Antenna Radio Profiles**.

Step 5 In the **Antenna Radio Profile** table, click **Add**.

Step 6 Configure wide and narrow beam steering for the antennae in the **Antenna Radio Profile** slide-in pane:

- In the **Radio Profile Name** field, enter a unique name for the radio profile.
- From the **Beam Steer Mode** drop-down list, choose a beam steering mode.

Step 7 Click **Save**.

The new antenna radio profile is displayed in the **Antenna Radio Profile** table.

Edit or Delete an Antenna Radio Profile

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose **Global**.

Step 4 Click **Antenna Radio Profiles**.

Step 5 In the **Antenna Radio Profile** table, check the check box next to the antenna radio profile name that you want to edit or delete.

- To edit the antenna radio profile, click **Edit**. In the **Antenna Radio Profile** slide-in pane, edit the configuration as necessary, and click **Save**. For more information, see [Create an Antenna Radio Profile, on page 322](#).
- To delete the antenna radio profile, click **Delete** and then click **Yes**.

About Cisco Connected Mobile Experiences Integration

Catalyst Center supports the integration of on-premises Cisco Connected Mobile Experiences (CMX) for wireless maps. With the CMX integration, you can get the exact location of your wireless clients, rogue access points and interferers on the floor map within the Catalyst Center user interface.

Depending on your requirements, you can create CMX settings either at the global level or at the site, building, or floor level. For a small enterprise, you can assign CMX at the global level, which is the parent node. All children inherit their settings from the parent node. For a medium enterprise, you can assign CMX at the building level, and for a large enterprise, you can assign CMX at the floor level.



Note CMX should be anonymized for security purposes.

Create Cisco CMX Settings

Before you begin

Make sure that CMX is configured with a valid SSL/TLS certificate. See the [CMX 10.5 SSL certificate installation procedure](#).

Step 1 From the top-left corner, click the menu icon and choose **System > Settings**.

Step 2 From the **External Services** section, click **Cisco Spaces/CMX Servers**.

The **Cisco Spaces/CMX Servers** window opens.

Step 3 From the **CMX Servers** table, click **Add**.

Step 4 Complete the fields in the **Add CMX Server** slide-in pane:

- **IP Address:** Enter the valid IP address of the CMX web GUI.
- **Username:** Enter the CMX web GUI username.

Note To assign a CMX server to a site, building, or floor, you must have Write permission on **Network Hierarchy**. For more information, see the "Catalyst Center User Role and Permissions" section in the [Cisco Catalyst Center Administrator Guide](#).

- **Password:** Enter the password credentials.

Note Make sure that CMX is reachable.

Step 5 Click **Add**.

The connection status is shown in three stages as follows:

- **Initiating Connection:** Verifies connectivity to the server.
- **Establishing Trust:** Establishes trust to the CMX server. The CMX server must have a valid SSL/TLS certificate configured to establish trust. If the certificate is not yet stored in Catalyst Center Trusted Certificates, you will be prompted to **Accept** the certificate to continue.
- **Connecting CMX Server:** Validates the user credentials provided.

Step 6 To assign a CMX server to a site, building, or a floor, click the menu icon and choose **Design > Network Settings**.

Step 7 Click the **Wireless** tab.

Step 8 From the left hierarchy tree, choose either **Global** or the required area, building, or floor.

Step 9 Click **Cisco Spaces/CMX Servers**.

Step 10 In the **Cisco Spaces/CMX Servers** section, from the **Location Settings** drop-down list, choose the CMX server.

Step 11 Click **Save**.

The **Create CMX Settings** window opens.

After the CMX is added, if you make any changes to the floor on the **Network Hierarchy** page, the changes are synchronized automatically with the CMX.

When the CMX is synced, Catalyst Center starts querying the CMX for the client location and displays the location on the floor map.

Step 12 From the floor map, you can do the following:

- View the location of the client, which is shown as a blue dot.
- Hover your cursor over an AP. A dialog box is displayed with **Info**, **Rx Neighbor**, and **Clients** tabs. Click each tab for more information. Click **Device 360** to open the Device 360 window and view issues. Click an issue to see the location of the issue and the location of the client device.
- Click an AP to open a side bar with details about the AP.
- Perform real-time client tracking when Intelligent Capture and CMX are integrated.

Step 13 If the CMX was down when you made changes, you must synchronize manually. To do so, on the **Network Hierarchy** window, hover your cursor over the ellipsis  next to the building or floor on which you made the changes in the left hierarchy tree, and then choose **Sync: Cisco Spaces/CMX Servers** to push the changes manually.

Step 14 To edit the CMX server details or delete a CMX server, do the following:

- a) From the top-left corner, click the menu icon and choose **System > Settings**.
- b) From the **External Services** section, click **Cisco Spaces/CMX Servers**.
- c) Select the CMX server that you want to edit, make any changes, and click **Update**.
- d) Select the CMX server that you want to delete and click **Delete**.
- e) Click **OK** to confirm the deletion.

For CMX Connection Failure

- Check if you have uploaded the CMX certificate to **System > Settings > Trusted Certificates**.
- After upgrading to Catalyst Center, edit the CMX connection details to reestablish the connection by reviewing and accepting the CMX SSL/TLS certificate.

For CMX Authentication Failure

- Check if you are able to log in to the CMX web GUI with the credentials that you provided at the time of CMX settings creation on Catalyst Center.
- Check if you are able to log in to the CMX console using SSH.
- Check if you are able to exercise CMX REST APIs using the API Documentation link on the CMX GUI.

If Clients Do Not Appear on the Catalyst Center Floor Map

- Check if the Cisco wireless controller on the particular floor is configured with CMX and is active.
- Check if the CMX GUI shows clients on the floor map.
- Use the Catalyst Center Maps API to list the clients on the floor:
`curl -k -u <user>:<password> -X GET /api/v1/dna-maps-service/domains/<floor group id>/clients?associated=true`

About Cisco Spaces Integration

Enterprises operating in the physical world have limited to no visibility into the behavior of people and connected assets within their buildings. Cisco Spaces solves this physical blind-spot problem using location-sensing intelligence from all underlying Cisco wireless networks and translating the data into business-ready insights.

Catalyst Center integrates with Cisco Spaces to provide you with the exact location of wireless clients, rogue APs, and interferers on Catalyst Center floor maps. Depending on your requirements, you can create Cisco Spaces settings either at the global level or at the site, building, or floor level.

When you assign Cisco Spaces at the global level or at the site, building, or floor level, Catalyst Center automatically sends the floor map configuration to Cisco Spaces. Similarly, any time you save a change to a floor map, Catalyst Center automatically synchronizes the floor map configuration with Cisco Spaces. Synchronization occurs serially; one floor map doesn't start to synchronize until the previously configured floor map synchronization is completed. So, if multiple floors are configured in close succession, it can take a long time to complete.

You can also trigger a manual synchronization of floor maps to Cisco Spaces. However, we recommend that you use discretion when using this option. When a manual synchronization is triggered, the Catalyst Center GUI hangs until the synchronization has completed and Catalyst Center returns a response to indicate the synchronization success or failure. Additionally, if an automatic synchronization is already in progress when a manual synchronization is triggered, the manual synchronization won't start until the automatic synchronization is done. While waiting for the automatic synchronization to end and during the manual synchronization itself, the Catalyst Center GUI hangs. In these cases, depending on the number of floor maps contained in the site, the Catalyst Center GUI could hang for a long period.

Therefore, you should use the manual synchronization option only in the unlikely event that the automatic map synchronization to Cisco Spaces fails due to a network issue or a temporary service outage. The manual synchronization option should not be used on a consistent basis to update floor map changes with to Cisco Spaces.

To integrate Cisco Spaces with Catalyst Center, see the "Catalyst Center Integration" section in the [Cisco Spaces Configuration Guide](#).

Assign Cisco Spaces to Sites

To monitor sites using Cisco Spaces, you need to assign Cisco Spaces to the site that you want to monitor.

Before you begin

Integrate Cisco Spaces with Catalyst Center. For details, see the [Cisco Spaces Configuration Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose either **Global** or the area, building, or floor to which you want to assign Cisco Spaces.

Step 4 Click **Cisco Spaces/CMX Servers**.

Step 5 In the **Cisco Spaces/CMX Servers** window, from the **Location Services** drop-down list, select a site.

Step 6 Click **Save**.

Catalyst Center deploys the site information to Cisco Spaces automatically.

Monitor Sites Using Cisco Spaces

You can monitor sites using Cisco Spaces.

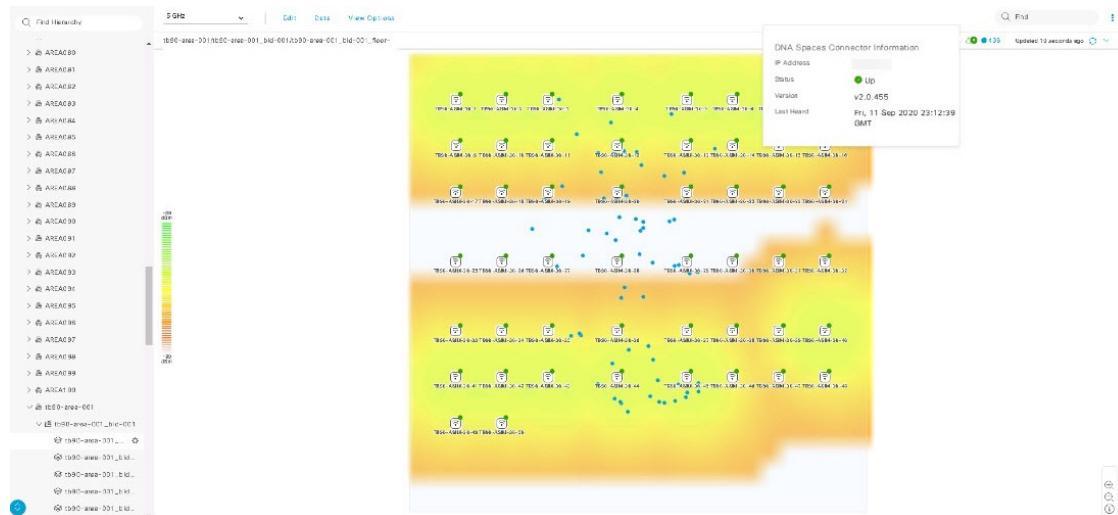
Before you begin

- Integrate Cisco Spaces with Catalyst Center. For details, see the [Cisco Spaces Configuration Guide](#).
- Assign Cisco Spaces to the site that you want to monitor.

Step 1 In the Catalyst Center GUI, click the menu icon and choose **Design > Network Hierarchy**.

Step 2 From the left hierarchy tree, choose either **Global** or the area, building, or floor that you want Cisco Spaces to monitor.

Step 3 To confirm that Cisco Spaces is operational, verify that the Cisco Spaces/CMX status icon displays on the floor that you want to monitor, as shown in the following figure.



Configure a FlexConnect VLAN

You can configure the following FlexConnect VLAN settings:

- **Native VLAN:** Allows a FlexConnect group to carry the management traffic between APs and Cisco Wireless Controllers.
- **AAA Override VLAN:** Provides dynamic VLAN assignment of locally switched clients.

You can apply these settings at the global level and override them at the site, building, or floor level.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Wireless** tab.

Step 3 From the left hierarchy tree, choose the required site:

- **Global:** Configures the VLAN at the global level for all sites.
- Area, building, or floor: Configures the VLAN at the chosen level only.

Step 4 Click **FlexConnect Settings**.

Child sites inherit the FlexConnect settings from the parent site. Inherited settings are displayed with an inherit icon next to the setting; hover your cursor over the icon to see the origin of the setting. You can use the **Delete** option to delete a setting and the **Inherit** option to inherit settings from the parent site, if it hasn't been inherited.

Step 5 In the **Native VLAN ID** field, enter a value for the VLAN ID. The valid range is from 1 through 4094.

Step 6 For the **AAA Override VLAN** settings, enter a VLAN ID and VLAN name mapping in the corresponding **VLAN ID** and **VLAN Name** fields. To add more mappings, click the Add icon.

Note The maximum number of VLAN mappings that you can define for a FlexConnect deployment is 16. However, for Cisco Catalyst 9800 Series Wireless Controllers, this number includes default WLAN VLANs and VLANs pushed by AAA.

Step 7 Click **Save**.

What to do next

Create a wireless network profile *or* configure an SSID:

- **Wireless Network Profile:** If you decide to create a wireless network profile, make sure that the **FlexConnect Local Switching** check box is checked. For more information, see [Create Network Profiles for Wireless](#), on page 339.
- **SSID:** If you want to configure an SSID, see [Create SSIDs for an Enterprise Wireless Network](#), on page 253 and [Create SSIDs for a Guest Wireless Network](#), on page 264.

For the saved FlexConnect VLAN settings to get configured on the wireless controller, you must provision the wireless controller. For information, see [Provision a Cisco AireOS Controller](#), on page 478 or [Configure and Provision a Cisco Catalyst 9800 Series Wireless Controller](#), on page 494.

After provisioning the wireless controller, you must provision the AP that is associated with the controller.

About Wireless Mesh Networks

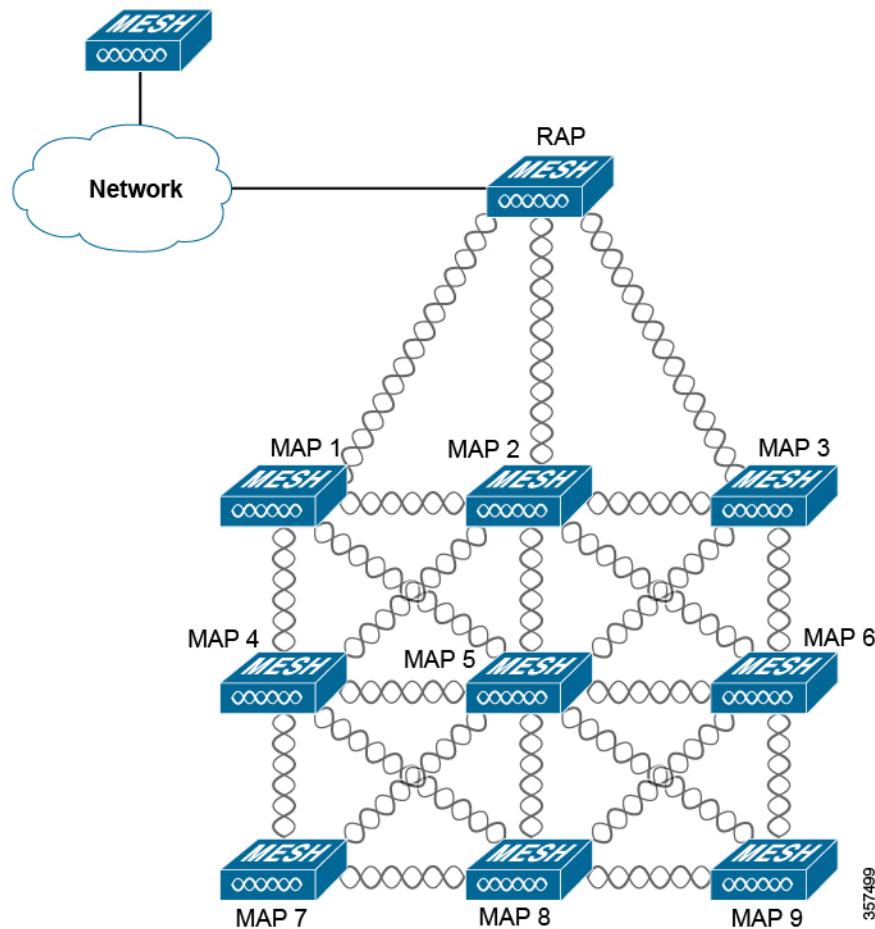
In a Cisco wireless mesh network, Access Points (APs) operate in one of the following two ways:

- Root Access Point (RAP): Connected to the wired network at each location.
- Mesh Access Point (MAP): Communicate wirelessly while providing a secure and scalable wireless LAN.



Note All APs are configured and shipped as MAPs. To use an AP as a RAP, you must reconfigure it as a RAP. In all mesh networks, make sure that there is at least one RAP.

RAPs are connected to the wired network at each location. All the downstream APs operate as MAPs and communicate using wireless links.



Both MAPs and RAPs can provide WLAN client access. However, typically, the location of RAPs is often not suitable for providing client access.

Some buildings have onsite controllers to terminate Control and Provisioning of Wireless Access Point (CAPWAP) sessions from the MAPs, but it's not a mandatory requirement because CAPWAP sessions can be backhauled to a wireless controller over a WAN.

In a Cisco wireless backhaul network, traffic can be bridged between MAPs and RAPs. This traffic can come from wired devices that are being bridged by the wireless mesh or CAPWAP traffic from the MAPs. This traffic is always AES encrypted when it crosses a wireless mesh link, such as a wireless backhaul.

For more information about mesh networks, see the latest [Cisco Wireless Mesh Access Points, Design and Deployment Guide](#).

Configure a Certificate Revocation Check

Cisco Wireless Controller Configuration

For mesh networks, you must configure a list of authorized APs in the wireless controller. Wireless controllers respond only to requests from the MAPs that are present in its authorization list.



Note Catalyst Center supports the configuration of authorization lists on Cisco Catalyst 9800 Series Wireless Controller running Cisco IOS Release 17.5 and later.

Both Cisco AireOS Wireless Controller and Cisco Catalyst 9800 Series Wireless Controller can use Catalyst Center to configure the Bridge Group Name (BGN) and RAP downlink backhaul mesh settings. In Cisco Catalyst 9800 Series Wireless Controller, you can also configure the maximum range of the MAPs, backhaul client access, and backhaul data rates.

These settings are configured for the global site in the **Create AP Profile** window. For more information, see [Configure Mesh Settings for an AP Profile for Cisco IOS XE Devices, on page 313](#) and [Configure Mesh Settings for an AP Profile for Cisco AireOS Devices, on page 317](#).

AP Configuration

If you have existing APs that you want to use in the mesh network mode, you must first change the AP Mode to Bridge or Flex+Bridge using the **Configure Access Point** workflow. For information, see [Configure APs, on page 851](#).

After an AP is configured for Bridge or Flex+Bridge mode, the **AP 360** window shows the mesh configuration. At this point, you must provision the APs with the new configuration. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).



Note For Cisco Catalyst 9800 Series Wireless Controllers, during bulk mesh AP provisioning across floors, we recommend that you don't update the following configurations simultaneously on already provisioned APs:

- Mesh role on the AP and mesh configuration (**Bridge Group Name, Range - Root AP to Mesh AP (in feet), Backhaul Client Access**) on the AP profile
- Mesh role on the AP and AP profile or flex profile mapping with the site tag

If you simultaneously update these configurations during bulk mesh AP provisioning, you must do one of the following:

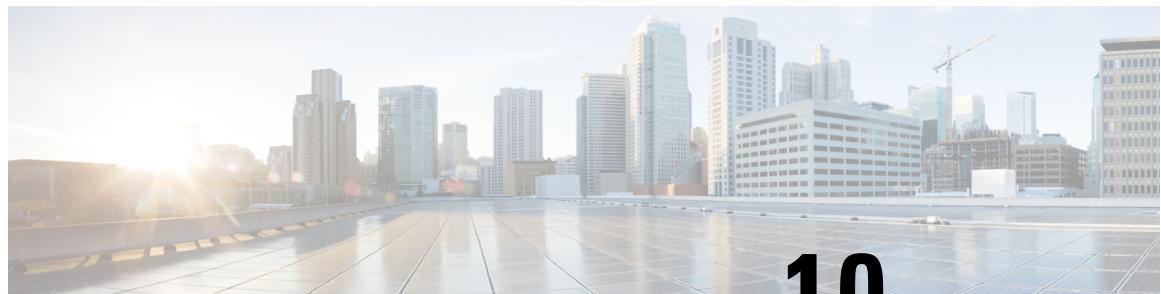
- Reprovision the Cisco Catalyst 9800 Series Wireless Controller. APs reboot after reprovisioning the wireless controller. After the reboot is complete, you can reprovision the APs with the required mesh role change.
- Reprovision one of the APs that has the updated mesh configuration. The other APs with the updated mesh configuration also reboot. After the reboot is complete, you can reprovision the APs with the required mesh role change.

Configure a Certificate Revocation Check

Use the following steps to configure a certificate revocation check.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Network Settings > Security and Trust**.
- Step 2** From the left hierarchy tree, choose a site, building, or floor.
- Step 3** In the **Revocation Check** drop-down list, **Revocation - Check: CRL None** is selected by default.
- Step 4** To skip the revocation check, choose **Revocation - Check: None** and click **Save**.
-

Configure a Certificate Revocation Check



CHAPTER 10

Configure Network Profiles

- [Network Profiles Overview, on page 333](#)
- [Create Network Profiles for Assurance, on page 333](#)
- [Create Network Profiles for Firewall, on page 335](#)
- [Create Network Profiles for Routing, on page 336](#)
- [Create Network Profiles for Switching, on page 338](#)
- [Create Network Profiles for Wireless, on page 339](#)

Network Profiles Overview

Network profiles allow you to configure settings and apply them to a specific site or group of sites. Catalyst Center supports up to 50 network profiles. You can create network profiles for various elements in Catalyst Center:

- [Create Network Profiles for Assurance, on page 333](#)
- [Create Network Profiles for Firewall, on page 335](#)
- [Create Network Profiles for Routing, on page 336](#)
- [Create Network Profiles for Switching, on page 338](#)
- [Create Network Profiles for Wireless, on page 339](#)

Create Network Profiles for Assurance

Creating a network profile for Assurance allows you to configure issue settings and apply them to a site or group of sites independently from the global issues settings. You can enable or disable an issue, and you can change its priority.

Notes:

- In Assurance, synchronization to the network device health score is available only for global issue settings, not custom issue settings. For information, see the [Cisco Catalyst Assurance User Guide](#).
- Some global issues are not customizable. These issues are not displayed in the list of custom issues for you to modify.

- To display modified issues at the top of the list, sort by **Last Modified**.
 - To delete custom settings, you must first unassign all the sites.
-

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Profiles**.

Step 2 Click **+Add Profile** and choose **Assurance**.

Step 3 In the **Profile Name** field, enter a valid profile name and click **Next**.

Catalyst Center adds the profile and the **Edit Profile** window appears.

Step 4 Set the **DEVICE TYPE** and **CATEGORY** filters to view the type of issues you want to configure.

Step 5 Click an issue in the **Issue Name** column to open a slide-in pane with the settings.

Note For some issues, changes made to the settings are shared across multiple device types. In the slide-in pane, Catalyst Center displays a caution that indicates the affected device types.

Step 6 To enable or disable whether Catalyst Center monitors the issue, click the **Enabled** toggle button.

Step 7 To set the issue priority, click the **Priority** drop-down list and select the priority. The options are:

- **P1**: A critical issue that needs immediate attention and can have a wide impact on network operations.
- **P2**: A major issue that can potentially impact multiple devices or clients.
- **P3**: A minor issue that has a localized or minimal impact.
- **P4**: A warning issue that may not be an immediate problem but addressing it can optimize the network performance.

Step 8 (For certain issues) In the **Trigger Condition** area, you can change the threshold value for when the issue is reported.

Examples of a trigger condition:

No Activity on Radio(2.4 GHz) >= 60 minutes.

Memory Utilization of Access Points greater than 90%.

Step 9 (Optional) If there are any changes to the settings, you can hover your cursor over **View Default Settings** to display the default settings. Click **Use Default** to restore all the issue settings to the default values.

Step 10 Click **Apply**.

Step 11 (For certain issues) Click **Manage Subscription** to subscribe to external notifications for supported issues when they are triggered.

Step 12 To assign the profile to sites, click **Assign Sites**. Check the check box next to the sites that you want to associate with this profile and click **Save**.

The **Edit Profile** window appears.

Note You can select a parent node or the individual sites. If you select a parent node, all the children under the parent node are also selected. You can uncheck the check box to deselect a site.

Step 13 Click **Done**.

The newly added profile appears on the **Network Profiles** window.

Create Network Profiles for Firewall

This workflow shows how to:

1. Create custom configurations.
2. Create Firepower Threat Defense (FTD) configurations.
3. View the profile summary.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Profiles**.

Step 2 Click **+Add Profile** and choose **Firewall**.

The **Firewall Type** page appears.

Step 3 To create custom configurations for regular firewalls like Adaptive Security Appliance (ASA) firewalls, do the following:

- a) In the **Name** field, enter the profile name.
- b) Choose the number of devices from the **Devices** drop-down list.

Note You can choose up to 10 devices per profile.

- c) Choose the type of device from the **Device Type** drop-down list.
- d) (Optional) From the **Device Tag** drop-down list, choose the device tags.
- e) Click **Next**.

The **Custom Configuration** page appears.

- f) From the **Template** drop-down list, choose a template.

Note If there are no templates, you must create at least one template in **Design > CLI Templates**. For information, see [Create Templates, on page 362](#).

- g) Click **Next**.

The **Summary** page appears. This page summarizes the custom configurations. Based on the selected device type, a hardware recommendation is provided.

- h) Click **Save**.

The **Network Profiles** page appears.

- i) To assign a site to the network profile, click **Assign Sites**. For more information, see [Create, Edit and Delete a Site, on page 167](#).

Step 4 To create FTD configurations to configure the FTD devices, do the following:

- a) In the **Name** field, enter the profile name.
- b) From the **Devices** drop-down list, choose the number of devices.

Note You can choose up to 10 devices per profile.

- c) To provision an FTD firewall, check the **FTD** check box.
- d) From the **Device Type** drop-down list, choose the type of device.
- e) (Optional) Choose the device tags from the **Device Tag** drop-down list.

- f) Click **Next**.

The **FTD Configuration** page appears.

- g) Click the **Routed Mode** or **Transparent Mode** radio button.
h) Click **Next**.

The **Summary** page appears. This page summarizes the FTD configurations. Based on the selected device type, hardware recommendation is provided on this page.

- i) Click **Save**.

The **Network Profiles** page appears.

- j) To assign a site to the network profile, click **Assign Sites**. For information, see [Create, Edit and Delete a Site, on page 167](#).
-

Create Network Profiles for Routing

This workflow shows how to:

1. Configure the router WAN.
 2. Configure the router LAN.
 3. Configure the integrated switch configuration.
 4. Create custom configurations.
 5. View the profile summary.
-

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Profiles**.

Step 2

Hover your cursor over **+ Add Profile** and choose **Routing**.

Step 3

The **Router WAN Configuration** page is displayed.

- Enter the profile name in the **Name** text box.
- Choose the number of **Service Providers** and **Devices** from the respective drop-down lists. Up to three service providers and ten devices are supported per profile.
- Choose the **Service Provider Profile** from the drop-down list. For more information, see [Configure Service Provider Profiles, on page 252](#).
- Choose the **Device Type** from the drop-down list.
- Enter a unique string for the **Device Tag** to identify the different devices or choose an existing tag from the drop-down list. Use the device tag if two or more devices are of the same type. If all the devices are of a different type, the device tag is optional. Make sure to choose the appropriate tag because your selection is used as part of the matching criteria for day-zero and day-n templates applied to the network profile.
- To enable at least one line link for each device to proceed, click **O** and check the check box next to **Connect**. Choose the **Line Type** from the drop-down list. Click **OK**.

If you choose multiple service providers, you can choose gigabit Ethernet for the primary interface and cellular for the secondary interface, or you can choose gigabit Ethernet for both interfaces. You can also choose cellular for the primary interface and gigabit Ethernet for the secondary interface.

Note Only Cisco 1100 Series Integrated Services Routers, Cisco 4200 Series Integrated Services Routers, Cisco 4300 Series Integrated Services Routers, and Cisco 4400 Series Integrated Services Routers support the cellular interface.

- Click **Next**.

Step 4 The **Router LAN Configuration** page is displayed.

To skip the router LAN configuration, click the **Skip** radio button and continue to Step 5. To configure the router LAN, perform the following actions:

- Click the **Configure Connection** radio button and choose **L2**, **L3**, or both.
- If you choose **L2**, click **+ Add Row**. Choose the **Type** from the drop-down list and enter the **VLAN ID/Allowed VLAN** and the **Description**. You can add multiple rows by clicking **+ Add Row**, and you can delete rows by clicking the **X** icon.
- If you choose **L3**, choose the **Protocol Routing** from the drop-down list and enter the **Protocol Qualifier**.
- Click **Next**.

Step 5 Based on your router configuration, the **Integrated Switch Configuration** page is displayed.

If the **Integrated Switch Configuration** page is not displayed, continue to Step 6.

The integrated switch configuration allows you to add new VLANs or retain the previous configuration chosen in the router LAN configuration.

- To add one or more new VLANs, click **+ Add Row**.
- Choose the **Type** from the drop-down list and enter the **VLAN ID/Allowed VLAN** and the **Description**.
- To delete a VLAN, click the **X** icon.
- Click **Next**.

Note Switchport Interface support is available only for Cisco 1100 Series and Cisco 4000 series Integrated Services Routers.

Step 6 The **Custom Configuration** page is displayed.

Custom configurations are optional. You can skip this step and apply the configurations at any time in the **Network Profiles** window.

If you choose to add custom configurations:

- Click the **Onboarding Template(s)** or **Day-N Template(s)** tab, as required.
- Choose a template from the drop-down list. The templates are filtered by **Device Type** and **Tag Name**.
- Click **Next**.

Step 7 On the **Summary** page, click **Save**.

Create Network Profiles for Switching

This page summarizes the router configurations. If you have multiple devices, you can click on each device to see its configuration data. Based on the devices and services chosen, the hardware recommendation is provided.

Step 8 The **Network Profiles** window is displayed. In this window, you can edit and delete the network profiles.

Click **Assign Site** to assign a site to the network profile. For more information, see [Create, Edit and Delete a Site, on page 167](#).

Create Network Profiles for Switching

You can apply two types of configuration templates to a switching profile:

- Onboarding template
- Day-*n* template

Before you begin

Define the **Onboarding Configuration** template that you want to apply to the devices. Such templates contain basic network configuration commands to onboard a device so that it can be managed on the network. See [Create Templates to Automate Device Configuration Changes, on page 359](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Profiles**.

Step 2 Click **+Add Profile** and choose **Switching**.

Step 3 In the Switching profile window, enter the profile name in the **Profile Name** text box.

Depending on the type of template that you want to create, click **OnBoarding Template(s)** or **Day-N Template(s)**.

- Click **+Add**.
- Select **Switches and Hubs** from the **Device Type** drop-down list.
- Select the **Tag Name** from the drop-down list. This step is optional. If the tag that you selected has already been associated with a template, only that template is available in the **Template** drop-down list.
- Select the **Device Type** from the drop-down list.
- Select a **Template** from the drop-down list. You can select the Onboarding Configuration template that you have already created.

Step 4 Click **Save**.

The profile that is configured on the switch is applied when the switch is provisioned. Note that you must add the network profile to a site for it to be effective.

Create Network Profiles for Wireless

Before you begin

- Ensure that you have created wireless SSIDs, RF profiles, and AP profiles under the **Design > Network Settings > Wireless** tab.
- If necessary, ensure that you have created templates in the **Design > CLI Templates** window.
- If necessary, ensure that you have created model configuration designs in the **Design > Feature Templates** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Profiles**.

Step 2 Click **Add Profile** and choose **Wireless**.

Step 3 Enter a valid profile name in the **Profile Name** field.

Step 4 To add sites to the profile, click **Assign** and do the following:

- a) In the **Add Sites to Profile** slide-in pane, check the check box next to the sites that you want to associate with this profile.

You can select a parent node or the individual site. If you select a parent site, all the children under the parent node are also selected. Note that you can uncheck the check box to deselect a site.

- b) Click **Save**.

Step 5 Configure the required settings in the following tabs:

- **SSIDs**: For more information, see [Add SSIDs to a Network Profile](#), on page 339.
- (Optional) **AP Zones**: For more information, see [Add AP Zones to a Network Profile](#), on page 341.
- **Model Configs**: For more information, see [Add Model Configurations to a Network Profile](#), on page 342.
- **Templates**: For more information, see [Add Templates to a Network Profile](#), on page 342.
- (Optional) **Advanced Settings**: For more information, see [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile](#), on page 353 and [Configure Additional Interfaces for a Network Profile](#), on page 355.

Step 6 Click **Save** to add the network profile.

Catalyst Center displays the new network profile on the **Design > Network Profiles** window.

Add SSIDs to a Network Profile

Before you begin

Ensure that you have created wireless SSIDs under the **Design > Network Settings > Wireless > SSIDs** window.

Step 1 In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), click the **SSID** tab.

Step 2 Click **Add SSID**.

Step 3 From the **SSID** drop-down list, choose the SSID that you have already created.

Step 4 (Optional) In the **WLAN Profile Name** field, enter a name for the WLAN profile.

Based on the WLAN profile name, Catalyst Center automatically generates the policy profile name.

Note

- When an SSID is associated with a network profile, Catalyst Center uses this WLAN profile name during provisioning. If you need to associate an SSID that has overrides (for configurations such as fabric, AP modes, FlexConnect, guest anchor, user interfaces, scheduler, and so on) with multiple network profiles, ensure that the WLAN profile name is unique for the SSID across all network profiles to prevent provisioning failure.
- If you modify the WLAN profile name for an existing SSID that is provisioned on a wireless controller, during the wireless controller reprovisioning, this SSID is deleted and recreated with the new WLAN profile name.

Step 5 Specify whether the SSID is fabric or nonfabric using the **Yes** or **No** radio buttons.

To create a nonfabric SSID, click **No**, and configure the following parameters:

- Click the **Enable SSID Scheduler** toggle button and choose the scheduler from the drop-down list.
- To use an interface for traffic switching, click the **Interface** radio button. From the **Interface Name** drop-down list, choose an interface name for the SSID, or click the plus icon (+) to create a wireless interface.
- To use a VLAN group for traffic switching, click the **VLAN Group** radio button. From the **VLAN Group Name** drop-down list, choose a VLAN group name for the SSID, or click the plus icon (+) to create a VLAN group.
- In the **Do you need Anchor for this SSID?** area, click **Yes** to add an anchor to the SSID. By default, **No** is selected.
- If you choose **Yes**, from the **Select Anchor Group** drop-down list, choose an anchor group for the SSID. For more information about anchor groups, see [Create an Anchor Group, on page 307](#).
- If you choose **No**, to enable local switching for WLAN, check the **Flex Connect Local Switching**.

If you add an anchor to the SSID, you can't enable **Flex Connect Local Switching**.

Note

If you modify any nonflex SSIDs that are already provisioned on the wireless controller to flex SSIDs (or conversely), you must reprovision the wireless controller. If you don't reprovision the wireless controller, the expected intent isn't configured on the wireless controller. For example, if you modify a nonflex SSID to flex SSID and don't reprovision the wireless controller, the SSID remains nonflex on the wireless controller and flex site tags aren't created.

If you enable **Flex Connect Local Switching** for an SSID, all the APs on the floor where the network profile is mapped, switch to FlexConnect mode.

The **Flex Group** option is enabled in the **Advanced Settings** tab. For more information, see [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).

When you enable local switching, any FlexConnect AP that advertises this WLAN can locally switch data packets.

- If you have enabled the **Flex Connect Local Switching** check box, enter a value for the VLAN ID in the **Local to VLAN** field.

Note

When you modify the local VLAN ID of an existing SSID and reprovision the AP without reprovisioning the wireless controller, the latest value of the local VLAN ID is updated in the flex profile used by the AP. If the same flex profile is used by other APs, these APs also have the updated local VLAN ID.

- Step 6** (Optional) To add another SSID, click the plus icon (+) and configure its parameters.

What to do next

Configure the other necessary settings for the network profile. For more information, see [Create Network Profiles for Wireless, on page 339](#).

Add AP Zones to a Network Profile

An AP zone allows you to associate different SSIDs and RF profiles for a set of APs on the same site. You can use device tags to identify the APs for which you want to apply AP zone. From the **AP Zones** tab, you can create separate AP zones with a subset of SSIDs configured in the network profile for a device tag.

Catalyst Center applies the AP zone configurations to APs during AP provisioning.

**Note**

- Catalyst Center doesn't apply AP zone configurations to the APs claimed from the Plug and Play (PnP) process.
- If an AP zone is already provisioned on an AP and you update the AP zone configuration, you must reprovision the wireless controller. Reprovisioning the AP is not necessary.

During AP provisioning:

- Based on the device tag and site of the AP, Catalyst Center selects the corresponding AP zone and automatically assigns the RF profile.
- If two AP zones are configured for an AP, you can choose the required AP zone.
- If there are no AP zones for an AP, you can choose the required RF profile.

Before you begin

Ensure that you have created wireless SSIDs under the **Design > Network Settings > Wireless > SSIDs** window.

- Step 1** In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), click the **AP Zones** tab.
- Step 2** Click **Add AP Zone**.
- Step 3** In the **AP Zone Name** field, enter a name for the AP zone.
- Step 4** From the **Device Tags** drop-down list, check the check box next to the device tags that you want to choose.
- Step 5** From the **RF Profile** drop-down list, choose an RF profile.

Add Model Configurations to a Network Profile

Step 6 From the **SSID** drop-down list, choose the SSIDs.

Step 7 (Optional) To add another AP zone, click the plus icon (+) and configure its parameters.

What to do next

Configure the other necessary settings for the network profile. For more information, see [Create Network Profiles for Wireless, on page 339](#).

To apply the AP zone configuration to an AP:

1. Reprovision the wireless controller. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
2. Provision the AP. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

Add Model Configurations to a Network Profile

You can attach model configuration designs to a network profile.

Step 1 In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), click the **Model Configs** tab.

Step 2 Click **Add Model Config**.

Step 3 In the **Add Model Config** slide-in pane, do the following:

- a. Click **Device Type(s)** and choose a device type.

You can either search for a device name by entering its name in the **Search** field, or expand **Switches and Hubs** or **Wireless Controller** and choose a device type.

- b. Expand **Wireless** and choose the model configuration designs that you want to attach to this network profile.
 - c. From the **Tags** drop-down list under **APPLICABILITY**, choose the applicable tags.
 - d. Click **Add**.
-

What to do next

Configure the other necessary settings for the network profile. For more information, see [Create Network Profiles for Wireless, on page 339](#).

Add Templates to a Network Profile

You can associate a template with a network profile.

Before you begin

You must create the necessary templates in the **Design > CLI Templates** window. For more information, see [Create Templates, on page 362](#).

Step 1 In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), click the **Templates** tab.

Step 2 Do the following:

- To associate an onboarding template, click the **OnBoarding Template(s)** tab.
- To associate a day-*n* template, click the **Day-N Template(s)** tab.

Step 3 Click **Attach Templates**.

Step 4 In the **Add Template** slide-in pane, do the following:

- a) Under **Templates**, click a template name.

You can either search for a template by entering its name in the **Search** field, or expand a project and choose a template.

- b) Click **Add**.

What to do next

Configure the other necessary settings for the network profile. For more information, see [Create Network Profiles for Wireless, on page 339](#).

Overview of AP Groups, Flex Groups, Site Tags, and Policy Tags

You can define custom names for AP groups, site tags, and policy tags in the **Advanced Settings** tab of the **Design > Network Profiles > Wireless** window. For more information, see [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).

Catalyst Center configures and applies the newly added custom names specified in the **Provision Group** settings of the **Advanced Settings** tab to the APs during AP provisioning.

**Note**

- AP group and flex group configurations are applicable to Cisco AireOS Wireless Controllers.
 - Site tag and policy tag configurations are applicable to Cisco Catalyst 9800 Series Wireless Controllers.
- Newly added site tag and policy tag configurations are applied when you provision the APs. Provisioning the wireless controller alone doesn't configure the new custom tags on the APs. You must reprovision the wireless controller or the APs if there are any modifications to the tags after provisioning.
- Keep in mind the following scenarios while provisioning or reprovisioning the wireless controller and APs:
- If there are no custom site or policy tags configured on the network profile, Catalyst Center uses the autogenerated tags and configures it on the wireless controller and applies the changes to the APs only during AP provisioning.
 - If there are custom site or policy tags configured on the network profile, Catalyst Center configures the custom tags on the wireless controller and applies the changes to the APs only during AP provisioning.
 - If the wireless controller and AP are already provisioned with autogenerated tags and if you create new custom tags in the network profile, you must reprovision the wireless controller or the AP to apply the changes.
 - If the wireless controller and AP are already provisioned with custom tags and if you delete the custom tags from the network profile, you must reprovision the wireless controller or the APs.
 - Reprovisioning the wireless controller deletes the custom tag configurations and configures the autogenerated tags on the wireless controller and the associated APs.
 - Reprovisioning the APs directly, without reprovisioning the wireless controller, configures the autogenerated tags on the APs but doesn't delete the custom tag configurations from the wireless controller. The tags are deleted during the next wireless controller reprovisioning.
 - If you've upgraded to Catalyst Center with FlexConnect Native VLAN override configured and site tags that are mapped to the same custom Flex profile for all the floors in a site, you must reconfigure the network profile with different site tags for each floor or else provisioning may fail.

You can use the same AP groups and flex groups across sites (buildings or floors) across multiple areas. Child sites inherit the AP groups and flex groups from their parent sites. However, if you create AP groups or flex groups for a child site, it overrides the settings inherited from its parent site. If an SSID is overridden for different floors in a building, you can't reuse the AP groups or flex groups for such floors. For AP group and flex group reuse examples, see [Custom AP Group and Flex Group Reuse Examples, on page 347](#).

Keep in mind the following scenarios while using the same AP groups and flex groups across multiple sites:

- You must configure the same RF profile for the shared AP groups.

For example, the custom AP group *AP-Group-1* is shared across *Network-Profile-1* and *Network-Profile-2*. It's managed by the same wireless controller with the same AP zone name (default or custom AP zone). If *Network-Profile-1* uses *RF-Profile-1* and *Network-Profile-2* uses *RF-Profile-2*, a validation error occurs during provisioning. You must configure the same RF profile for *AP-Group-1*.

- You must configure the same AP zone name for the shared custom AP groups.

For example, the custom AP group *AP-Group-1* is shared across *Network-Profile-1* and *Network-Profile-2*. Both network profiles use the same RF profile *RF-Profile-1*. If *Network-Profile-1* uses the AP zone *default-zone* and *Network-Profile-1* uses *AP-Zone-1*, a validation error occurs during provisioning. You must configure the same AP zone name for *AP-Group-1*.

- For shared custom AP groups, if any site with active APs is removed and the RF profile is also modified simultaneously, do one of the following before reprovisioning the APs:
 - Create another custom AP group and reprovision the APs in the sites that are removed from the custom AP group.
 - Reprovision the APs without creating a custom AP group so that the AP uses the Catalyst Center-generated AP group. Later, reprovision the APs with the updated RF profile and the shared custom AP group.

For example, the custom AP group *AP-Group-1* that uses *RF-Profile-1* is shared across *Building-1/Floor-1* and *Building-2/Floor-2*. When you provision APs on *Building-1/Floor-1* and *Building-2/Floor-2*, the APs join *AP-Group-1* on both the floors. If you change the RF profile to *RF-Profile-2* and simultaneously remove *Building-2/Floor-2* from *AP-Group-1*, a validation error occurs during provisioning. You must reprovision the APs on *Building-2/Floor-2* to move them to the required AP group. Later, reprovision APs on *Building-1/Floor-1*.

- For shared custom AP groups, if the AP zone name is changed, you must reprovision the existing APs in the old AP zone. Later, reprovision the APs with the new AP zone and the custom AP group.

For example, *Network-Profile-1* is assigned to *Building-1/Floor-1* with *AP-Group-1*, *RF-Profile-1*, and *AP-Zone-1*. *Network-Profile-2* is assigned to *Building-2/Floor-2* with *AP-Group-1*, *RF-Profile-1*, and *AP-Zone-1*. The managed AP location for the *Wireless-Controller-1* is configured as *Building-1* and *Building-2*. *AP1* is provisioned on *Building-1/Floor-1* and *AP2* is provisioned on *Building-2/Floor-2*. If you change the AP group to *New-AP-Group* and AP zone to *AP-Zone-3* on both *Network-Profile-1* and *Network-Profile-2*, and reprovision *AP1* or *AP2* with *AP-Zone-3* on the corresponding floors, a validation error occurs. You must reprovision *AP1* and *AP2* with *AP-Zone-1*. Later, reprovision *AP1* and *AP2* with *AP-Zone-3* and *New-AP-Group*.

- For shared custom AP groups, if you modify the AP zone on a parent site, these modifications are also inherited by the child sites. You must create the required AP zone on the network profile assigned to the child site.



- Note** If the child site has overridden configurations, the configurations aren't overwritten.

For example, *Building-1* contains child sites *Floor-1* and *Floor-2*. *Network-Profile-1* is assigned to *Building-1* and *Floor-1*, and *AP-Group-1*, *AP-Zone-1*, and *RF-Profile-1* are configured for *Building-1*. *Network-Profile-2* is assigned to *Floor-2*, and *AP-Group-1*, *AP-Zone-1*, and *RF-Profile-1* are configured for *Floor-2*. *AP1* is provisioned on *Floor-1* and *AP2* is provisioned on *Floor-2* with *AP-Zone-1*. AP zone configuration for *AP-Group-1* on *Building-1* is updated to use *AP-Zone-2* and *RF-Profile-2*. Since *Floor-2* inherits values from *Building-1*, any updates to the AP group settings on *Building-1* are automatically reflected in *Floor-2*. So, even though *APZone-2* doesn't exist in *Network-Profile-2*, it's updated in the *Floor-2* AP group settings due to inheritance. If you reprovision *AP1* on *Floor-1* with *AP-Zone-2*, a validation error occurs. You must create *AP-Zone-1* in *Network-Profile-2*.

- For shared custom AP groups, if the SSID is changed in the AP group, you must reprovision the APs on all the sites that use the modified AP group. If you reprovision the APs on only a few sites using the modified AP group, the AP provisioning fails. To ensure successful reprovisioning of APs, we recommend that you do one of the following:
 - Create a unique custom AP group at the sites requiring updates to the AP group. This custom AP group can be shared by multiple sites before you reprovision the APs.
 - Reprovision the wireless controller.

For example, the custom AP group *APGroup1* is shared across *Building-1/Floor-1* and *Building-2/Floor-2*. *Building-1/Floor-1* has *AP-Group-1* with *AP-Zone-1*, the SSID *WLAN-1*, and the RF profile *Typical*. *Building-1/Floor-2* has *AP-Group-1* with *AP-Zone-1*, the SSID *WLAN-2*, and the RF profile *Typical*. *AP1* is provisioned on *Floor-1* and uses *AP-Group-1*. If you provision *AP2* on *Floor-2* with *AP-Zone-1*, *WLAN-2*, *Typical*, a validation error occurs. You can create a unique custom AP group for *Floor-2* before reprovisioning *AP2*.

- For shared custom AP groups, if you change the RF profile and reprovision the corresponding APs, the custom AP group is updated with the new RF profile across sites for all the APs using the custom AP group.

For example, the custom AP group *AP-Group-1* is shared across *Network-Profile-1* and *Network-Profile-2*. *Network-Profile-1* is assigned to *Building-1/Floor-1* and uses *RF-Profile-1*. *Network-Profile-2* is assigned to *Building-2/Floor-2* and uses *RF-Profile-1*. *AP1* is provisioned on *Floor-1* and *AP2* is provisioned on *Floor-2*. If you update the RF profile of *AP-Group-1* to *RF-Profile-2*, and reprovision the APs, all APs using *AP-Group-1* are updated to use *RF-Profile-2*.

- You can't use the same flex group on multiple sites with different native VLAN or AAA override VLAN.

Custom policy tags can be reused across sites (areas, buildings, and floors). When you assign a custom policy tag to a site—an area, a building, or multiple floors in a building—all APs provisioned to that site and AP zone can use the same custom policy tag. By default, the custom policy tags are applicable for APs in the default AP zone; for custom AP zones, edit the policy tag and assign the custom policy tag to the required zones.

Note the following while reusing the custom policy tags:

- Child sites inherit the custom policy tags from the parent sites. However, if you create another policy tag for the child site, it overrides the settings inherited from the parent site.
- A custom policy tag can be assigned to multiple sites and multiple AP zones. All AP zones associated with the policy tag must share the same set of SSIDs and the SSIDs must have the same configuration. If a policy tag is associated to multiple AP zones that have different SSID configurations, an error is shown while editing the policy tag or the network profile.
- A custom policy tag can't be shared when any of the sites that share the custom policy tag and are managed by the same wireless controller have different SSID configurations due to a site-level SSID override. In such cases, a validation error occurs during provisioning—either AP provisioning or wireless controller provisioning (if the **Skip AP Provision** check box is unchecked) due to different WLAN profile and policy profile mappings for the same custom policy tag. An error message with the reason for failure is displayed in the configuration preview. The error message provides details for up to five sites that have a mismatch for the custom policy tag. For more information on the custom policy tag usage, see [Custom Policy Tag Reuse Use Case Examples, on page 349](#).
- Custom policy tag reuse is supported when learning device configurations from a pre-existing infrastructure as well.

- Policy tags are mapped to WLAN and RLAN profiles. Any changes in the policy tag may impact the RLAN configurations.
- Policy tag reuse isn't supported for Catalyst Center autogenerated tags.

Custom flex profiles are configured either during wireless controller provisioning or during AP provisioning as follows:

- During wireless controller provisioning: If there's a flex model configuration attached to the network profile, a custom flex profile or a Catalyst Center autogenerated flex profile (based on the option selected while configuring a custom site tag) is created during wireless controller provisioning. The custom flex profile is configured with the same settings as that of the default flex profile except for the Catalyst Center intent configurations as defined in the model configuration with **IP Overlap** enabled. When you provision the AP after provisioning the wireless controller, the custom flex profile isn't overwritten except for the FlexConnect VLAN settings (Native VLAN and AAA Override VLAN), if configured.
- During AP provisioning: If there's no model configuration attached to the network profile, a custom flex profile is created during AP provisioning. The custom flex profile is configured with the same settings as that of the default flex profile except for the FlexConnect VLAN settings (Native VLAN and AAA Override VLAN), if configured. Catalyst Center enables the pairwise master key (PMK) propagation in the custom flex profile during AP provisioning.

Custom AP Group and Flex Group Reuse Examples

Scenario 1

A custom AP group and flex group are shared between multiple sites with no site overrides and all sites are managed by the same wireless controller.

Site	Site Override	AP Group, AP Zone, and RF Profile	Native VLAN ID Override	Primary Wireless Controller
<i>Area-1/Building-1/Floor-1</i>	None	<i>Custom-AP-Group-1, default-zone, Typical</i>	None	<i>Wireless-Controller-1</i>
<i>Area-2/Building-1/Floor-1</i>	None	<i>Custom-AP-Group-1, default-zone, Typical</i>	None	<i>Wireless-Controller-1</i>

In this scenario, the custom AP group and flex group can be shared between the sites and the APs can be successfully provisioned to these sites using the same custom AP group.

Scenario 2

A custom AP group is shared between multiple sites where some sites have site overrides for SSID and all the sites are managed by the same wireless controller.

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller
<i>Area-1/Building-1/Floor-1</i>	Site override - PSK changes	<i>Custom-AP-Group-1, AP-Zone-1, HIGH</i>	<i>Wireless-Controller-1</i>

Custom AP Group and Flex Group Reuse Examples

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller
Area-2/Building-1/Floor-1	None	Custom-AP-Group-1, AP-Zone-1, HIGH	Wireless-Controller-1

In this scenario, the custom AP group can't be reused as it has different WLAN profile mapping for the same SSID. If you provision APs to these sites using the same custom AP group, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Area-1/Building-1/Floor-1*) is successful but a validation error is displayed during the second AP provisioning at *Area-2/Building-1/Floor-1*, which is attempting to reuse the custom AP group.

Scenario 3

A custom AP group is shared between multiple sites with different RF profiles and all the sites are managed by the same wireless controller.

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller
Area-1/Building-1/Floor-1	None	Custom-AP-Group-1, AP-Zone-1, HIGH	Wireless-Controller-1
Area-2/Building-1/Floor-1	None	Custom-AP-Group-1, AP-Zone-1, LOW	Wireless-Controller-1

In this scenario, the custom AP group can't be reused as it has different RF profiles. If you provision APs to these sites using the same custom AP group, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Area-1/Building-1/Floor-1*) is successful but a validation error is displayed during the second AP provisioning at *Area-2/Building-1/Floor-1*, which is attempting to reuse the custom AP group.

Scenario 4

A custom AP group is shared between multiple sites where some sites have no site overrides for SSID for the primary controller, but has an override for the secondary controller.

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller	Secondary Wireless Controller
Building-1	None	Custom-AP-Group-1, AP-Zone-1, HIGH	Wireless-Controller-1	Wireless-Controller-2
Building-1/Floor-1	None	Custom-AP-Group-1, AP-Zone-1, HIGH	Wireless-Controller-1	Wireless-Controller-2

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller	Secondary Wireless Controller
<i>Building-1/Floor-2</i>	None	<i>Custom-AP-Group-1, AP-Zone-1, HIGH</i>	<i>Wireless-Controller-1</i>	<i>Wireless-Controller-2</i>
<i>Building-2/Floor-1</i>	SSID override	<i>Custom-AP-Group-1, AP-Zone-1, LOW</i>	<i>Wireless-Controller-2</i>	None

In this scenario, the custom AP group can't be reused as it has different WLAN profile mapping for the same SSID for *Wireless-Controller-2*. If you provision APs to these sites using the same custom AP group, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Building-1/Floor-1*) is successful but a validation error is displayed during the second AP provisioning at *Building-2/Floor-1*, which is attempting to reuse the custom AP group.

Scenario 5

A custom AP group is shared between multiple sites with different sets of WLANs and all sites are managed by the same wireless controller.

Site	Site Override	AP Group, AP Zone, and RF Profile	Primary Wireless Controller
<i>Area-1/Building-1/Floor-1</i>	None	<i>Custom-AP-Group-1, AP-Zone-1 (WLAN-1, WLAN-2), HIGH</i>	<i>Wireless-Controller-1</i>
<i>Area-2/Building-1/Floor-1</i>	None	<i>Custom-AP-Group-1, AP-Zone-1 (WLAN-3, WLAN-4), HIGH</i>	<i>Wireless-Controller-1</i>

In this scenario, the custom AP group can't be reused as it has different WLAN profile mapping for the same wireless controller. If you provision APs to these sites using the same custom AP group, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Area-1/Building-1/Floor-1*) is successful but a validation error is displayed during the second AP provisioning at *Area-2/Building-1/Floor-1*, which is attempting to reuse the custom AP group.

Custom Policy Tag Reuse Use Case Examples

Scenario 1

A custom policy tag is shared between multiple sites with no site overrides and all sites are managed by the same Cisco Wireless Controller.

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Building 1/Floor 1</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Building 1/Floor 2</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>

In this scenario, the custom policy tags can be shared between the sites and the APs can be successfully provisioned to these sites using the same custom policy tag.

Scenario 2

A custom policy tag is shared between multiple sites where some sites have site overrides for SSID and all the sites are managed by the same wireless controller.

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Building 1/Floor 1</i>	Site Override	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Building 1/Floor 2</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>

In this scenario, the custom policy tag cannot be reused because the same tag has two different WLAN profile and policy profile mappings for the same SSID. If you provision APs to these sites using the same custom policy tag, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Building 1/Floor 1*) will be successful but a validation error is shown during the second AP provisioning at *Building 1/Floor 2*, which is attempting to reuse the custom policy tag.

Scenario 3

A custom policy tag is shared between multiple sites where some sites have site overrides for SSID and the sites are managed by different primary wireless controllers.

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Building 1/Floor 1</i>	Site Override	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 2</i>
<i>Building 1/Floor 2</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>

In this scenario, the custom policy tags can be reused and the APs can be successfully provisioned to these sites using the same custom policy tag.

Scenario 4

A custom policy tag is shared between sites which have different policy profile (learned from pre-existing infrastructure) and all the sites are managed by the same wireless controller.

Site	Site Override	Policy Profile	Policy Tag and AP Zone	Primary wireless controller
<i>Building 1/Floor 1</i>	None	<i>Profile 1</i> (learned from pre-existing infrastructure)	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Building 1/Floor 2</i>	None	<i>Profile 2</i> (learned from pre-existing infrastructure)	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>

In this scenario, the custom policy tag cannot be reused because the same tag is mapped to two different policy profiles for the same SSID on the same wireless controller. If you provision APs to these sites using the same custom policy tag, a validation error occurs during provisioning.



Note The AP provisioning for the first site in this site hierarchy (*Building 1/Floor 1*) will be successful but a validation error is shown during the second AP provisioning at *Building 1/Floor 2*, which is attempting to reuse the custom policy tag.

Scenario 5

A custom policy tag is shared between multiple sites where some sites have no site overrides for the primary wireless controller and some sites have overrides for the secondary wireless controller. All the sites are managed by the same primary wireless controller and have N+1 HA configured.

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller	Secondary wireless controller
<i>Building 1/Floor 1</i>	No Override from Global level	<i>Custom Policy Tag 1, default -zone</i>	<i>wireless controller 2</i>	-
<i>Building 2</i>	Site Override	<i>Custom Policy Tag 1, default -zone</i>	<i>wireless controller 1</i>	<i>wireless controller 2</i>
<i>Building 2/Floor 1</i>	No Override from <i>Building 2</i>	<i>Custom Policy Tag 1, default -zone</i>	<i>wireless controller 1</i>	<i>wireless controller 2</i>
<i>Building 2/Floor 2</i>	No Override from <i>Building 2</i>	<i>Custom Policy Tag 1, default -zone</i>	<i>wireless controller 1</i>	<i>wireless controller 2</i>

In this scenario, since all the sites are managed by the same N+1 wireless controller, the custom policy tag cannot be reused for *wireless controller 2* because the same tag has two different WLAN profile and policy profile mappings for the same SSID on the same wireless controller (*wireless controller 2*). A validation error occurs when you provision *wireless controller 2*. However, there's no error expected while provisioning the *wireless controller 1*.



Note Validation is done independently for each of the wireless controllers.

Scenario 6

A custom policy tag is shared across areas with the same network profile.

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Area 1/Building 1/Floor 1</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Area 2/Building 2/Floor 1</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1 or 2</i>

In this scenario, custom policy tags can be shared across wireless controllers managing different areas under the same network profile.

Scenario 7

A custom policy tag is shared across areas with multiple network profiles.

Example 1

Site	Network Profile	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Area 1/Building 1/Floor 1</i>	<i>Profile 1</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Area 2/Building 2/Floor 1</i>	<i>Profile 2</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1 or 2</i>

In the above example, custom policy tag can be reused across areas with different network profiles.

Example 2

Site	Network Profile	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Area 1/Building 1/Floor 1</i>	<i>Profile 1</i>	None	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1</i>
<i>Area 2/Building 2/Floor 1</i>	<i>Profile 2</i>	Site Override in Area 2	<i>Custom Policy Tag 1, default-zone</i>	<i>wireless controller 1 or 2</i>

In the above example, the custom policy tag cannot be reused due to site override in *Area 2*.

Scenario 8

A custom policy tag is shared across multiple AP zones.

Example 1

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Area 1/Building 1/Floor 1</i>	None	<i>Custom Policy Tag 1, workarea (SSID 1)</i>	<i>wireless controller 1</i>
<i>Area 2/Building 2/Floor 1</i>	None	<i>Custom Policy Tag 1, corridor (SSID 1)</i>	<i>wireless controller 1</i>

In the above example, the same custom policy tag can be reused across two AP zones (*workarea*, *corridor*) when they have the same set of SSID (SSID 1).

Example 2

Site	Site Override	Policy Tag and AP Zone	Primary wireless controller
<i>Area 1/Building 1/Floor 1</i>	None	<i>Custom Policy Tag 1, workarea (SSID 1, SSID 2)</i>	<i>wireless controller 1</i>
<i>Area 2/Building 2/Floor 1</i>	None	<i>Custom Policy Tag 1, corridor (SSID 1)</i>	<i>wireless controller 1</i>

In the above example, the custom policy tag cannot be reused because the AP zones do not have the same set of SSIDs.



Note Reconfiguring a shared custom policy tag (for example, swapping the AP zone for a policy tag with another tag) results in conflicting configurations for existing APs on different floors that are yet to be reprovisioned. This prevents provisioning because the APs that are yet to be provisioned are still using the old configuration. However, reconfiguration of a shared custom policy tag is allowed in cases where all the APs that share the tag are on the same floor. The APs are updated with the latest configuration when you reprovision the APs of all the zones.

Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile

Catalyst Center allows you to add AP groups, flex groups, site tags, and policy tags in a network profile. Adding AP groups and flex groups saves time during AP provisioning by eliminating the need to make repetitive configuration changes and ensures consistency across your devices. If you don't configure the custom names, Catalyst Center uses the autogenerated AP group names and tags for the APs.



Note Flex group configuration is available only when the network profile has at least one associated flex-based SSID.

Before you begin

- Ensure that you have assigned a site to the network profile.

Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile

- To create flex group names, under the **SSIDs** tab, ensure that you have checked the **Flex Connect Local Switching** check box and defined the VLAN ID in the **Local to VLAN** field to mark the nonfabric SSID as a flex-based SSID. For more information, see [Add SSIDs to a Network Profile, on page 339](#).

If you have enabled **Flex Connect Local Switching** for an SSID, all the APs on the floor where the network profile is mapped, switch to FlexConnect mode.

- For information about reprovisioning the wireless devices, and using the groups and tags, see [Overview of AP Groups, Flex Groups, Site Tags, and Policy Tags, on page 343](#).

Step 1 In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), hover your cursor over **Advanced Settings** and click **Provision Group**.

Step 2 (Optional) To create an AP group in the network profile, expand **AP Groups and AP Profiles** and click **Create Custom AP Group**.

In the **Add AP Group** slide-in pane, do the following:

- In the **AP Group Name** field, enter the AP group name.
- From the **AP Zone** drop-down list, choose an AP zone.

To broadcast all the SSIDs associated with the network profile, choose **Not Applicable**.

Note This drop-down list is enabled if you have added AP zones to the network profile in the **AP Zones** tab. For more information, see [Add AP Zones to a Network Profile, on page 341](#).

If you choose an AP zone, the RF profile is inherited from the AP zone configuration.

- From the **AP Profile** drop-down list, choose an AP profile.

To create an AP profile, click **Create New**. For more information, see [AP Profiles, on page 309](#).

- From the **RF Profile** drop-down list, choose an RF profile.

Note This drop-down list is disabled if you choose an AP zone from the **AP Zone** drop-down list.

- In the **Select Sites** area, you can either search for a site by entering its name or expand **Global** to choose a site.
- Click **Save**.

Step 3 (Optional) To create a flex group in the network profile, expand **Flex Group** and click **Create Flex Group**.

In the **Create Flex Group** slide-in pane, do the following:

- In the **Flex Group Name** field, enter the flex group name.
- In the **Select Sites** area, you can either search for a site by entering its name or expand **Global** to choose a site.
- Click **Save**.

Step 4 (Optional) To create a site tag in the network profile, expand **Site Tags and AP Profiles** and click **Create Custom Site Tag**.

In the **Create Site Tag** slide-in pane, do the following:

- In the **Site Tag Name** field, enter the site tag name.
- From the **AP Profile** drop-down list, choose an AP profile.

To create an AP profile, click **Create New**. For more information, see [AP Profiles, on page 309](#).

- In the **Flex Profile Name** field, enter the flex profile name.

Note To enable the **Flex Profile Name** field, in the **SSID** tab, check the **Flex Connect Local Switching** check box. For more information, see [Add SSIDs to a Network Profile, on page 339](#).

To use a Catalyst Center autogenerated name, check the **Auto generate Flex Profile Name** check box.

- d) In the **Select Sites** area, you can either search for a site by entering its name or expand **Global** to choose a site. You can select multiple areas under an area.
- e) Click **Save**.

Step 5 (Optional) To create a policy tag in the network profile, expand **Policy Tag** and click **Create Policy Tag**.

In the **Create Policy Tag** slide-in pane, do the following:

- a) In the **Policy Tag Name** field, enter the policy tag name.
- b) From the **AP Zone** drop-down list, choose an AP zone.

Note This drop-down list is enabled if you have added AP zones to the network profile in the **AP Zones** tab. For more information, see [Add AP Zones to a Network Profile, on page 341](#).

- c) In the **Select Sites** area, you can either search for a site by entering its name or expand **Global** to choose a site.
- d) Click **Save**.

What to do next

Configure the other necessary settings for the network profile. For more information, see [Create Network Profiles for Wireless, on page 339](#).

Configure Additional Interfaces for a Network Profile

An additional interface on a Cisco Wireless Controller maps a WLAN to a VLAN or subnet. You can configure additional interfaces for a network profile for wireless.

Step 1 In the **Add a Network Profile** window (**Design > Network Profiles > Add Profile > Wireless**), hover your cursor over **Advanced Settings** and click **Additional Interface**.

Step 2 To create an additional interface, click **Create New Interface** and do the following:

- a) In the **Interface Name** field of the **Add Interface** slide-in pane, enter a name for the interface.
- b) In the **VLAN ID** field, enter a VLAN ID.

For Cisco AireOS Wireless Controllers, the valid range is from 1 through 4094. For Cisco Catalyst 9800 Series Wireless Controllers, the valid range is from 2 through 4094.

- c) Click **Save**.

Alternatively, you can create an additional interface on the **Design > Network Settings > Wireless > Interfaces & VLAN Groups > Interfaces** window. For more information, see [Create a Wireless Interface, on page 276](#).

Step 3 To add additional interfaces to a network profile, do one of the following:

- Click the plus icon (+) next to the required additional interface.
- Click the additional interface name, and then click **Add Selected**.

Configure Additional Interfaces for a Network Profile

Note To choose multiple additional interfaces, press **Shift**, click the additional interface names, and then click **Add Selected**.

- To add all the additional interfaces, click **Add All**. You can use the **Search** field to filter the additional interfaces.

What to do next

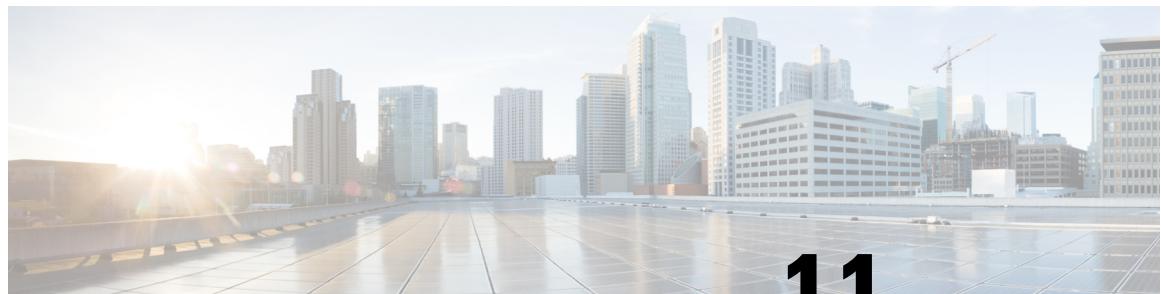
After configuring the necessary settings for the network profile, click **Save**. For more information, see [Create Network Profiles for Wireless, on page 339](#).



PART **IV**

Configure and Maintain Network Devices

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CHAPTER 11

Create Templates to Automate Device Configuration Changes

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About CLI Templates

Catalyst Center provides an interactive CLI Templates window to author your CLI templates. You can design templates easily with a predefined configuration by using parameterized elements or variables. After creating a template, you can use the template to deploy your devices in one or more sites that are configured anywhere in your network.

With CLI Templates, you can:

- View the list of available templates.
- Create, edit, clone, import, export, and delete a template.
- Filter the template based on the **Project Name**, template **Type**, **Template Language**, **Category**, **Device Family**, **Device Series**, **Commit State** and **Provision Status**.
- View the following template attributes on **Design > CLI Templates** window in the **Templates** table:
 - **Name:** Name of the CLI template.

- **Project:** Project under which the CLI template is created.
- **Type:** Type of CLI template (regular or composite).
- **Version:** Number of versions of the CLI template.
- **Commit State:** Shows if the latest version of the template is committed. You can view the following information under the **Commit State** column:
 - The timestamp of the last committed date.
 - A warning icon means the template is modified but not committed.
 - A check icon means the latest version of the template is committed.

**Note**

The last template version must be committed to provision the template on the devices.

- **Provision Status:** You can view the following information under the **Provision Status** column:
 - The number of devices on which the template is provisioned.
 - A check icon displays the number of devices for which the CLI template was provisioned without any failures.
 - A warning icon displays the number of devices for which the latest version of the CLI template is not yet provisioned.
 - A cross icon displays the number of devices for which the CLI template deployment failed.
 - **Potential Design Conflicts:** Displays potential conflicts in the CLI template.
 - **Network Profiles:** Displays the number of network profiles attached to a CLI template. In the **Network Profiles** column, click **Attach** to attach a CLI template to network profiles.
 - **Actions:** In the **Actions** column, hover your cursor over the ellipsis icon to clone, commit, delete, or edit a template; edit a project; or attach a template to a network profile.
 - Add interactive commands.
 - Autosave the CLI commands.
 - Version control the templates for tracking purposes.
- You can view the versions of a CLI template. On the **CLI Templates** window, click the template name and click the **Template History** tab to view the template version.
- Detect errors in templates.
 - Simulate templates.
 - Define variables.
 - Detect run-time conflict.



Note Ensure that your template does not overwrite a network-intent configuration pushed by Catalyst Center.

Onboarding Templates or Day-Zero Templates

Onboarding templates in Catalyst Center are used to automate the initial provisioning and onboarding process on the network devices. Onboarding templates define the configuration settings that should be applied to a device during the onboarding process.

Onboarding templates are primarily used with Plug and Play (PnP) to streamline the deployment of new network device in the network.

For example, you have a set of new switches that you want to deploy in your network. With an onboarding template, you can define the initial configuration settings, such as interface configurations, VLAN assignments, and basic security settings that should be applied to these switches during the onboarding process. When you connect the new switches to the network, Catalyst Center will automatically detect them using PnP and apply the defined configuration settings from the onboarding template, ensuring consistent and standardized configurations across your network.



Note

- Day-zero template is pushed as part of PnP.
- Day-zero templates are not allowed to bind to source or system variables, that is, the templates will not have the option to bind or use variables in the template with the source object values while editing or through the input form enhancements; for example, DHCP server, DNS server, and syslog server.
- Day-zero templates does not support the usage of special keywords that are described in the section [Special Keywords, on page 376](#).
- It is recommended to ensure that you are using the correct configuration in the day-zero template, as day-zero template pushes the entire configuration as it is, including the incorrect line.

Deploy Configurations on the Network Devices with Day-*n* Templates

You can use day-*n* templates to apply configurations to the network devices, after devices have been added to the inventory. Day-*n* templates in Catalyst Center are used for configuration management and consistency across your network devices. They are designed for simplifying the process of making configuration changes, pushing firmware updates, or deploying network-wide policy changes to multiple devices at the same time. Day-*n* templates capture a specific configuration state or change that you want to apply to one or more devices.

Day-*n* templates are associated to a network profile as described in section [Attach a CLI Template to the Network Profiles, on page 369](#). The templates are applied to the devices during device provisioning. A device can be provisioned multiple times. By default, only new configuration is pushed during re-provisioning, but this setting can be overridden.

For example, you want to deploy a new Access Control List (ACL) on a group of switches in your network to enforce a security policy. With a day-*n* template, you can define the ACL configuration and apply it to the targeted switches. Catalyst Center will push the configuration to the devices, ensuring consistent application of the ACL across the network. If you need to update the ACL in the future, you can make changes to the day-*n* template, and Catalyst Center will push those changes to the devices accordingly.

**Note**

- The day-*n* templates are compiled and stored in Catalyst Center but their configurations are delivered to the devices in inventory through multiple concurrent SSH sessions. So the commands are sent to the devices line-by-line.
- If the day-*n* template contains an incorrect configuration, when such line is pushed to the device and fails, it stops Catalyst Center from applying the rest of the template.

Create Projects

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 Click **Add** and then choose **New Project**.

The **Add New Project** slide-in pane is displayed.

Step 3 Enter a unique name in the **Project Name** field.

Step 4 (Optional) Enter a description for the project in the **Project Description** field.

Step 5 Click **Continue**.

The project is created and appears in the left pane.

What to do next

Add a new template to the project. For more information, see [Create a Regular Template, on page 362](#) and [Create a Composite Template, on page 365](#).

Create Templates

Templates provide a method to easily predefine configurations using parameter elements and variables. Templates allow an administrator to define a configuration of CLI commands that can be used to consistently configure multiple network devices, reducing deployment time. Variables in the template allow customization of specific settings per device.

Create a Regular Template

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Note By default, the **Onboarding Configuration** project is available for creating day-zero templates. You can create your own custom projects. Templates, created in custom projects, are categorized as day-*n* templates.

Step 2 In the left pane, click **Project Name** and choose the project under which you are creating templates.

Step 3 Click **Add** and then choose **New Template** from the drop-down list.

Note The template that you create for day zero can also be applied for day *n*.

Step 4 In **Add New Template** slide-in pane, configure the settings for the regular template.

In the **Template Details** area, do the following:

a. Enter a unique name in the **Template Name** field.

b. Choose the **Project Name** from the drop-down list.

c. **Template Type:** Click **Regular Template**.

d. **Template Language:** Choose either the **Velocity** or **Jinja** language to use for the template content.

- **Velocity:** Use the Velocity Template Language (VTL). For information, see <http://velocity.apache.org/engine/devel/vtl-reference.html>.

The Velocity template framework restricts the use of variables that start with a number. Make sure that the variable name starts with a letter and not with a number.

Note Do not use the dollar (\$) sign while using Velocity templates. If you use the dollar (\$) sign, any value after it is treated as a variable. For example, if a password is configured as

"\$a123\$q1ups\$va112", the CLI Templates treats this as variables "a123", "q1ups", and "va112". To work around this issue, use the Linux shell style for text processing with Velocity templates.

- **Jinja:** Use the Jinja language. For information, see <https://www.palletsprojects.com/p/jinja/>.

e. Choose the **Software Type** from the drop-down list.

Note You can choose the specific software type (such as IOS-XE or IOS-XR) if there are commands specific to these software types. If you choose IOS as the software type, the commands apply to all software types, including IOS-XE and IOS-XR. This value is used during provisioning to check whether the selected device confirms to the selection in the template.

In the **Device Type Details** area, do the following:

a. Click the **Add Device Details** link.

b. Choose **Device Family** from the drop-down list.

c. Choose either the device series or device model by doing one of the following:

- Click the **Device Series** tab and check the check box next to the preferred device series.
- Click the **Device Models** tab and check the check box next to the preferred device model.

d. Click **Add**.

In the **Additional Details** area, do the following:

a. Choose the **Device Tags** from the drop-down list.

Blocked List Commands

- Note** Tags are like keywords that help you locate your template more easily. If you use tags to filter the templates, you must apply the same tags to the device to which you want to apply the templates. Otherwise, you get the following error during provisioning:

```
Cannot select the device. Not compatible with template
```

- b.** Enter the **Software Version** in the software version field.

- Note** During provisioning, Catalyst Center checks to see if the selected device has the software version listed in the template. If there is a mismatch, the template is not provisioned.

- c.** Enter a **Template Description**.

Step 5 Click **Continue**.

The CLI template is created.

- Note** Click the **CLI Template Best Practices** link at the top-right corner of the template window to view some of the best practices that must be used in a CLI template to minimize compliance issues.

Step 6 To edit the template content, select the template that you created, click the ellipsis under **Actions**, and choose **Edit Template**. For more information, see [Edit Templates, on page 366](#).**Blocked List Commands**

Blocked list commands are commands that cannot be added to a template or provisioned through a template. If you use blocked list commands in your templates, it shows a warning in the template that it may potentially conflict with some of the Catalyst Center provisioning applications.

The following commands are blocked in this release:

- **router lisp**
- **hostname**

Sample Templates

Refer to these sample templates for switches while creating variables for your template.

Configure Hostname

```
hostname $name
```

Configure Interface

```
interface $interfaceName
description $description
```

Configure NTP on Cisco Wireless Controllers

```
config time ntp interval $interval
```

Create a Composite Template

Two or more regular templates are grouped into a composite sequence template. You can create a composite sequential template for a set of templates, which are applied collectively to devices. For example, when you deploy a branch, you must specify the minimum configurations for the branch router. The templates that you create can be added to a single composite template, which aggregates all the individual templates that you need for the branch router. You must specify the order in which templates that are in the composite template are deployed to devices.



Note You can add only a committed template to a composite template.

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 In the left pane, click **Project Name** and select the project under which you are creating templates.

Step 3 Click **Add** at the top right of the window, and choose **New Template** from the drop-down list.

The **Add New Template** slide-in pane is displayed.

Step 4 In the **Add New Template** slide-in pane, configure the settings for the composite template.

In the **Template Details** area, do the following:

- a) Enter a unique name in the **Template Name** field.
- b) Choose the **Project Name** from the drop-down list.
- c) **Template Type:** Choose **Composite Sequence** radio button.
- d) Choose the **Software Type** from the drop-down list.

Note You can select the specific software type (such as IOS-XE or IOS-XR) if there are commands specific to these software types. If you select IOS as the software type, the commands apply to all software types, including IOS-XE and IOS-XR. This value is used during provisioning to check whether the selected device confirms to the selection in the template.

In the **Device Type Details** area, do the following:

- a. Click the **Add Device Details** link.
- b. Choose **Device Family** from the drop-down list.
- c. Choose either the device series or device model by doing one of the following:
 - Click the **Device Series** tab and check the check box next to the preferred device series.
 - Click the **Device Models** tab and check the check box next to the preferred device model.
- d. Click **Add**.

In the **Additional Details** area, do the following:

- a. Choose the **Device Tags** from the drop-down list.

Note Tags are like keywords that help you locate your template more easily. If you use tags to filter the templates, you must apply the same tags to the device to which you want to apply the templates. Otherwise, you get the following error during provisioning:

Cannot select the device. Not compatible with template

- b. Enter the **Software Version** in the software version field.

Note During provisioning, Catalyst Center checks to see if the selected device has the software version listed in the template. If there is a mismatch, the template is not provisioned.

- c. Enter the **Template Description**.

Step 5 Click Continue.

The composite template window is displayed, which shows the list of applicable templates.

Step 6 Click the **Add Templates** link, click to add the templates, and then click **Done**.

The composite template is created.

Note Click the **CLI Template Best Practices** link at the top-right corner of the template window to view some of the best practices that must be used in a CLI template to minimize compliance issues.

Step 7 Check the check box next to the composite template that you created, click the ellipsis under **Actions** column, and choose **Commit** to commit the template content.

Edit Templates

After creating a template, you can edit the template to include content.

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 In the left pane, choose the **Project Name** and select the template that you want to edit.

The chosen template is displayed.

Note Click the **CLI Template Best Practices** link at the top-right corner of the template window to view some of the best practices that must be used in a CLI template to minimize compliance issues.

Step 3 Enter the template content. You can have a template with a single-line configuration or a multi-select configuration.

Step 4 Click **Properties** next to the template name at the top of the window to edit **Template Details**, **Device Details** and **Additional Details**. Click **Edit** next to the respective area.

Step 5 The template is auto saved. You can also choose to change the time interval of auto save, by clicking at the time recurrence next to **Auto Saved**.

Step 6 Click **Template History** to view the versions of the template. Also, you can click **Compare** to view the difference in the template versions.

Step 7 Click **Variables** tab to view the variables from the CLI template.

Step 8 Click the **Show Design Conflicts** toggle button to view potential errors in the template.

Catalyst Center allows you to view, potential and run-time errors. For more information, see [Potential Design Conflicts Detection Between CLI Template and Service Provisioning Intent, on page 380](#) and [Detect CLI Template Run-Time Conflict, on page 381](#).

- Step 9** Click **Save** at the bottom of the window.

After saving the template, Catalyst Center checks for any errors in the template. If there are any syntax errors, the template content is not saved and all input variables that are defined in the template are automatically identified during the save process. The local variables (variables that are used in **for** loops, assigned through a set, and so on) are ignored.

- Step 10** Click **Commit** to commit the template.

Note You can associate only a committed template to a network profile.

- Step 11** Click **Attach to Network Profile** link, to attach the created template to a network profile.
-

Template Simulation

The interactive template simulation lets you simulate the CLI generation of templates by specifying test data for variables before sending them to devices. You can save the test simulation results and use them later, if required.

- Step 1** From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

- Step 2** From the left pane, choose a project and click a template, for which you want to run a simulation.

The template is displayed.

- Step 3** Click the **Simulation** tab.

- Step 4** Click **Create Simulation**.

The **Create Simulation** slide-in pane is displayed.

- Step 5** Enter a unique name in **Simulation Name** field.

Note If there are implicit variables in your template then select a device from the **Device** drop-down list to run the simulation against real devices based on your bindings.

- Step 6** Click **Import Template Parameters** to import the template parameters or click **Export Template Parameters** to export the template parameters.

- Step 7** To use the variables from the last device provisioning, click **Use Variable Values from the Last Provisioning** link. New variables must be added manually.

- Step 8** Choose values of the variables, by clicking on the link and click **Run**.
-

Export Template(s)

You can export a template or multiple templates to a single file, in JSON format.

Import Template(s)

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > CLI Templates**.
- Step 2** Check a check box or multiple check box, next to the template name to select a template or multiple template that you want to export.
- Step 3** From the **Export** drop-down list, choose **Export Template**.
- Step 4** (Optional) You can filter the templates based on categories in the left pane.
- Step 5** The latest version of the template is exported.
- To export an earlier version of the template, do the following:
- Click the template name to open the template.
 - Click **Template History** tab.
- The **Template History** slide-in pane is displayed.
- Choose the preferred version.
 - Click **View** button below the version.
- The CLI template of that version is displayed.
- Click **Export** at the top of the template.
- The JSON format of the template is exported.
-

Import Template(s)

You can import a template or multiple templates under a project.



Note You can import templates only from an earlier version of Catalyst Center to a newer version. However, the opposite is not allowed.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > CLI Templates**.
- Step 2** In the left pane, choose the project for which you want to import templates, under **Project Name** and choose **Import > Import Template**.
- Step 3** **Import Templates** slide-in pane is displayed.
- Choose the **Project Name** from the drop-down list.
 - Upload the JSON file by doing one of the following actions:
 - Drag and drop the file to the drag and drop area.
 - Click, **Choose a file**, browse to the location of the JSON file, and click **Open**.
- File size should not exceed 10Mb.

- c. Check the check box to create a new version of imported template, if template with the same name already exists in the hierarchy.
- d. Click **Import**.

The CLI template is successfully imported to the chosen project.

Clone a Template

You can make a copy of a template to reuse portions of it.

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 Click the ellipsis under **Action** column and choose **Clone**.

Step 3 The **Clone Template** slide-in pane is displayed.

Do the following:

- a. Enter a unique name in **Template Name** field.
- b. Choose the **Project Name** from the drop-down list.

Step 4 Click **Clone**.

The latest version of the template is cloned.

Step 5 (Optional) Alternatively, you can clone the template by clicking the template name. The template is displayed. Click **Clone** above the template.

Step 6 To clone an earlier version of the template, do the following:

- a. Select the template by clicking the template name.
- b. Click the **Template History** tab.
The **Template History** slide-in pane is displayed.
- c. Click the preferred version.
The chosen CLI template is displayed.
- d. Click **Clone** above the template.

Attach a CLI Template to the Network Profiles

To provision a CLI template, it needs to be attached to a network profile. Use this procedure to attach a CLI template to a network profile or multiple network profiles.

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

The **CLI Templates** window is displayed.

Step 2 In the **Templates** table, under **Network Profile** column, click **Attach** to attach a template to the network profile.

Note Alternatively, you can click the ellipsis  under **Actions** column and choose **Attach to Profile**, or you can attach a template to the network profile from **Design > Network Profiles** window. For more information, see [Associate Templates to Network Profiles, on page 378](#).

The **Attach to Network Profile** slide-in pane is displayed.

Step 3 Check the check box next to the network profile name and click **Save**.

The CLI template is attached to the chosen network profile.

Step 4 The number displayed under **Network Profile** column shows the number of network profiles attached to a CLI template.

Click the number to view the network profile details.

Step 5 To attach more network profiles to a CLI template, do the following:

- Click the number under **Network Profile** column.

Alternatively, in **Actions** column, click the ellipsis icon  and choose **Attach to Profile**.

The **Network Profiles** slide-in pane is displayed.

- Click **Attach to Network Profile** link at the top right of the slide-in pane, check the check box next to the network profile name, and click **Attach**.

Provision CLI Templates

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 Check the check box next to the template that you want to provision and click **Provision Templates** at the top of the table.

You can provision multiple templates.

You are redirected to the **Provision Template** workflow.

Step 3 In the **Get Started** window, enter a unique name in **Task Name** field.

Step 4 In the **Select Devices** window, choose the devices from the applicable devices list, which are based on the device details defined in the template. Click **Next**.

Step 5 In the **Review Applicable Templates** window, review the devices and the attached templates. If required, you can remove the templates that you do not want to be provisioned on the device.

Step 6 In the **Configure Template Variables** window, configure the template variables for each device.

Step 7 In the **Preview Configuration** window, select the device to preview the configuration that is being provisioned on it.

Step 8 In the **Schedule Task** window, select whether to provision the template **Now** or **Later**. Click **Next**.

Step 9 In the **Summary** window, review the template configurations for your devices. Click **Edit** to make any changes; otherwise, click **Submit**.

Your devices will be provisioned with the template.

- Note** You can review configurations before deploying them on Cisco network devices. You can review the commands that are used in CLI templates in the **Preview Configuration** window.
- You can secure the configuration deployment with the **ITSM Approval** procedure.
- This feature is available when provisioning the device from **Inventory > Provision Device**. For more information, see [Visibility and Control of Device Configurations, on page 132](#).
- If the provisioning of a template fails, Catalyst Center does not attempt to roll back the commands that were pushed before the template provisioning failure.

Export Project(s)

You can export a project or multiple projects, including their templates, to a single file in JSON format.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > CLI Templates**.
- Step 2** In the left pane, select a project or multiple project that you want to export under **Project Name**.
- Step 3** From **Export** drop-down list, choose **Export Project**.
- Step 4** Click **Save**, if prompted.
-

Import Project(s)

You can import a project or multiple projects with their templates, into the Catalyst Center CLI Templates.



-
- Note** You can import projects only from an earlier version of Catalyst Center to a newer version. However, the opposite is not allowed.
-
- Step 1** From the top-left corner, click the menu icon and choose **Design > CLI Templates**.
- Step 2** From the **Import** drop-down list, choose **Import Project**.
- Step 3** The **Import Projects** slide-in pane is displayed.
- Upload the JSON file by doing one of the following actions:
 - Drag and drop the file to the drag and drop area.
 - Click **Choose a file**, browse to the location of the JSON file, and click **Open**.
- File size should not exceed 10Mb.
- Check the check box to create a new version of the template, in the existing project, if the project with the same name already exists in hierarchy.
- Click **Import**.

The project is successfully imported.

Template Variables

The Template Variables is used for adding additional metadata information to the template variables in the template. You can also use the variables to provide validations for variables such as maximum length, range, and so on.

Step 1 From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2 From the left pane, choose a project and click a template.

The template is displayed.

Step 3 Click the **Variables** tab.

It enables you to add metadata to the template variables. All the variables that are identified in the template are displayed. You can configure the following metadata:

- Choose the variable from the left pane, and click the **Variable** toggle button if you want the string to be considered as a variable.

Note By default the string considered as a variable. Click the toggle button, if you do not want the string to be considered as a variable.

- Check the **Required Variable** check box if this is a required variable during the provisioning. All the variables by default are marked as Required, which means you must enter the value for this variable at the time of provisioning. If the parameter is not marked as **Required Variable** and if you do not pass any value to the parameter, it substitutes an empty string at run time. A lack of a variable can lead to command failure, which may not be syntactically correct. If you want to make an entire command optional based on a variable not marked as **Required Variable**, use the **if-else** block in the template.

- Enter the field name in the **Field Name**. This is the label that is used for the UI widget of each variable during provisioning.

- In **Variable Data Value** area, choose the **Variable Data Source** by clicking the radio button. You can choose, **User Defined** value or **Bound to Source** value to hold a specific value.

Do the following, if you choose **User Defined** value:

- Choose the **Variable Type** from the drop-down list: **String**, **Integer**, **IP Address**, or **Mac Address**
- Choose the **Data Entry Type** from the drop-down list: **Text Field**, **Single Select**, or **Multi Select**.
- Enter the default variable value in the **Default Variable Value** field.
- Check the **Sensitive Value** check box for sensitive value.
- Enter the number of characters that are allowed in the **Maximum Characters** field. This is applicable only for the string data type.
- Enter hint text in the **Hint Text** field.
- Enter any additional information in the **Additional Info** text box.

Do the following, if you choose **Bound to Source** value:

- a. Choose the **Data Entry Type** from the drop-down list: **Text Field**, **Single Select**, or **Multi Select**.
- b. Choose the **Source** from the drop-down list: **Network Profile**, **Common Settings**, **Cloud Connect** and **Inventory**.
- c. Choose the **Entity** from the drop-down list.
- d. Choose the **Attribute** from the drop-down list.
- e. Enter the number of characters that are allowed in the **Maximum Characters** field. This is applicable only for the string data type.
- f. Enter hint text in the **Hint Text** field.
- g. Enter any additional information in the **Additional Info** text box.

For more details on **Bound to Source** value, see [Variable Binding, on page 373](#).

Step 4 After configuring metadata information, click **Review Form** to review the variable information.

Step 5 Click **Save**.

Step 6 To commit the template, choose **Commit**. The **Commit** window is displayed. You can enter a commit note in the **Commit Note** text box.

Variable Binding

While creating a template, you can specify variables that are contextually substituted. Many of these variables are available under **Design > CLI Templates**.

CLI templates provide an option to bind or use variables in the template with the source object values while editing or through the input form enhancements; for example, DHCP server, DNS server, and syslog server.

Some variables are always bound to their corresponding source and their behavior cannot be changed. To view the list of implicit variables, click the template and click **Variables** tab.



Note Variable binding is not supported for day-zero template, it is only supported for day-n template.

The predefined object values can be one of the following:

- Network Profile
 - SSID
 - Policy profile
 - AP group
 - Flex group
 - Flex profile
 - Site tag
 - Policy tag

- Common Settings
 - DHCP server
 - Syslog server
 - SNMP trap receiver
 - NTP server
 - Timezone site
 - Device banner
 - DNS server
 - NetFlow collector
 - AAA network server
 - AAA endpoint server
 - AAA server pan network
 - AAA server pan endpoint
 - WLAN info
 - RF profile info
- Cloud Connect
 - Cloud router-1 Tunnel IP
 - Cloud router-2 Tunnel IP
 - Cloud router-1 Loopback IP
 - Cloud router-2 Loopback IP
 - Branch router-1 Tunnel IP
 - Branch router-2 Tunnel IP
 - Cloud router-1 Public IP
 - Cloud router-2 Public IP
 - Branch router-1 IP
 - Branch router-2 IP
 - Private subnet-1 IP
 - Private subnet-2 IP
 - Private subnet-1 IP mask
 - Private subnet-2 IP mask
- Inventory

- Device
- Interface
- AP group
- Flex group
- WLAN
- Policy profile
- Flex profile
- Webauth parameter map
- Site tag
- Policy tag
- RF profile

- **Common Settings:** Settings available under **Design > Network Settings > Network**. The common settings variable binding resolves values that are based on the site to which the device belongs.

Step 1

From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

Step 2

Choose the template and click the **Variables** tab to bind variables in the template to network settings.

Step 3

Select the variables in the left pane and check the **Required Variable** check box to bind variables to the network settings.

Step 4

To bind variables to network settings, select each variable from the left pane, and under **Variable Data Source**, click the **Bound to Source** radio button. Do the following:

- a. From the **Data Entry Type** drop-down list, choose the type of UI widget to create at the time of provisioning: **Text Field**, **Single Select**, or **Multi Select**.
- b. Choose the **Source**, **Entity**, and **Attribute** from the respective drop-down lists.
- c. For the source type **CommonSettings**, choose one of these entities: **dhcp.server**, **syslog.server**, **snmp.trap.receiver**, **ntp.server**, **timezone.site**, **device.banner**, **dns.server**, **netflow.collector**, **aaa.network.server**, **aaa.endpoint.server**, **aaa.server.pan.network**, **aaa.server.pan.endpoint**, **wlan.info** or **rfprofile.info**.

You can apply a filter on the **dns.server** or **netflow.collector** attributes to display only the relevant list of **bind** variables during provisioning of devices. To apply a filter on an attribute, select an attribute from the **Filter by** drop-down list. From the **Condition** drop-down list, select a condition to match the **Value**.

- d. For the source type **NetworkProfile**, choose **SSID** as the entity type. The SSID entity that is populated is defined under **Design > Network Profile**. The binding generates a user-friendly SSID name, which is a combination of SSID name, site, and SSID category. From the **Attributes** drop-down list, choose **wlanid** or **wlanProfileName**. This attribute is used during the advanced CLI configurations at the time of template provisioning.
- e. For the source type **Inventory**, choose one of these entities: **Device**, **Interface**, **AP Group**, **Flex Group**, **Wlan**, **Policy Profile**, **Flex Profile**, **Webauth Parameter Map**, **Site Tag**, **Policy Tag**, or **RF Profile**. For the entity type **Device** and **Interface**, the **Attribute** drop-down list shows the device or interface attributes. The variable resolves to the AP Group and Flex Group name that is configured on the device to which the template is applied.

You can apply filter on the **Device**, **Interface**, or **Wlan** attributes to display only the relevant list of **bind** variables during provisioning of devices. To apply a filter on an attribute, select an attribute from the **Filter by** drop-down list. From the **Condition** drop-down list, select a condition to match the **Value**.

After binding variables to a common setting, when you assign templates to a wireless profile and provision the template, the network settings that you defined under **Network Settings > Network** appear in the drop-down list. You must define these attributes under **Network Settings > Network** at the time of designing your network.

Step 5

If the template contains variable bindings that bind to specific attributes and the template code accesses those attributes directly, you must do one of the following:

- Change the binding to the object instead of to the attributes.
- Update the template code to not access the attributes directly.

For example, if the template code is as follows, where **\$interfaces** binds to specific attributes, you must update the code as shown in the following example, or modify the binding to the object instead of to the attributes.

Old sample code:

```
#foreach ( $interface in $interfaces )
$interface.portName
    description "something"
#end
```

New sample code:

```
#foreach ( $interface in $interfaces )
    interface $interface
        description "something"
#end
```

Special Keywords

All commands executed through templates are always in the **config t** mode. Therefore, you do not have to specify the **enable** or **config t** commands explicitly in the template.

Day-zero templates do not support special keywords.

Enable Mode Commands

Specify the **#MODE_ENABLE** command if you want to execute any commands outside of the **config t** command.

Use this syntax to add **enable mode** commands to your CLI templates:

```
#MODE_ENABLE
<<commands>>
#MODE_END_ENABLE
```

Interactive Commands

Specify **#INTERACTIVE** if you want to execute a command where a user input is required.

An interactive command contains the input that you must enter following the execution of a command. To enter an interactive command in the CLI Content area, use the following syntax:

```
CLI Command<IQ>interactive question 1 <R> command response 1 <IQ>interactive question
2<R>command response 2
```

Where <IQ> and <R> tags evaluate the text provided against what is seen on the device.

The Interactive question uses regular expressions to validate if the text received from the device is similar to the text entered. If the regular expressions entered in the <IQ><R> tags are found, then the interactive question passes and a part of the output text appears. This means that you need to enter a part of the question and not the entire question. Entering Yes or No between the <IQ> and <R> tags is sufficient but you must make sure that the text Yes or No appears in the question output from the device. The best way to do this is by running the command on the device and observing the output. In addition, you need to ensure that any regular expression metacharacters or newlines entered are used appropriately or avoided completely. The common regular expression metacharacters are . () [] { } | * + ? \ \$ ^ : &.

For example, the following command has output that includes metacharacters and newlines.

```
Switch(config)# no crypto pki trustpoint server-CA
% Removing an enrolled trustpoint will destroy all certificates received from the related
Certificate Authority
Are you sure you want to do this? [yes/no]:
```

To enter this in a template, you need to select a portion that does not have any metacharacters or newlines. Here are a few examples of what could be used.

```
#INTERACTIVE
no crypto pki trustpoint server-CA<IQ>yes/no<R>yes
#ENDS_INTERACTIVE

#INTERACTIVE
no crypto pki trustpoint server-CA<IQ>Removing an enrolled<R>yes
#ENDS_INTERACTIVE

#INTERACTIVE
no crypto pki trustpoint server-CA<IQ>Are you sure you want to do this<R>yes
#ENDS_INTERACTIVE

#INTERACTIVE
crypto key generate rsa general-keys <IQ>yes/no<R> no
#ENDS_INTERACTIVE
```

Where <IQ> and <R> tags are case-sensitive and must be entered in uppercase.



Note In response to the interactive question after providing a response, if the newline character is not required, you must enter the <SF> tag. Include one space before the <SF> tag. When you enter the <SF> tag, the </SF> tag pops up automatically. You can delete the </SF> tag because it is not needed.

For example:

```
#INTERACTIVE
config advanced timers ap-fast-heartbeat local enable 20 <SF><IQ>Apply(y/n)?<R>y
#ENDS_INTERACTIVE
```

Combining Interactive Enable Mode Commands

Use this syntax to combine interactive **Enable Mode** commands:

```
#MODE_ENABLE
#INTERACTIVE
commands<IQ>interactive question<R> response
#ENDS_INTERACTIVE
#MODE_END_ENABLE

#MODE_ENABLE
#INTERACTIVE
mkdir <IQ>Create directory<R>xyz
#ENDS_INTERACTIVE
#MODE_END_ENABLE
```

Multiline Commands

If you want multiple lines in the CLI template to wrap, use the **MLTCMD** tags. Otherwise, the command is sent line by line to the device. To enter multiline commands in the CLI Content area, use the following syntax:

```
<MLTCMD>first line of multiline command
second line of multiline command
...
...
last line of multiline command</MLTCMD>
```

- Where **<MLTCMD>** and **</MLTCMD>** are case-sensitive and must be in uppercase.
- The multiline commands must be inserted between the **<MLTCMD>** and **</MLTCMD>** tags.
- The tags cannot start with a space.
- The **<MLTCMD>** and **</MLTCMD>** tags cannot be used in a single line.

Associate Templates to Network Profiles

Before you begin

Before provisioning a template, ensure that the template is associated with a network profile and the profile is assigned to a site.

During provisioning, when the devices are assigned to specific sites, the templates associated with the site through the network profile appear in the advanced configuration.

Step 1

From the top-left corner, click the menu icon and choose **Design > Network Profiles**, and click **Add Profile**.

The following types of profiles are available:

- **Assurance**: Click this to create an Assurance profile.
 - **Firewall**: Click this to create a firewall profile.
 - **Routing**: Click this to create a routing profile.
 - **Switching**: Click this to create a switching profile.
- Click the **Onboarding Templates** or **Day-N Templates**, as required.

- In the **Profile Name** field, enter the profile name.
 - Click **+Add Template** and choose the device type, tag, and template from the **Device Type**, **Tag Name**, and **Template** drop-down lists.

If you do not see the template that you need, create a new template in **Design > CLI Templates** window. For more information, see [Create a Regular Template, on page 362](#).
 - Click **Save**.
- **Telemetry Appliance:** Click this to create a Catalyst Center Traffic Telemetry Appliance profile.
 - **Wireless:** Click this to create a wireless profile. Before assigning a wireless network profile to a template, ensure that you have created wireless SSIDs.
 - In the **Profile Name** field, enter the profile name.
 - Click **+ Add SSID**. The SSIDs that were created under **Network Settings > Wireless** are populated.
 - Under **Attach Template(s)**, from the **Template** drop-down list, choose the template that you want to provision.
 - Click **Save**.

Note You can view the Switching and Wireless profiles in the **Cards** and the **Table** view.

Step 2 The **Network Profiles** window lists the following:

- **Profile Name**
- **Type**
- **Version**
- **Created By**
- **Sites:** Click **Assign Site** to add sites to the selected profile.

Step 3 For day-*n* provisioning, choose **Provision > Network Devices > Inventory** and do the following:

- a) Check the check box next to the device name that you want to provision.
- b) From the **Actions** drop-down list, choose **Provision**.
- c) In the **Assign Site** window, assign a site to which the profiles are attached.
- d) In the **Choose a Site** field, enter the name of the site to which you want to associate the controller, or choose from the **Choose a Site** drop-down list.
- e) Click **Next**.
- f) The **Configuration** window appears. In the **Managed AP Locations** field, enter the AP locations managed by the controller. You can change, remove, or reassign the site. This is applicable only for wireless profiles.
- g) Click **Next**.
- h) The **Advanced Configuration** window appears. The templates associated with the site through the network profile appear in the advanced configuration.
 - Check the **Provision these templates even if they have been deployed before** check box if you overwrote any configurations from intent in the template, and you want your changes to override. (This option is disabled by default.)
 - The **Copy running config to startup config** option is enabled by default, which means that after deploying the template configuration, **write mem** will be applied. If you don't want to apply the running config to the startup config, you must uncheck this check box.

Detect Conflicts in a CLI Template

- Use the **Find** feature to quickly search for the device by entering the device name, or expand the templates folder and select the template in the left pane. In the right pane, select values for those attributes that are bound to the source.
 - To export the template variables into a CSV file while deploying the template, click **Export** in the right pane. You can use the CSV file to make necessary changes in the variable configuration and import it into Catalyst Center at a later time by clicking **Import** in the right pane.
- i) Click **Next** to deploy the template.
 - j) Choose whether you want to deploy the template **Now** or schedule it for later. The **Status** column in the **Device Inventory** window shows **SUCCESS** after the deployment succeeds.

Step 4

Click **Export Deployment CSV** to export template variables from all the templates in a single file.

Step 5

Click **Import Deployment CSV** to import template variables from all the templates in a single file.

Step 6

For day-zero provisioning, choose **Provision > Plug and Play** and do the following:

- a) Choose a device from the **Actions** drop-down list, and choose **Claim**.
- b) Click **Next** and in **Site Assignment** window, choose a site from the **Site** drop-down list.
- c) Click **Next** and in **Configuration** window, choose the image and the day-zero template.
- d) Click **Next** and in the **Advanced Configuration** window, enter the location.
- e) Click **Next** to view the **Device Details**, **Image Details**, **Day-0 Configuration Preview**, and **Template CLI Preview**.

Detect Conflicts in a CLI Template

Catalyst Center allows you to detect conflicts in a CLI template. You can view potential design conflicts and run-time conflicts for switching, wireless, SD-Access, or fabric.

Potential Design Conflicts Detection Between CLI Template and Service Provisioning Intent

Potential Design Conflicts identify the intent commands in the CLI template and flag them, if the same command is pushed by switching, wireless, SD-Access, or fabric. Intent commands are not recommended for use, because Catalyst Center supports this configuration through intent provision for device.

Step 1

From the top-left corner, click the menu icon and choose **Design > CLI Templates**.

The **CLI Templates** window is displayed.

Step 2

(Optional) In the left pane, from the **Project Name** drop-down list, choose a project with your preferred CLI templates.

Note To view only the templates with conflicts, in the left pane, under **Potential Design Conflicts**, check the **Conflicts** check box.

Step 3

Click the template name to view the total number of conflicts.

Alternatively, under the **Potential Design Conflicts** column, you can also view the total number of conflicts by clicking the warning icon.

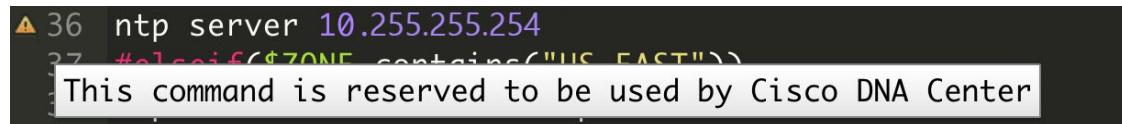
The CLI Template is displayed.

Step 4 In the template, hover your cursor over the warning icon to view the details of the conflict.

The CLI commands that have conflicts are flagged with a warning icon. For new templates, the conflicts are detected after you save the template.

Example:

When the intent command **ntp server** is used in the CLI template, Catalyst Center displays the following message when you hover your cursor over the warning icon:



Step 5 (Optional) To show or hide the conflicts, click the **Show Design Conflicts** toggle button.

Step 6 (Optional) You can also view the number of conflicts on newly configured CLI templates by doing following:

a) From the top-left corner, click the menu icon and choose **Provision > Inventory**.

On the **Inventory** window, a message with a warning icon is displayed, which shows the number of conflicts in the newly configured CLI template.

b) Click the **Update CLI Templates** link to view the conflicts.

Detect CLI Template Run-Time Conflict

Run-time conflict detection matches the exact CLI commands in the CLI template with the already provisioned commands. If an exact command match is detected, Catalyst Center flags the command. Catalyst Center allows you to detect run-time conflict for switching, wireless, SD-Access, or fabric.



Note Catalyst Center doesn't support run-time conflict detection for Cisco Catalyst 9800 Series Wireless Controllers.

Before you begin

You must configure the CLI template through Catalyst Center to detect run-time conflict.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window is displayed.

Step 2 Under the **Template Provision Status** column, view the template provisioning status of devices, which shows the number of templates provisioned on the device.

The templates that are provisioned successfully are displayed with a tick icon. The templates that have conflicts are displayed with a warning icon.

Step 3 Under the **Template Provision Status** column, click the link to open the **Template Status** slide-in pane.

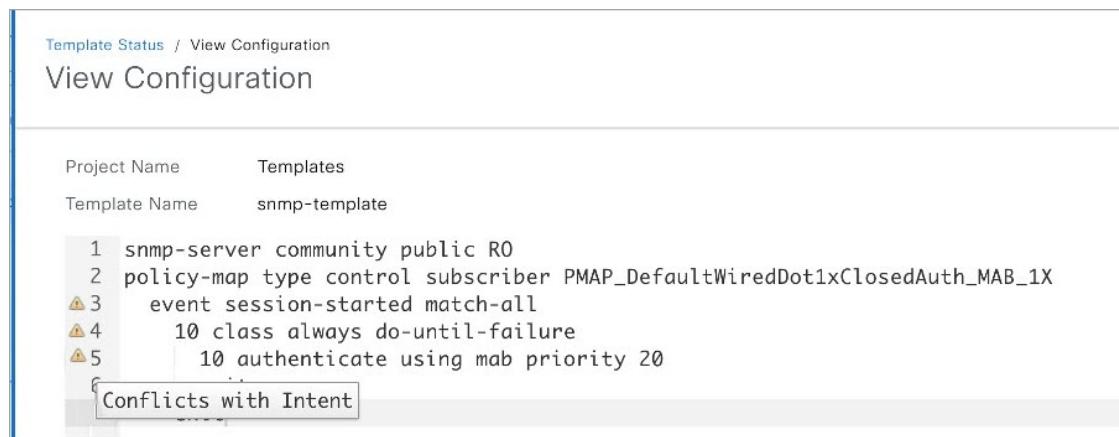
You can view the following information in the table:

Detect CLI Template Run-Time Conflict

- **Template Name**
- **Project Name**
- **Provision Status:** Displays **Template Provisioned** if the template was provisioned successfully or **Template Out of Sync** if there are any conflicts in the template.
- **Conflict Status:** Displays the number of conflicts in the CLI template.
- **Actions:** Click **View Configuration** to view the CLI template. Commands that have conflicts are flagged with a warning icon.

Example:

The following example shows the **View Configuration** slide-in pane with run-time conflicts:



The screenshot shows the 'View Configuration' slide-in pane. At the top, it displays 'Template Status / View Configuration' and the title 'View Configuration'. Below this, it shows 'Project Name' and 'Templates' with 'Template Name' set to 'snmp-template'. The main area contains the following CLI configuration:

```

Project Name      Templates
Template Name    snmp-template
1  snmp-server community public RO
2  policy-map type control subscriber PMAP_DefaultWiredDot1xClosedAuth_MAB_1X
⚠ 3    event session-started match-all
⚠ 4      10 class always do-until-failure
⚠ 5        10 authenticate using mab priority 20
  Conflicts with Intent

```

A callout box labeled 'Conflicts with Intent' points to the warning icons (⚠) preceding the third, fourth, and fifth lines of the configuration.

Step 4 (Optional) You can view the number of conflicts in a CLI template under the **Template Conflicts Status** column in the **Inventory** window.

Step 5 Identify the run-time conflicts by generating a configuration preview:

- a) Check the check box next to the device name.
- b) From the **Actions** drop-down list, choose **Provision Device**.
- c) On the **Assign Site** window, click **Next**. On the **Advanced Configuration** window, make the necessary changes and click **Next**. On the **Summary** window, click **Deploy**.
- d) In the **Provision Device** slide-in pane, click the **Generate Configuration Preview** radio button and click **Apply**.
- e) Click the **Work Items** link to view the generated configuration preview.

Alternatively, click the menu icon and choose **Activities > Tasks** and open the work item to view the generated configuration preview.

- f) (Optional) If the activity is still loading, click **Refresh**.
- g) Click the preview link to open the **Configuration Preview** slide-in pane. You can view the CLI commands with run-time conflicts that are flagged with warning icons.



CHAPTER 12

Design Model Configuration

- [Introduction to Feature Templates, on page 383](#)
- [Discover and Create Designs from a Legacy Device, on page 384](#)
- [Create a Model Config Design for AAA RADIUS Attributes, on page 384](#)
- [Create a Model Config Design for Advanced SSID, on page 385](#)
- [Create a Model Config Design for Cisco CleanAir, on page 390](#)
- [Create a Model Config Design for Dot11ax Configuration, on page 392](#)
- [Create a Model Config Design for Event-Driven RRM, on page 394](#)
- [Create a Model Config Design for Flex Configuration, on page 395](#)
- [Create a Model Config Design for Global IPv6 Configuration, on page 397](#)
- [Create a Model Config Design for Multicast, on page 398](#)
- [Create a Model Config Design for RRM FRA Parameters, on page 400](#)
- [Create a Model Config Design for RRM General Parameters, on page 401](#)
- [Create a Model Config Design for Rogue General Parameters, on page 403](#)

Introduction to Feature Templates

Model Config allows you to define advanced customizations of the Cisco Validated Designs (CVDs) that are encapsulated within the provisioning applications. Model Configs are a set of model-based, discoverable, and customizable configuration capabilities, which you can deploy on your network devices with high-level service intent and device-specific CLI templates.

The Model Configs feature simplifies network provision by extracting complex device configurations and facilitating customizable network configurations using an intuitive GUI instead of device-specific CLIs. A common design is deployed to various device hardware platforms and software types in a uniform way. During deployments, the Catalyst Center infrastructure automatically validates and translates extracted designs to device-specific CLI commands.

To provision model config design, do the following:

1. Create a new model config design using the **Feature Templates** window (menu icon > **Design > Feature Templates**).
2. Apply the model config design to different network profiles.
3. Using the provision workflow, apply the model config design that is specified in network profiles to a network device.

Supported Model Config Design Types

Catalyst Center supports the following wireless Model Config design types:

- AAA Radius attributes configuration
- Advanced SSID configuration
- CleanAir configuration
- Event driven RRM configuration
- Flex configuration
- Dot11ax configuration
- Global IPv6 configuration
- Multicast configuration
- RRM FRA configuration
- RRM general configuration

Discover and Create Designs from a Legacy Device

Instead of manually creating designs using the Feature Templates, you can use the Discover Model Configs feature to discover the existing model configuration designs available on legacy devices and use them as a template to create new designs.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2 Click the **Discovery** tab.

A list of discovered devices that are available in the **Inventory** window is displayed.

Step 3 Click the radio button next to the device name and click **Discover Model Configs**.

Step 4 In the right pane, expand **Wireless** and choose a model configuration design type.

The configuration available for the selected model configuration type is displayed. For example, if you choose **CleanAir Configuration** under **Wireless**, the available configuration for the CleanAir is displayed.

Step 5 Click the radio button next to the configuration that you want to use as a template to create a new design, and click **Create Design**.

Step 6 In the window that is displayed, make the necessary changes and click **Save**.

Create a Model Config Design for AAA RADIUS Attributes

Use the **AAA Radius Attributes Configuration** model configuration design to define the **Called-station-id** parameter value for Cisco AireOS Wireless Controllers and Cisco Catalyst 9800 Series Wireless Controllers.

The **Default AAA_Radius_Attributes_Configuration** defines the called-station ID as **ap-macaddress-ssid**. You cannot edit or delete this default model configuration design. However, you can create a custom model configuration design for your specific network design.

Before you begin

You should have discovered the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2 In the left pane, expand **Wireless** and choose **AAA Radius Attributes Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3 In the **Design Instances** window, click **Add**.

Step 4 In the **Design Name** field of the **Add Called-station-id** slide-in pane, enter a name for the model configuration design.

Step 5 To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.

A property that is locked in the design can't be changed during device provisioning.

Step 6 From the **Called-station-id** drop-down list, choose an attribute value.

Step 7 Click **Save**.

The new design instance is displayed in the **Design Instances** window.

Step 8 (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on a wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) or [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

Create a Model Config Design for Advanced SSID

A WLAN associates a service set identifier (SSID) to an interface or an interface group. The WLAN is configured with security, quality of service (QoS), radio policies, and other wireless network parameters. You can configure up to 512 WLANs for each wireless controller.

Use the **Advanced SSID Configuration** model configuration design to configure the advanced SSID parameters on devices.

Before you begin

You must discover the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Feature Templates**.
- Step 2** In the left pane, expand **Wireless** and choose **Advanced SSID Configuration**.
- Alternatively, you can search for a model configuration by entering its name in the **Search** field.
- Step 3** In the **Design Instances** window, check the **Default Advanced SSID Design** check box to use the default advanced SSID design.
- Note** You can't edit or delete the **Default Advanced SSID Design**.
- Step 4** In the **Design Instances** window, click **Add**.
- Step 5** In the **Design Name** field of the **Add Advanced SSID Configuration** slide-in pane, enter a name for the model configuration.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
- A property that is locked in the design can't be changed during device provisioning.
- Step 7** In the **General** tab, do the following:
- From the **Peer to Peer Blocking** drop-down list, choose an option for peer-to-peer blocking.

Peer-to-peer blocking is applied to individual WLANs. Each client inherits the peer-to-peer blocking setting of the WLAN to which it's associated. Peer-to-peer blocking enables you to have more control over how traffic is directed.

 - **DISABLE**: Disables peer-to-peer blocking and forwards traffic locally within the wireless controller whenever possible.
 - **DROP**: Causes the wireless controller to discard the client packets.
 - **FORWARD UP**: Causes the client packets to be forwarded on an upstream VLAN. The device above the wireless controller decides what to do with the packets. The device can either be a router or a Layer 3 switch.
 - **ALLOW PVT GROUP**: Applicable to preshared key (PSK) clients only. Traffic is forwarded based on the associated identity PSK (IPSK) tags for the source and destination client devices.
 - Click the **Passive Client Enable** toggle button to enable the Passive Client feature.

Passive clients are wireless devices, such as scales and printers, that are configured with a static IP address. These clients do not transmit any IP information (such as IP address, subnet mask, and gateway information) when they associate with an AP. As a result, when passive clients are used, the wireless controller never knows the IP address unless they use DHCP.
 - Click the **Assisted Roaming Prediction Optimization** toggle button to configure an assisted roaming prediction list for a WLAN.
 - Click the **Neighbor List Dual Band** toggle button to configure a neighbor list on a dual radio band.
 - Click the **Network Admission Control (NAC-SNMP)** toggle button to enable SNMP NAC support on the WLAN.
 - Click the **Network Admission Control (NAC-Radius)** toggle button to enable RADIUS NAC support on the WLAN.

- g) From the **DHCP Required** drop-down list, choose **Yes** or **No** to pass the DHCP request before going into the RUN state (a state where the client can pass traffic through the wireless controller).
- h) In the **DHCP Server - IP Address** field, enter the IP address of the DHCP server.
- i) Click the **FlexConnect Local Authentication** toggle button to enable FlexConnect local authentication.
- j) Click the **802.11ax Status** toggle button to enable 802.11ax configuration parameters.
- k) Click the **Aironet IE** toggle button to enable support for Aironet IE on this SSID.
- l) Click the **Load Balance Enable** toggle button to enable the load balancing feature.
- m) In the **DTIM Period 5GHz Band (In Beacon Intervals)** [1-255] field, enter a value for the 5-GHz band.

The valid range is from 1 through 255. The default value is 1 (to transmit broadcast and multicast frames after every beacon).

If the beacon period of the 802.11 network is 100 ms and the DTIM value is set to 1, the AP transmits buffered broadcast and multicast frames 10 times every second. If the beacon period is 100 ms and the DTIM value is set to 2, the AP transmits buffered broadcast and multicast frames five times every second. Either of these settings are suitable for applications, including Voice Over IP (VoIP), that expect frequent broadcast and multicast frames.

However, the DTIM value can be set as high as 255 (to transmit broadcast and multicast frames after every 255th beacon).

- n) In the **DTIM Period 2.4GHz Band (In Beacon Intervals)** [1-255] field, enter a value for the 2.4-GHz band. The valid range is from 1 through 255. The default value is 1 (to transmit broadcast and multicast frames after every beacon).
- o) In the **Max Clients Per WLAN** field, enter the maximum number of clients that are allowed to join the WLAN.
The valid range is between 0 and 10,000.
- p) In the **Max Clients Per AP Radio Per WLAN** [0-500] field, enter the maximum number of clients that are allowed to join the WLAN per AP.
The valid range is between 0 and 500.
- q) In the **Max Clients Per AP Per WLAN** [0-1200] field, enter the maximum number of client connections that are allowed per AP.
The valid range is between 0 and 1200.
- r) From the **WMM Policy** drop-down list, choose an option for the WMM policy: **Allowed**, **Disabled**, or **Required**.
By default, the WMM policy is **Allowed**.
- s) In the **NAS ID** field, enter the network access server identifier.

Step 8

In the **Client Data Rates** tab, configure the following client data rate limits per client by entering values in the respective fields:

- **Average Downstream Data Rate Per Client (kbps)**
- **Burst Downstream Data Rate Per Client (kbps)**
- **Average Downstream Real-Time Rate Per Client (kbps)**
- **Burst Downstream Real-Time Rate Per Client (kbps)**
- **Average Upstream Data Rate Per Client (kbps)**
- **Burst Upstream Data Rate Per Client (kbps)**
- **Average Upstream Real-Time Rate Per Client (kbps)**

- **Burst Upstream Real-Time Rate Per Client (kbps)**

Step 9 In the **SSID Data Rates** tab, configure the following SSID data rate limits per SSID by entering values in the respective fields:

- **Average Upstream Data Rate Per SSID (kbps)**
- **Burst Upstream Data Rate Per SSID (kbps)**
- **Average Upstream Real-Time Rate Per SSID (kbps)**
- **Burst Upstream Real-Time Rate Per SSID (kbps)**
- **Average Downstream Data Rate Per SSID (kbps)**
- **Burst Downstream Data Rate Per SSID (kbps)**
- **Average Downstream Real-Time Rate Per SSID (kbps)**
- **Burst Downstream Real-Time Rate Per SSID (kbps)**

Step 10 Hover your cursor over **More** and click **802.11ax Configuration** to configure the 802.11ax BSS configuration parameters. To enable or disable the following parameters, you can use the corresponding toggle buttons:

- **BSS Target Wake Up Time**
- **Downlink OFDMA**
- **Uplink OFDMA**
- **Downlink MU-MIMO**
- **Uplink MU-MIMO**

Note These parameters apply only to 2.4-GHz and 5-GHz radio bands. You can configure 802.11ax parameters for the 6-GHz radio band under the **Design > Network Settings > Wireless > RF Profiles** window. For more information, see [Create a Wireless Radio Frequency Profile, on page 277](#).

Step 11 Hover your cursor over **More** and click **Off Channel Scanning Defer** to configure the scan defer time and defer priority.

- a) In the **Scan Defer Time [0-60000msecs]** field, set the time in milliseconds.

The valid values are between 0 and 60000 milliseconds; the default value is 100 milliseconds. If you set the time to 0, the scan deferral does not happen. The scan defer time is common for all priorities on the same WLAN, and the scan is deferred if a packet is transmitted or received in any one of the deferred priorities.

- b) Click the corresponding toggle buttons to configure the required priority markings for packets:

- **Defer Priority0**
- **Defer Priority1**
- **Defer Priority2**
- **Defer Priority3**
- **Defer Priority4**
- **Defer Priority5**

- Defer Priority6
- Defer Priority7

Note These parameters are not supported on the Cisco AireOS Wireless Controller.

Step 12 Hover your cursor over **More** and click **Device Analytics** to configure the device analytics parameters:

- a) Click the **Share Data with Client** toggle button to enable sharing Cisco device data with the client.
- b) Click the **Advertise Support** toggle button to configure device analytics support.
- c) Click the **Advertise PC Analytics Support** toggle button to configure PC analytics support.

Note These parameters are not supported on the Cisco AireOS Wireless Controller.

Step 13 Hover your cursor over **More** and click **802.11k Beacon Radio Measurement** to configure the 802.11k beacon radio measurement parameters:

- a) Click the **Client Scan Report On Association** toggle button to send beacon measurement request (client scan report) on client association.
- b) Click the **Client Scan Report On Roam** toggle button to send beacon measurement request (client scan report) on client roaming.

Note These parameters are not supported on the Cisco AireOS Wireless Controller.

Step 14 Hover your cursor over **More** and click **Multicast Buffer** to configure the multicast buffer parameter:

- a) Click the **Multicast Buffer Enable** toggle button to configure multicast buffer tuning mode for 802.11a radio for WLAN.

Note This parameter is not supported on the Cisco AireOS Wireless Controller.

Step 15 Hover your cursor over **More** and click **SIP-CAC** to configure the SIP Call Admission Control (CAC) parameters:

- a) Click the **Call Snooping** toggle button to configure call snooping for the WLAN mapped to the policy profile.
- b) Click the **Send Disassociate** toggle button to configure the SIP CAC send disassociate option.
- c) Click the **Send 486 Busy** toggle button to configure the SIP CAC send 486 busy option.

Note These parameters are not supported on the Cisco AireOS Wireless Controller.

Step 16 Hover your cursor over **More** and click **Miscellaneous** to configure the following parameters:

- a) Click the **Media Stream Multicast-Direct** toggle button to configure multicast direct for WLAN.
- b) Click the **802.11ac MU-MIMO** toggle button to configure 802.11ac MU-MIMO on WLAN.
- c) Click the **Wifi To Cellular Steering** toggle button to configure Wi-Fi to cellular steering on WLAN.
- d) Click the **Wi-Fi Alliance Agile Multiband** toggle button to configure Wifi alliance agile multiband (MBO) support.
- e) Click the **Fastlane+ (ASR)** toggle button to configure advanced scheduling request handling on WLAN.
- f) Click the **Dot11v Bss Max Idle Protected** toggle button to configure BSS maximum idle processing per WLAN.
- g) Click the **Universal Admin** toggle button to allow universal admin mode to be enabled on a 802.1x, WPA, or WPA2-secured WLAN.
- h) Click the **Opportunistic Key Caching** toggle button to configure opportunistic key caching.
- i) Click the **IP Source Guard** toggle button to configure MAC verification.
- j) Click the **Enable DHCP Option82 Remote ID suboption** toggle button to configure the DHCP Option82 remote ID option.
- k) Click the **VLAN Central Switching** toggle button to configure VLAN central switching.

- l) Click the **IP Mac Binding** toggle button to configure control over support for IP MAC binding creation.
- m) In the **Idle threshold (0-4294967295 bytes)** field, enter the idle threshold value. The valid range is between 0 and 4294967295 bytes. The default value is 0.
- n) In the **Reassociation Timeout time [1-100 seconds]** field, enter the reassociation timeout time. The valid range is between 1 and 100 seconds. The default value is 20 seconds.
- o) From the **mDNS Mode** drop-down list, choose an mDNS mode: **Bridging, Drop, or Gateway**

Note These parameters are not supported on the Cisco AireOS Wireless Controller.

Step 17

Click **Save**.

The created design instance is displayed in the **Design Instances** window under the **Advanced SSID Configuration - Model Configs** area.

Step 18

(Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Create a Model Config Design for Cisco CleanAir

CleanAir is a spectrum intelligence solution designed to manage the challenges of a shared wireless spectrum proactively. It allows you to see all the users of the shared spectrum (both native devices and foreign interferers). It also enables you or your network to act on this information. For example, you can manually remove the interfering device, or the system can automatically steer the channel away from the interference. CleanAir provides spectrum management and Radio Frequency (RF) visibility.

Before you begin

You should have discovered the devices in your network using the **Discovery** functionality so that the discovered devices are listed in the **Inventory** window.

Step 1

From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2

In the left pane, expand **Wireless** and choose **CleanAir Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3

In the **Design Instances** window, check the **Default CleanAir 802.11a Design** or **Default CleanAir 802.11b Design** check box to use the default CleanAir design.

Note You can't edit and delete the **Default CleanAir 802.11a Design** or **Default CleanAir 802.11b Design**.

- Step 4** In the **Design Instances** window, click **Add**.
- Step 5** In the **Design Name** field of the **Add CleanAir Configuration** window, enter a name for the design.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
A property that is locked in the design can't be changed during device provisioning.
- Step 7** From the **Radio Band** drop-down list, choose **2.4 GHz or 5 GHz**.
- Step 8** Click the **CleanAir Enable** toggle button to enable the CleanAir functionality on the 2.4-GHz or 5-GHz radio band.
If the **CleanAir Enable** toggle button is enabled, click it to disable the feature and prevent the wireless controller from detecting spectrum interference.
- Step 9** Click the **CleanAir Device Reporting Enable** toggle button to enable the CleanAir system to report detected sources of interference, if any.
If the **CleanAir Device Reporting Enable** toggle button is enabled, click it to disable the feature and prevent the wireless controller from reporting interferers.
- Step 10** Click the **Persistent Device Propagation** toggle button to enable propagation of information about persistent devices that can be detected by CleanAir.
Persistent device propagation enables you to propagate information about persistent devices to the neighboring APs that are connected to the same wireless controller. Persistent interferers are present at the location, and interfere with WLAN operations even if they are not detectable at all times.
- Step 11** Expand **Enable Interferers Features** and check the check box next to the source of interference that needs to be detected and reported by the CleanAir system:
- Ble Beacon
 - Bluetooth Paging Inquiry
 - Bluetooth SCO ACL
 - Generic Dect
 - Generic TDD
 - Generic Waveform
 - Jammer
 - Microwave Oven
 - Motorola Canopy
 - SI FHSs
 - Spectrum 802.11 FH
 - Spectrum 802.11 Non STD Channel
 - Spectrum 802.11 Spec Inverted
 - Spectrum 802.11 Super AG SuperAG
 - Spectrum 802.15.4
 - Video

Create a Model Config Design for Dot11ax Configuration

- Wimax Fixed
- Wimax Mobile
- Xbox

Step 12 In the **CleanAir Description** field, enter a description.

Step 13 Click **Save**.

The created design instance is displayed in the **Design Instances** window under the **CleanAir Configuration - Model Configs** area.

Step 14 (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Create a Model Config Design for Dot11ax Configuration

The **Dot11ax Configuration** model configuration design configures Dot11ax parameters on devices.

The Dot11ax configuration involves the 802.11ax wireless specifications standard, also known as High Efficiency (HE) Wireless. Dot11ax is a dual-band technology that uses 2.4-GHz, 5-GHz, and 6-GHz bands. You can configure Dot11ax configuration parameters only on Wi-Fi 6-supported Cisco Catalyst 9100 Series Access Points.



Note BSS color is used to identify an overlapping basic service set (OBSS). BSS configurations are pushed on Wi-Fi 6-supported APs only. The Cisco Catalyst 9100 Series Access Points are the next-generation Wi-Fi 802.11ax APs, and ideal for high-density, high-definition applications.

Before you begin

You must discover the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2 In the left pane, expand **Wireless** and choose **Dot11ax Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3 In the **Design Instances** window, to use the default Dot11ax designs, check the check box next to the required default designs:

- **Default Dot11ax 6-GHz Design**
- **Default Dot11ax 802.11a Design**
- **Default Dot11ax 802.11b Design**

Note You can't edit or delete the default Dot11ax designs.

Step 4 In the **Design Instances** window, click **Add**.

Step 5 In the **Design Name** field of the **Add Dot11ax Configuration** window, enter a name for the model configuration design.

Step 6 To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.

A property that is locked in the design can't be changed during device provisioning.

Step 7 Click the **BSS Color** toggle button to enable the BSS color functionality. The default value is disabled.

BSS color functionality is supported on:

- Cisco AireOS Wireless Controllers that run Cisco AireOS Release 8.10 and later
- Cisco Wireless Controllers that run Cisco IOS XE Release 17.1 and later

Step 8 Click the **Target Wakeup Time** toggle button to enable the target wake-up time. The default value is disabled.

Target wake-up time is supported on:

- Cisco AireOS Wireless Controllers that run Cisco AireOS Release 8.10 and later
- Cisco Wireless Controllers that run Cisco IOS XE Release 17.1 and later

Step 9 Click the **Target Wakeup Time Broadcast** toggle button to enable the target wake-up time broadcast. The default value is disabled.

Target wake-up time broadcast is supported on:

- Cisco AireOS Wireless Controllers that run Cisco AireOS Release 8.10 and later
- Cisco Wireless Controllers that run Cisco IOS XE Release 17.3.1 and later

Step 10 Click the **Multiple BSSID** toggle button to enable the multiple basic service set identifier (BSSID) functionality. The default value is disabled.

Multiple BSSID is supported only on Cisco Wireless Controllers that run Cisco IOS XE Release 17.7.1 and later.

Note This toggle button is available only when you choose the **6 GHz** radio band.

Step 11 From the **Radio Band** drop-down list, choose **2.4 GHz**, **5 GHz**, or **6 GHz**. The default value is disabled.

Step 12 Click the **OBSS PD** toggle button to enable the Overlapping BSS Packet Detect (OBSS-PD) functionality.

OBSS-PD is supported only on Cisco Wireless Controllers that run Cisco IOS XE Release 17.4 and later.

Note This toggle button is not available for the **6 GHz** radio band.

Create a Model Config Design for Event-Driven RRM

- Step 13** In the **Non-SRG OBSS PD Max Threshold (dbm)** field, enter a value for the non-Spatial Reuse Group (SRG) OBSS-PD maximum threshold in dBm. The default value is -62 dBm.
Non-SRG OBSS-PD is supported only on Cisco Wireless Controllers that run Cisco IOS XE Release 17.4 and later.
- Note** This toggle button is not available for the **6 GHz** radio band.
- Step 14** Click **Save**.
The created design instance is displayed in the **Design Instances** window under the **Dot11ax Configuration – Model Configs** area.
- Step 15** (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the APs. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller](#), on page 478.

Create a Model Config Design for Event-Driven RRM

The **Event Driven RRM Configuration** model configuration design configures event-driven RRM parameters for the 2.4-GHz, 5-GHz, and 6-GHz radios.

Before you begin

You should have discovered the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Feature Templates**.
- Step 2** In the left pane, expand **Wireless** and choose **Event Driven RRM Configuration**.
Alternatively, you can search for a model configuration by entering its name in the **Search** field.
- Step 3** In the **Design Instances** window, check the **Default Event Driven 2.4GHz Design** or **Default Event Driven 5 GHz Design** check box to use the default advanced SSID design.
- Note** You can't edit or delete the default event-driven RRM design.
- Step 4** In the **Design Instances** window, click **Add**.
- Step 5** In the **Design Name** field of the **Add Event Driven RRM Configuration** slide-in pane, enter a name for the model configuration design.

Step 6 To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.

A property that is locked in the design can't be changed during device provisioning.

Step 7 From the **Radio Band** drop-down list, select the radio band: **2.4GHz**, **5GHz**, or **6GHz**.

Note The 6-GHZ radio band is not supported on Cisco AireOS Wireless Controllers.

Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.6 and later support the 6-GHz radio band.

Step 8 Click the **Event Driven RRM** toggle button to run RRM when a CleanAir-enabled AP detects a significant level of interference.

Step 9 From the **Sensitivity Threshold** drop-down list, choose the sensitivity threshold level at which you want the RRM to be triggered from the following options.

When the interference for the AP rises above the threshold level, RRM initiates a local dynamic channel assignment (DCA) run and changes the channel of the affected AP radio, if possible, to improve network performance.

- **Low**: Specifies the least sensitivity to non-Wi-Fi interference as indicated by the AQ value.
- **Medium**: Specifies medium sensitivity to non-Wi-Fi interference as indicated by the AQ value.
- **High**: Specifies the most sensitivity to non-Wi-Fi interference as indicated by the AQ value.
- **Custom**: Specifies custom sensitivity to non-Wi-Fi interference as indicated by the AQ value. If you choose this option, you must specify a custom value in the **Custom Threshold [1-99]** field.

Step 10 Click **Save**.

The created design instance is displayed in the **Design Instances** window under the **Event Driven RRM Configuration - Model Configs** area.

Step 11 (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless](#), on page 339.
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller](#), on page 478.

Create a Model Config Design for Flex Configuration

Use the **Flex Configuration** model configuration design to configure the FlexConnect configuration on devices.

Before you begin

Using the **Discovery** feature, discover the devices in your network so that the discovered devices are listed in the **Inventory** window.

- Step 1** From the top-left corner, click the menu icon and choose **Design > Feature Templates**.
- Step 2** In the left pane, expand **Wireless** and choose **Flex Configuration**.
- Alternatively, you can search for a model configuration by entering its name in the **Search** field.
- Step 3** In the **Design Instances** window, check the **Default Flex Configuration** check box to use the default FlexConnect design.
- Note** You can't edit or delete the **Default Flex Configuration** design.
- Step 4** In the **Design Instances** window, click **Add**.
- Step 5** In the **Design Name** field of the **Add Flex Configuration** slide-in pane, enter a name for the design.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
- A property that is locked in the design can't be changed during device provisioning.
- Step 7** From the **Radio Band** drop-down list, choose **2.4 GHz or 5 GHz**.
- Step 8** Click the **CleanAir Enable** toggle button to enable the CleanAir functionality on the 2.4-GHz or 5-GHz radio band.
- If the **CleanAir Enable** toggle button is enabled, click it to prevent the Cisco Wireless Controller from detecting spectrum interference.
- Step 9** Click the **CleanAir Device Reporting Enable** toggle button to enable the CleanAir system to report detected sources of interference, if any.
- If the **CleanAir Device Reporting Enable** toggle button is enabled, click it to prevent the Cisco Wireless Controller from reporting interferers.
- Step 10** Click the **Persistent Device Propagation** toggle button to enable propagation of information about persistent devices that can be detected by CleanAir.
- Persistent device propagation enables you to propagate information about persistent devices to the neighboring APs that are connected to the same Cisco Wireless Controller. Persistent interferers are present at the location, and interfere with WLAN operations even if they are not detectable at all times.
- Step 11** Expand **Enable Interferers Features** and check the check box next to the source of interference that needs to be detected and reported by the CleanAir system:
- Ble Beacon
 - Bluetooth Paging Inquiry
 - Bluetooth SCO ACL
 - Generic Dect
 - Generic TDD
 - Generic Waveform

- Jammer
- Microwave Oven
- Motorola Canopy
- SI FHSs
- Spectrum 802.11 FH
- Spectrum 802.11 Non STD Channel
- Spectrum 802.11 Spec Inverted
- Spectrum 802.11 Super AG SuperAG
- Spectrum 802.15.4
- Video
- Wimax Fixed
- Wimax Mobile
- Xbox

Step 12 In the **CleanAir Description** field, enter a description.

Step 13 Click **Apply**.

The created design instance is displayed in the **Design Instances** window under the **CleanAir Configuration - Model Configs** area.

Step 14 (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless](#), on page 339.
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller](#), on page 478.

Create a Model Config Design for Global IPv6 Configuration

Before you begin

You should have discovered the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

- Step 2** In the left pane, expand **Wireless** and choose **Global IPV6 Configuration**. Alternatively, you can search for a model configuration by entering its name in the **Search** field.
- Step 3** In the **Design Instances** window, check the **Default Global IPv6 Design** check box to use the default global IPV6 design.
- Note** You can't edit or delete the **Default Global IPv6 Design**.
- Step 4** In the **Design Instances** window, click **Add**.
The window appears.
- Step 5** In the **Design Name** field of the **Add Global IPV6 Configuration** slide-in pane, enter a name for the model configuration design.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
A property that is locked in the design can't be changed during device provisioning.
- Step 7** Click the **Global IPV6 Config** toggle button to enable IPv6 globally on devices.
- Step 8** Click **Save**.
The created design instance is displayed in the **Design Instances** window under the **Global IPV6 Configuration - Model Config** area.
- Step 9** (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Create a Model Config Design for Multicast

Use the **Multicast Configuration** model configuration design to configure multicast parameters on devices.

If your network supports packet multicasting, you can configure the multicast method that the Cisco Wireless Controller uses. The wireless controller performs multicasting in one of these modes:

- Unicast mode: In this mode, the wireless controller unicasts every multicast packet to every access point associated to the wireless controller. This mode is not very efficient, but is required on networks that do not support multicasting.
- Multicast mode: In this mode, the wireless controller sends multicast packets to a CAPWAP multicast group. This method reduces the overhead on the wireless controller processor and shifts the work of packet replication to your network. This method is more efficient than the unicast method.

Before you begin

You should have discovered the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Feature Templates**.
- Step 2** In the left pane, expand **Wireless** and choose **Multicast Configuration**.
Alternatively, you can search for a model configuration by entering its name in the **Search** field.
- Step 3** In the **Design Instances** window, check the **Default Multicast Design** check box to use the default multicast design.
Note You can't edit or delete **Default Multicast Design**.
- Step 4** In the **Design Instances** window, click **Add Design**.
- Step 5** In the **Design Name** field of the **Add Multicast Configuration**, enter a name for the model configuration design.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
A property that is locked in the design can't be changed during device provisioning.
- Step 7** Click the **Enable Global Multicast Mode** toggle button to configure sending multicast packets. The default value is disabled.
- Step 8** From the **AP Multicast Mode** drop-down list, choose **UNICAST** or **MULTICAST**.
- Choose **UNICAST** to configure the wireless controller to use the unicast method to broadcast packets.
 - Choose **MULTICAST** to configure the wireless controller to use the multicast method to broadcast packets to a CAPWAP multicast group.
- Step 9** Expand **IPV4 Multicast Group Address** and enter the IPv4 multicast address in the **IP Address** field.
- Step 10** Expand **IPV6 Multicast Group Address** and enter the IPv6 multicast address in the **IP Address** field.
- Step 11** Click **Apply**.
The created design instance is displayed in the **Design Instances** window under the **Multicast - Model Config** area.
- Step 12** (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Create a Model Config Design for RRM FRA Parameters

The **RRM FRA Configuration** model configuration design configures the Flexible Radio Assignment (FRA) parameters for Radio Resource Management (RRM) for 2.4-5 GHz and 5-6 GHz radio bands.

Before you begin

You must discover the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2 In the left pane, expand **Wireless** and choose **RRM FRA Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3 In the **Design Instances** window, check the corresponding default FRA design check box to use the default design:

- **Default FRA 2.4-5GHz Design**
- **Default FRA 5-6GHz Design**

- Note**
- You can't edit or delete the default FRA designs.
 - The 6-GHz radio band is not supported in Cisco AireOS Wireless Controllers.
 - The Cisco Catalyst 9800 Series Wireless Controllers that run Cisco IOS XE Release 17.6 and later support the 6-GHz radio band.

Step 4 In the **Design Instances** window, click **Add**.

Step 5 In the **Design Name** field of the **Add Flexible Radio Assignment (FRA) Configuration** slide-in pane, enter a name for the model configuration.

Step 6 To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.

A property that is locked in the design can't be changed during device provisioning.

Step 7 From the **Radio Band** drop-down list, choose a radio band.

Step 8 Click the **FRA Freeze** toggle button to enable the FRA freeze functionality. This functionality is disabled by default. Cisco Wireless Controllers that run Cisco IOS XE Release 17.6.1 and later support this functionality.

Note This toggle button is available only for the **2.4-5 GHz** radio band.

Step 9 Click the **FRA Status** toggle button to enable the FRA status functionality. This functionality is enabled by default.

Step 10 From the **FRA Interval** drop-down list, choose an FRA interval.

Step 11 From the **FRA Sensitivity** drop-down list, choose an FRA sensitivity value.

This parameter sets the FRA coverage overlap sensitivity.

Note This drop-down list is available only for the **2.4-5 GHz** radio band.

Step 12 Click **Save**.

The created design instance is displayed in the **Design Instances** window in the **RRM FRA Configuration – Model Configs** area.

Step 13 (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.**What to do next**

1. Attach the created model configuration design to a network profile so that it can be deployed on the access points. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).
2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

Create a Model Config Design for RRM General Parameters

The **RRM General Configuration** model configuration design configures the Radio Resource Management (RRM) general parameters for the 2.4-GHz, 5-GHz, and 6-GHz radios.

Before you begin

You should have discovered the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.**Step 2** In the left pane, expand **Wireless** and choose **RRM General Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3 The **Design Instances** window shows the following default RRM general configuration designs. You can check the respective default **RRM General Design** check box to use the default design.

You can't edit or delete the Default RRM General Design.

- Default RRM General 2.4 GHz Design
- Default RRM General 5 GHz Design
- Default RRM General 6 GHz Design

Note The 6-GHz radio band is not supported on Cisco AireOS Wireless Controllers.

Note Cisco Catalyst 9800 Series Wireless Controller running Cisco IOS XE Release 17.6 and later releases support the 6-GHz radio band.

Create a Model Config Design for RRM General Parameters

- Step 4** In the **Design Instances** window, click **Add**.
- Step 5** In the **Design Name** field of the **Add RRM General Configuration** slide-in pane, enter a name for the model configuration design.
- Step 6** To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
- A property that is locked in the design can't be changed during device provisioning.
- Step 7** In the **Radio Band** tab, choose the radio band from the **Radio Band** drop-down list: **2.4 GHz**, **5 GHz**, or **6 GHz**.
- Step 8** In the **Threshold** tab, set the throughput threshold value for the radio band selected in the Throughput Threshold (1000-10000000 Bps) field.
- Step 9** In the **Monitoring** tab, configure the monitoring channels and neighbor discover type.
- From the **Monitoring Channels** drop-down list, choose one of the following options to specify the set of channels that the AP uses for RRM scanning. By default, the monitoring channel is set to **Country**.
 - **All**: RRM channel scanning occurs on all channels supported by the selected radio, which includes channels not allowed in the country of operation.
 - **Country**: RRM channel scanning occurs only on the data channels in the country of operation. This is the default value.
 - **DCA**: RRM channel scanning occurs only on the channel set used by the DCA algorithm.
 - From the **Neighbor Discover Type** drop-down list, choose the neighbor discovery type. By default, the mode is set to **Transparent**.
 - **Transparent**: Sets the neighbor discover type to transparent. Packets are sent as is.
 - **Protected**: Sets the neighbor discover type to protected. Packets are encrypted.
- Step 10** In the **Coverage** tab, click the **Global Coverage Hole Detection Enabled** toggle button to enable coverage hole detection. By default, this value is selected.
- If you enable coverage hole detection, the Cisco Wireless Controller automatically determines, based on data received from the APs, if any APs have clients that are potentially located in areas with poor coverage.
- Step 11** Click **Save**.
- The created design instance is displayed in the **Design Instances** window under the **RRM General Configuration - Model Configs** area.
- Step 12** (Optional) To edit a design, check the check box next to the design name that you want to edit, and click **Edit**. Make the changes and click **Save**.

What to do next

1. Attach the created model configuration design to a network profile so that it can be deployed on the wireless controller. From the top-left corner, click the menu icon and choose **Design > Network Profiles**. For more information, see [Create Network Profiles for Wireless, on page 339](#).

2. Provision the model configuration design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Create a Model Config Design for Rogue General Parameters

Use this procedure to configure Rogue general configuration and client exclusions policies.

Before you begin

You must discover the devices in your network using the **Discovery** feature so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Feature Templates**.

Step 2 In the left pane, expand **Wireless** and choose **Rogue General Configuration**.

Alternatively, you can search for a model configuration by entering its name in the **Search** field.

Step 3 In the **Design Instances** window, to use the default rogue general configuration designs, check the check box next to the required default designs:

- **Default Rogue General Configuration Critical**
- **Default Rogue General Configuration Custom**
- **Default Rogue General Configuration High**
- **Default Rogue General Configuration Low**

Step 4 Click **Add** to create new rogue general configuration profile.

The **Add Rogue General Configuration** slide-in pane is displayed.

Step 5 In the **Add Rogue General Configuration** slide-in pane, do the following:

- a) In the **Design Name** field, enter a name for the model configuration design.
- b) In the **General** tab, choose the **Rogue Detection Security Level** from the drop-down list.
- c) In the **Expiration timeout for Rogue APs** field, enter the time in seconds for the chosen rogue detection security level as follows:
 - **LOW**: If you choose low security level, expiration timeout must be 240 seconds.
 - **HIGH**: If you choose high security level, expiration timeout must be 1200 seconds.
 - **CRITICAL**: If you choose critical security level, expiration timeout must be 3600 seconds.
 - **CUSTOM**: If you choose custom security level, expiration timeout must be between 240 to 3500 seconds.
- d) Toggle the **Validate Rogue Clients against AAA** toggle button to validate the rogue clients.
- e) Toggle the **Detect and Report Adhoc Networks** toggle button to report an ad hoc network.
- f) Toggle the **Validate Rogue APs against AAA** toggle button to validate the rogue APs.

Note **Validate Rogue APs against AAA** toggle button and **Rogue Polling Interval (seconds)** field is only displayed if you select security level as custom.

Create a Model Config Design for Rogue General Parameters

- g) In the **Rogue Polling Interval (seconds)** field, enter a valid rogue polling time interval in seconds.
The valid rogue polling interval value ranges from 60 to 86400 seconds.
- h) In the **Rogue Detection Client Number Threshold** field, enter the valid threshold value between 0 to 256.
- i) In the **Rogue Init Timer (seconds)** field, enter the time in seconds. The default value is 180 seconds.
- j) In the **AP Authentication Alarm Threshold** field, enter a valid threshold value between 1 to 255.
- k) Toggle the **Syslog Notification** toggle button to get notification, if any system logs are generated.
- l) In the **MFP Key Refresh Interval (hours)** field, enter a valid time interval in hours, between 1 to 24.
- m) (Optional) To lock all the properties in the design, click **Lock all**. To lock a specific property, click the corresponding lock icon next to the property.
- n) Click **Save**.

Step 6

Provision the model config design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

What to do next

1. (Optional) To add model configuration to a network profile, see [Add Model Configurations to a Network Profile, on page 342](#).
2. Provision the model config design specified in the network profile to network devices. From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

For more information, see [Provision a Cisco AireOS Controller, on page 478](#).



CHAPTER 13

Manage Software Images

- [About Image Repository, on page 405](#)
- [Integrity Verification of Software Images, on page 406](#)
- [View Software Images, on page 406](#)
- [Use a Recommended Software Image, on page 409](#)
- [Import a Software Image, on page 409](#)
- [Assign a Software Image to a Device Family, on page 410](#)
- [Upload Software Images for Devices in Install Mode, on page 411](#)
- [About Golden Software Images, on page 411](#)
- [Specify a Golden Software Image, on page 412](#)
- [Configure an Image Distribution Server, on page 413](#)
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- [Provision a Software Image, on page 415](#)

About Image Repository

Catalyst Center stores all the software images, software maintenance updates (SMUs), subpackages, ROMMON images, and so on, for the devices in your network. Image Repository provides the following functions:

- **Image Repository:** Catalyst Center stores all the unique software images according to image type and version. You can view, import, and delete software images.
- **Provision:** You can push software images to the devices in your network.

Before using Image Repository features, you must enable Transport Layer Security protocol (TLS) on older devices such as Cisco Catalyst 3000, 4000, and 6000. After any system upgrades, you must re-enable TLS. For more information, see “Configure Security for Catalyst Center” in the [Cisco Catalyst Center Administrator Guide](#).

**Note**

In Release 2.3.3 and later, Catalyst Center supports only internal bootflash as the primary boot option for Software Image Management (SWIM) and Software Maintenance Updates (SMUs) on the IE3x00 series, and IE9x00 series switches.

If you have an earlier release of Catalyst Center (before Release 2.3.3), and if an IE3x00, or IE9x00 device in your network is already booted with a Secure Digital (SD) flash memory module, then ensure that you set the internal bootflash as the primary boot option on the device, using the **boot flash-primary** command.

To save and synchronize a running configuration from SD flash to bootflash, use the **sync** command.

Integrity Verification of Software Images

The Integrity Verification application monitors software images that are stored in Catalyst Center for unexpected changes or invalid values that could indicate your devices are compromised. During the import process, the system determines image integrity by comparing the software and hardware platform checksum value of the image that you are importing to the checksum value identified for the platform in the Known Good Values (KGV) file to ensure that the two values match.

On the **Image Repository** window, a message displays if the Integrity Verification application cannot verify the selected software image using the current KGV file. For more information about the Integrity Verification application and importing KGV files, see the *Cisco Catalyst Center Administrator Guide*.

View Software Images

After you run Discovery or manually add devices, Catalyst Center automatically stores information about the software images, SMUs, and subpackages for the devices.

Step 1

From the top-left corner, click the menu icon and choose **Design > Image Repository**.

The **Image Repository** window summarizes the details about device families, software images, and advisories.

- **SUMMARY:** Shows the number of device families, devices, and device families without golden images.
- **TOTAL IMAGES:** Shows the number of running images, imported images, and golden images.
- **ADVISORIES:** Shows the number of critical and high advisories.

The **Image Families** table shows the details of **Family Name**, **Devices**, **Images**, **Advisories**, and **Images Marked Golden** for each device family.

Note When cisco.com credentials are not set, a warning alert is displayed.

Step 2

Click **Routers**, **Switches**, **Wireless Controllers**, **Security and VPN**, **Sensors**, or **Virtual Devices** in the top of the window or click the search or filter icon in the **Image Families** table to filter device families.

By default, the **Image Repository** window shows all the device families.

Note Third party(non-Cisco) devices are not shown in the **Image Repository** window, because image activation and image update features are not supported for third-party devices.

Step 3 Click **Sync Updates** and then click **OK** in the subsequent warning message to synchronize image information from cisco.com for all managed devices in Catalyst Center.

If cisco.com credentials are not set, you are prompted to specify them.

You can view the progress of task in **Show Tasks**. Once the task is successful, the image information is updated for all device families.

Note You can fetch image information only once in an hour.

Step 4 Click **Show Tasks** to view status of all the tasks that are related to software images.

The **Recent Tasks** slide-in pane shows status of the last 50 tasks. From the **Task Status** drop-down list, choose **All**, **Failed**, **In-Progress**, or **Successful** to filter the tasks based on status.

Step 5 Click **Import Image** to import a software image or software image update. For more information, see [Import a Software Image, on page 409](#).

Step 6 Click **Update Devices** to update a device in inventory.

In the **Inventory** window, choose a device and go to **Actions > Inventory** to edit, resync, reboot, or delete a device in inventory.

Step 7 In the **Image Families** table, click **Imported Images** to view the details about imported software images. The **Imported Images** row is always displayed as the first row in the table.

In the **Imported Image Family** window, the **Images** table shows **Image Name**, **Version**, **Device Series Assigned**, and **Action** for all the imported software images.

In the **Action** column, click **Assign** to assign a software image to a device family. For more information, see [Assign a Software Image to a Device Family, on page 410](#).

Step 8 In the **Image Families** table, click the name of a device family to view all the software images associated with the particular device family.

In the **Image Family** window, the **Images** table shows the **Image Name**, **Version**, **Devices**, **Advisories**, **Golden Image**, **Device Roles & Tags** for all the software images.

In the **Image Family** window, do the following:

- a) In the left pane, click **Roles & Tags**, **Major Versions**, or **Golden Images** or click the search or filter icon in the **Images** table to filter the software images.
- b) In the **Version** column, click the **Add On** link to view the applicable SMUs, **PSIRT SMU**, **Subpackages**, **ROMMON**, **APSP**, and **APDP** upgrades for the base image.

Subpackages are the additional features that can be added to the existing base image. The subpackage version that matches the image family and the base image version is displayed here.

AP Service Pack (APSP) and AP Device Pack (APDP) are images for upgrading APs associated with wireless controllers.

- When a new AP hardware model is introduced, APDP is used to connect to the existing wireless network.
- For associated APs, critical AP bug fixes are applied through APSP.

Note If you tag any SMU as golden, it is automatically activated when the base image is installed.

You cannot tag a subpackage as golden.

For ROMMON upgrades, the cisco.com configuration is mandatory. When a device is added, the latest ROMMON details are retrieved from cisco.com for applicable devices. Also, when the base image is imported or tagged, the ROMMON image is automatically downloaded from cisco.com.

- c) In the **Device(s)** column, click the number of devices to view the devices that are using the image.
- d) In the **Advisory** column, click the number of critical or high advisories to view the advisories for a specific software image.

The **Image Advisory** slide-in pane shows **Family Name**, **Version**, and **Advisories** of the software image. The advisories are classified as **Critical**, **High**, **Medium**, **Low**, and **Informational**.

Click **CRITICAL**, **HIGH**, or **MEDIUM** to view the advisories specific to each category.

To fix the advisories, do the following:

1. Click **Fix Advisories**.

The **Image Update** window appears.

2. Select a recommended software image to update the device.

If the recommended software image is not available in the image repository, you can download it from cisco.com.

3. Click **Download and Mark Golden**.

From the **Download Image** dialog box, do one of the following:

- Keep the **Mark the image as golden after download** check box checked (the default). Then, click **Download**. The software image is downloaded and marked as golden.
- Uncheck the **Mark the image as golden after download** check box and click **Download**. The software image is downloaded to the repository but is not marked as golden.

4. Click **OK**.

The software image is downloaded. You can view the progress in **Show Tasks**.

- e) In the **Golden Image** column, click the star icon to specify the software image as golden.

If the software image that you specify as golden is not already uploaded into the Catalyst Center repository, click the download icon to import the software image.

For more information about golden images, see [About Golden Software Images, on page 411](#) and [Specify a Golden Software Image, on page 412](#).

- f) In the **Device Roles & Tags** column, do the following:

1. Click the edit icon to assign a device role or tag.

To assign a device role and/or tag, the corresponding software image must have been imported.

2. In the **Assign Device Roles & Tags** slide-in pane, select the device roles and tags for which you want to indicate that this is a golden software image.

- Note**
- Device tags take precedence over device roles when both are selected for a software image.
 - You can create and assign new device tags in **Provision > Network Devices > Inventory**.

-
3. Click **Save**.
-

Use a Recommended Software Image

Catalyst Center displays and allows you to select Cisco-recommended software images for the devices that it manages.



Note Only the latest Cisco-recommended software images are available for download.

- Step 1** From the top-left corner, click the menu icon and choose **System > Settings > Cisco.com Credentials**.
- Step 2** Verify that you have entered the correct credentials to connect to cisco.com.
- Step 3** From the top-left corner, click the menu icon and choose **Design > Image Repository**.
Catalyst Center displays the Cisco-recommended software images according to device type.
- Step 4** Designate the recommended image as golden. See [Specify a Golden Software Image, on page 412](#) for more information.
- Step 5** Push the recommended software image to the devices in your network. See [Provision a Software Image, on page 415](#) for more information.
-

Import a Software Image

You can import software images and software image updates from your local computer or from a URL.

Imported images are categorized based on different supervisors that are present in a specific device family. Categorization under different supervisors supports only the Cisco Catalyst 9400 series family.

If you use FTP to import an image from an FTP server, use the FTP standard:

```
ftp://username:password@ip_or_hostname/path
```

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Image Repository**.
- Step 2** Click **Import Image**.
- Step 3** In the **Import Image/Add-on** slide-in pane, click the **Select from computer** radio button and click **Choose a file** to navigate to a software image or software image update stored locally.

Alternately, click the **Enter URL** radio button and enter the image URL in the **Enter Image URL** field to specify an HTTP or FTP source from which you want to import the software image or software image updates.

Note Software images are compliant with Federal Information Processing Standard (FIPS). If FIPS mode is enabled in Catalyst Center, you cannot import images from URL. Import images from your computer or cisco.com.

Assign a Software Image to a Device Family

- Step 4** If the image you are importing is for a third-party (non-Cisco) vendor, select **Third party** under **Source**. Choose an **Application Type**, describe the device **Family**, and identify the **Vendor**.
- Note** Image activation and Image update features are not supported for third party (non-Cisco) devices.
- Step 5** Click **Import**.
- A window displays the progress of the import.
- Step 6** Click **Show Tasks** to verify that the image was imported successfully.
- If you imported a SMU, Catalyst Center automatically applies the SMU to the correct software image, and an **Add-On** link appears below the corresponding software image.
- Step 7** Click the **Add-On** link to view the SMU.
- Step 8** In the **Device Role** field, select the role for which you want to mark this SMU as golden. See [Specify a Golden Software Image, on page 412](#).
- You can only mark a SMU as golden if you previously marked the corresponding software image as golden.
- Note** Catalyst Center does not allow you to import software images for the FTD devices that are managed by FMC. When you add FMC to inventory and it goes to the Managed state, the software images present in FMC are shown in the image repository and are categorized based on device family.

Assign a Software Image to a Device Family

After importing a software image, you can assign or unassign it to available device families. The imported image can be assigned to multiple devices at any time.

To assign an imported software image to a device family:

- Step 1** From the top-left corner, click the menu icon and choose **Design > Image Repository**.
- Step 2** Click **Imported Images**.
- Step 3** Click **Assign** in the corresponding image name row.
- Step 4** In the **Assign Device Family** window, choose the **Device Series from Cisco.com** or **All Device Series** and click **Assign** link to which you want to map the image.
- Note:** If cisco.com credentials are not set, specify the credentials in **System > Settings > Cisco.com Credentials**.
- Step 5** Select appropriate site from the Global hierarchy and click **Assign** and then click **Save**.
- Step 6** To unassign an image, choose a site from the Global hierarchy and click **Unassign** link in the **Action** column.
- The software image is assigned to the device family and the number of devices using that image are shown in the **Device(s)** column. After assigning the image, you can mark it as a golden image. See [Specify a Golden Software Image](#).
- If the device family is marked as a golden image, you cannot delete that image from the device family.

Note

For PnP devices, you can import a software image and assign it to a device family even before the device is available. You can also mark the image as a golden image. When the device is made available in the inventory, the image that is assigned to the device family is automatically assigned to the newly added devices of that device family.

When the image is imported and Catalyst Center has cisco.com credentials added, Catalyst Center provides the list of device families that are applicable for the image. You can select the required device family from the list.

When the image is not available in cisco.com or when credentials are not added in Catalyst Center, you must design the right device family for the image.

Upload Software Images for Devices in Install Mode

The **Image Repository** window might show a software image as being in Install Mode. When a device is in Install Mode, Catalyst Center is unable to upload its software image directly from the device. When a device is in Install Mode, you must first manually upload the software image to the Catalyst Center repository before marking the image as golden, as shown in the following steps.

-
- Step 1** From the top-left corner, click the menu icon and choose **Design > Image Repository**.
 - Step 2** In the **Image Name** column, find the software image of the device that is running in **Install Mode**.
 - Step 3** Click **Import** to upload the binary software image file for the image that is in Install Mode.
 - Step 4** Click **Choose File** to navigate to a software image stored locally or **Enter image URL** to specify an HTTP or FTP source from which to import the software image.
 - Step 5** Click **Import**.
A window displays the progress of the import.
 - Step 6** Click **Show Tasks** and verify that the software image you imported is green, indicating it has been successfully imported and added to the Catalyst Center repository.
 - Step 7** Click **Refresh**.
The **Image Repository** window refreshes. Catalyst Center displays the software image, and the Golden Image and Device Role columns are no longer dimmed.
-

About Golden Software Images

Catalyst Center allows you to designate software images and SMUs as *golden*. A golden software image or SMU is a validated image that meets the compliance requirements for the particular device type. Designating a software image or SMU as golden saves you time by eliminating the need to make repetitive configuration changes and ensures consistency across your devices. You can designate an image and a corresponding SMU as golden to create a standardized image. You can also specify a golden image for a specific device role. For example, if you have an image for the Cisco 4431 Integrated Service Routers device family, you can further specify a golden image for those Cisco 4431 devices that have the Access role only.

Specify a Golden Software Image

You cannot mark a SMU as golden unless the image to which it corresponds is also marked golden.

Specify a Golden Software Image

You can specify a golden software image for a device family or for a particular device role. The device role is used for identifying and grouping devices according to their responsibilities and placement within the network.

Step 1 From the top-left corner, click the menu icon and choose **Design > Image Repository**.

The software images are displayed according to device type.

Step 2 From the **Family** column, select a device family for which you want to specify a golden image.

Step 3 From the **Image Name** column, select the software image that you want to specify as golden.

Step 4 If the software image that you specify as golden is already uploaded into the Catalyst Center repository, click the star icon in the **Golden Image** column.

The software image is marked as golden.

Step 5 If the software image that you specify as golden is not already uploaded into the Catalyst Center repository, click the download icon in the **Golden Image** column.

This process might take some time.

Note Importing software images from devices is not allowed.

Step 6 From the **Download Image** dialog box, do one of the following:

- Keep the **Mark the image as golden after download** check box checked by default and click **Download**. The software image is downloaded and marked as golden.

Note If Cisco.com credentials are not set, you are prompted to specify them.

The in-progress software image download is shown in the **Device Role** column.

If the software image is downloaded and successfully marked as golden, the color of the star icon turns gold. If the software image download fails, the color of the star icon turns red and a **Please Retry** status is displayed.

- Uncheck the **Mark the image as golden after download** check box and click **Download**. The software image is downloaded to the repository but is not marked as golden.

Step 7 In the **Device Role** column, select a device role for which you want to specify a golden software image. Even if you have devices from the same device family, you can specify a different golden software image for each device role. Note that you can select a device role for physical images only, not virtual images.

Configure an Image Distribution Server

An image distribution server helps in the storage and distribution of software images. You can configure up to three external image distribution servers to distribute software images. You can also set up one or more protocols for the newly added image distribution servers.

Step 1 From the top-left corner, click the menu icon and choose **System > Settings > Device Settings > Image Distribution Servers**.

Step 2 In the **Image Distribution Servers** window, click **Servers**.

The table displays details about the host, username, SFTP, SCP, and connectivity of image distribution servers.

Step 3 Click **Add** to add a new image distribution server.

The **Add a New Image Distribution Server** slide-in pane is displayed.

Step 4 Configure the following image distribution server settings:

- **Host:** Enter the hostname or IP address of the image distribution server.
- **Root Location:** Enter the working root directory for file transfers.

Note For Cisco AireOS Wireless Controllers, image distribution fails if the configured path is longer than 16 characters.

- **Username:** Enter a username to log in to the image distribution server. The username must have read/write privileges in the working root directory of the server.
- **Password:** Enter a password to log in to the image distribution server.
- **Port Number:** Enter the port number on which the image distribution server is running.

Step 5 Click **Save**.

Step 6 Because some legacy wireless controller software versions support only weak ciphers (such as SHA1-based ciphers) for SFTP, Catalyst Center should enable SFTP compatibility mode for SFTP connections from wireless controllers for software image management and wireless assurance. You can temporarily enable support for weak ciphers on the Catalyst Center SFTP server for up to 90 days. To allow weak ciphers:

- a) Hover over the **i** icon next to the IP address of the SFTP server and click **Click here**.
- b) In the **Compatibility Mode** slide-in pane, check the **Compatibility Mode** check box and enter a duration (from 1 minute to 90 days).
- c) Click **Save**.

Step 7 (Optional) To edit the settings, click the **Edit** icon next to the corresponding image distribution server, make the required changes, and click **Save**.

Step 8 (Optional) To delete an image distribution server, click the **Delete** icon next to the corresponding image distribution server and click **Delete**.

Change the Protocol Order of an Image Distribution Server

You can change the protocol order of an image distribution server. Protocol order helps in performing verification checks on the image distribution servers. By default, the software images are distributed using the first protocol in the protocol order.

Step 1 From the top-left corner, click the menu icon and choose **System > Settings > Device Settings > Image Distribution Servers**.

Step 2 In the **Image Distribution Servers** window, click the **Preferences** tab.

The default protocol order is displayed.

Step 3 In the Protocol Order area, click the **On/Off** protocol toggle button to enable or disable a protocol.

Note The HTTPS or SCP protocol must be enabled for image distribution. The SFTP protocol must be enabled for all protocol orders.

If the HTTPS protocol is disabled or image distribution fails while using the HTTPS protocol, the software image is distributed using the SCP protocol.

Step 4 Drag and drop the protocols to change the protocol order.

Step 5 Click **Save**.

Add Image Distribution Servers to Sites

You can associate SFTP servers located in different geographical regions to sites, buildings, and floors. All the devices under the network hierarchy use the associated image distribution server during a network upgrade.

Before you begin

You must configure an image distribution server. See [Configure an Image Distribution Server, on page 413](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Servers**.

Step 2 Expand the **Image Distribution** area to select SFTP servers to act as Image Distribution servers.

Step 3 Check the **Add image distribution servers** check box to view the fields.

Step 4 From the **Primary** drop-down list, choose the image distribution server that you want to configure as primary.

Step 5 Click the icon and from the **Secondary** drop-down list, choose the image distribution server that you want to configure as secondary.

Step 6 Click **Save**.

Provision a Software Image

Catalyst Center compares each device software image with the image that you have designated as golden for that specific device type. If there is a difference between the software image and the golden image, Catalyst Center specifies that the software image of the device is outdated. If this is the case, you can update the outdated software image.

Before pushing a software image to a device, Catalyst Center performs upgrade readiness prechecks on the devices, such as checking the device management status, disk space, and so on. If any prechecks fail, you cannot perform the software image upgrade. You need to correct any issues before you can upgrade the software image on the devices.

If all the prechecks succeed, you can distribute (copy) the new image to the device and activate it (that is, make the new image the running image). The activation of the new image requires a reboot of the device. Because a reboot might interrupt the current network activity, you can schedule the process for a later time.

After the software image is successfully upgraded, Catalyst Center performs upgrade postchecks, such as checking the CPU usage, route summary, and so on, to ensure that the state of the network remains unchanged.

Before you begin

- Make sure the device type has a designated golden image. See [Specify a Golden Software Image, on page 412](#).
- Enabling ITSM in Catalyst Center enforces an ITSM approval process for better control of Catalyst Center software image updates. To enable enhanced control of configuration changes, on the **System > Settings > Visibility and Control of Configurations** window, click **ITSM Approval** to schedule the image update approval in ITSM. For more information, see "Enable Visibility and Control of Configurations" in the [Cisco Catalyst Center Administrator Guide](#).



Note If you have enabled Visibility of Configurations, the system cannot generate a configuration preview for image upgrade. This is expected behavior for SWIM workflows.

- If you must upgrade the software image immediately, you can disable **ITSM Approval** in the **Visibility and Control of Configurations** window, or you can disable the Automation Events for ITSM (ServiceNow) bundle. To access the bundle, choose **Platform > Manage > Bundles > Automation Events for ITSM (ServiceNow)**.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

Step 2 From the **Focus** drop-down list, choose **Software Images**. Select the device whose image you want to upgrade.

Note If the prechecks succeed for a device, the **Outdated** link in the **Software Image** column has a green check mark. If any of the upgrade readiness prechecks fail for a device, the **Outdated** link has a red check mark, and you cannot update the software image for that device. Click the **Outdated** link and correct the errors before proceeding. See [List of Device Upgrade Readiness Prechecks](#).

Step 3 From the **Actions** drop-down list, choose **Software Images > Image Update**.

You are redirected to the **Image Update** workflow.

Step 4

In the **Image Update** window, enter a unique name in **Task Name** field.

Step 5

In the **Software Distribution Checks** window, click the toggle button to enable or disable prechecks and postchecks for the software distribution.

Note If you associated the external image distribution server with a network hierarchy, the image distribution server distributes the image to all devices under the network hierarchy. See [Add Image Distribution Servers to Sites, on page 414](#).

To choose the validators that you want to run for the current workflow or add new custom checks, do the following:

- Hover your mouse over the information icon to view the validation criteria and the CLI commands that are used for the validation.
- Click the toggle button to uncheck the validators that you do not want to run for the current workflow.
- (Optional) To add new custom prechecks and postchecks, do the following:

- Click **add a custom check** to launch the **New Custom Check** window.
- Enter the **Name** for the custom check.
- From the **When** drop-down list, choose **pre**, **post**, or both.
- From the **Select a Test Device** drop-down list, choose the device you want to check.
- Click **Open Command Runner**, and enter the CLI commands.
- Expand **Add Known Command-Patterns to Ignore During Checks** to add a command pattern that is used to ignore the matching output for the checks.

To add a command pattern, do the following:

- To create a new pattern, enter a desired name and string or pattern.
- To use an existing pattern, click **most commonly used patterns**, select the desired pattern, and click **Add Selected**.
- Click **Test All Patterns**.

- Expand the **Additional Criteria** area.

From the **Operation** drop-down list, choose **Distribution**, **Activation**, or both.

- From the **Device Series** drop-down list, choose the desired device series and click **Save**.

- (Optional) To reorder the sequence of the checks, drag and drop a check in the desired order.

Note At the top of the workflow window, place your cursor over the blue progress bar to identify your current step and to switch back to any of the previous steps.

Step 6

In the **Software Activation Checks** window, click the toggle button to enable or disable prechecks and postchecks for the software activation.

(Optional) Click the **Skip Activation** toggle button to skip activation for the current image update.

To add new custom prechecks and postchecks, follow substep c of Step 5.

Step 7

In the **Device Activation Order** window, do the following:

- a) To move the devices to sequential order, select the desired devices and click **Move to Sequential Update Order**.
- b) In the **Sequential** tab, select the devices and click **Reorder List**.

To reorder the sequence of the devices, drag and drop the devices in the order you want and click **Finish Reorder**.

Note By default, the device activation order is set to parallel as first. Click **Edit** to change the activation order.

- c) Click the **Abort on Update Failure** toggle button to end the activation process on the remaining devices upon activation failure of the first device in the order.
- d) To enable the ISSU upgrade, choose the device that you want to upgrade. From the **ISSU** drop-down list, choose **Enable ISSU Upgrade**.

Step 8 In the **Schedule Task and Clean Up** window, do the following:

- a) Click the **Now** radio button to start the activation or distribution immediately.
- b) Click the **Later** radio button, and define the date, time, and time zone to schedule the activation or distribution later.
- c) (Optional) Click the **After Distribution** toggle button to trigger the software activation process immediately after the software distribution.
- d) (Optional) Check the **Initiate Flash Cleanup After Activation** check box to initiate a flash cleanup of the device's memory.

Note Catalyst Center stores only the running software image and removes all the previous software images saved on the device.

Step 9 Check the **Initiate Flash Cleanup after Activation** check box to remove all the previous software images saved on the device.

Note Catalyst Center stores only the running software image and removes all the previous software images saved on the device.

Step 10 In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.

Step 11 To proceed, click **Submit**.

Step 12 (Optional) To check the status of the update, from the **Actions** drop-down list, choose **Software Images > Image Update Status**.

Import the ISSU Compatibility Matrix

In-Service Software Upgrade (ISSU) is a process that upgrades an image on a device with no or minimal service interruption. ISSU is supported only within or between long-lived releases, such as 17.3.x to 17.3.y or 17.3.x to 17.6.y. For an example of the Cisco IOS XE ISSU compatibility matrix for Catalyst Switches, see <https://software.cisco.com/download/home/286315874/type/286326638/release/17.6.2>. You can download and import the ISSU compatibility matrix that corresponds to the target release in Catalyst Center to upgrade devices with ISSU.

Step 1 From the top-left corner, click the menu icon and choose **Design > Image Repository**.

Step 2 Click **Import Images**.

Upgrade a Software Image with ISSU

Step 3 In the **Import Image/Add-on** slide-in pane, click the **Select ISSU compatibility matrix** radio button and click **Choose a file** to navigate to an ISSU compatibility matrix file stored locally.

Step 4 Click **Import**.

Step 5 Click **Show Tasks** to view the ISSU compatibility matrix file import status.

Note In Catalyst Center 2.3.7 and later, compatibility matrix files are automatically downloaded for ISSU-supported devices' running images and golden tagged images available in cisco.com.

Upgrade a Software Image with ISSU

Upgrading devices using the In-Service Software Upgrade (ISSU) eliminates the need to reboot and reduces service interruption.

Before you begin

- Before you upgrade a device using the ISSU, you must import the ISSU compatibility matrix file. See [Import the ISSU Compatibility Matrix, on page 417](#).
- Enabling ITSM in Catalyst Center enforces an ITSM approval process for better control of Catalyst Center software image updates. To enable enhanced control of configuration changes, on the **System > Settings > Visibility and Control of Configurations** window, click **ITSM Approval** to schedule the image update approval in ITSM. For more information, see "Enable Visibility and Control of Configurations" in the [Cisco Catalyst Center Administrator Guide](#).



Note If you have enabled Visibility of Configurations, the system cannot generate a configuration preview for image upgrade. This is expected behavior for SWIM workflows.

- If you must upgrade the software image immediately, you can disable **ITSM Approval** in the **Visibility and Control of Configurations** window, or you can disable the Automation Events for ITSM (ServiceNow) bundle. To access the bundle, choose **Platform > Manage > Bundles > Automation Events for ITSM (ServiceNow)**.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

Step 2 From the **Focus** drop-down list, choose **Software Images** and choose the device whose image you want to upgrade.

Step 3 From the **Actions** drop-down list, choose **Software Images > Update Image**.

The **Image Upgrade** window appears.

Step 4 In the **Analyze Selection** window, enable the ISSU upgrade:

- a) Choose the device that you want to upgrade with ISSU.

Note The **To Image** column shows the ISSU validation status.

- **ISSU shown in amber:** ISSU validation failed because the selected image is not ISSU compatible.
- **ISSU shown in gray:** ISSU validation succeeded and the device supports ISSU.

- b) From the **ISSU** drop-down list, choose **Enable ISSU Upgrade**.
- c) Click **Next**.

Step 5

From the **Distribute** window, choose whether you want to start the image distribution **Now** or schedule it for later.

To choose the validators you want to run for the current workflow and add new custom checks, do the following:

- a) Hover your cursor over the Info icon to view the validation criteria and the CLI commands that are used for validation.
- b) Click the toggle button to uncheck the validators that you do not want to run for the current workflow.
- c) (Optional) To add new custom prechecks and postchecks, do the following:
 1. Click **add a new check** to launch the **Add a New Custom Check** window.
 2. Enter the **Name** for the custom check.
 3. Click the **When** drop-down list and choose **pre, post, or both**.
 4. From the **Select a Test Device** drop-down list, choose a device for which you want to run the custom checks.
 5. Click **Open Command Runner** and enter the CLI commands.
 6. Expand the **Additional Criteria** area.
 7. Click the **Operation** drop-down arrow and choose **Distribution**.
 8. Click the **Device Series** drop-down arrow and choose the device series for which you want to run the custom checks.
 9. Click **Save**.
 10. If you want to edit a custom check, click the corresponding More icon, choose **Edit**, make the required changes, and click **Save**.
 11. If you want to delete a custom check, click the corresponding More icon, choose **Delete**, and in the **Confirm Delete** message, click **Delete**.

Note

- If associated with a network hierarchy, the external image distribution server distributes the image to all devices in the network hierarchy. See [Add Image Distribution Servers to Sites, on page 414](#).
- If **ITSM Approval** is enabled in Catalyst Center, you can update the image (distribute and activate) only after receiving the approval.

Step 6

Click **Next**.

Step 7

In the **Activate** window, choose whether you want to start the activation **Now** or schedule it for later.

Step 8

Check the **Initiate Flash Cleanup after Activation** check box to remove all the previous software images saved on the device.

Note

Catalyst Center stores only the running software image and removes all the previous software images saved on the device.

To choose the validators you want to run for the current workflow and add new custom checks, do the following:

- a) Hover your cursor over the Info icon to view the validation criteria and the CLI commands that are used for validation.
- b) Click the toggle button to uncheck the validators that you do not want to run for the current workflow.

List of Device Upgrade Readiness Prechecks

- c) (Optional) To add new custom prechecks and postchecks, do the following:
1. Click **add a new check** link to launch the **Add a New Custom Check** window.
 2. Enter the **Name** for the custom check.
 3. Click the **When** drop-down list and choose **pre**, **post**, or **both** as required.
 4. Click **Select a Test Device** drop-down list and choose a device for which you want to run these custom checks.
 5. Click **Open Command Runner** and enter the CLI commands.
 6. Expand the **Additional Criteria** area.
 7. Click the **Operation** drop-down list and choose **Activation**.
 8. Click the **Device Series** drop-down list and choose the device series for which you want to run these custom checks.
 9. Click **Save**.
 10. If you want to edit a custom check, click the corresponding More icon, choose **Edit**, make the required changes, and click **Save**.
 11. If you want to delete a custom check, click the corresponding More icon, choose **Delete**, and click **Delete** in the **Confirm Delete** message.

Step 9 Click **Next**.

Step 10 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 11 From the **Actions** drop-down list, choose **Software Images > Image Update Status** and check the status of the update.

List of Device Upgrade Readiness Prechecks

Precheck	Description
File transfer check	Checks if the device is reachable through HTTPS and SCP The default order of protocols is HTTPS first and then SCP. For Catalyst Center configured with FQDN, an error message is displayed if the name server associated with the device is unreachable.
NTP clock check	Compares device time and Catalyst Center time to ensure successful Catalyst Center certificate installation.
Flash check	Calculates the disk space required for upgrading to golden image with add-on and performs flash clean up proactively before image distribution. If there is not enough disk space, a warning or error message is returned. For information about the supported devices for Auto Flash cleanup and how files are deleted, see Auto Flash Cleanup .
Config register check	Verifies the config registry value.
Crypto RSA check	Checks whether an RSA certificate is installed.

Precheck	Description
Crypto TLS check	Checks whether the device supports TLS 1.2.
Weak Crypto Check	Checks whether the device is configured with weak crypto like SNMP V3 user added with MD5 authentication. The image upgrade is blocked due to weak crypto for device with software image version 17.14 and later.
IP Domain name check	Checks whether the domain name is configured.
Startup config check	Checks whether the startup configuration exists for the device.
NFVIS Flash check	Checks whether the golden image is ready to be upgraded in the NFVIS device.
Service Entitlement check	Checks whether the device has a valid license.
Image Compatibility Check	Checks whether golden image is compatible with the device.

View Image Update Status

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Step 2** From the **Focus** drop-down list, choose **Software Images**.
- Step 3** From the **Actions** drop-down list, choose **Software Images > Image Update Status**.
- By default, the **Image Update Status** window shows all the image update tasks.
- Step 4** To filter the tasks based on the update status, click **In Progress**, **Success**, or **Failure**.
- Step 5** In the left pane, click **Task Names** or **Image Versions** to filter the tasks based on operations or image versions.
- The **Status** column shows the current status of the tasks. For in-progress tasks, a progress bar shows the progress of the image update.
- Step 6** Click the device name to view detailed information about a task. For more information, see [View Image Update Workflow, on page 422](#).
- Step 7** Click **Upcoming Tasks** to view the tasks that are scheduled for a later time.
The **Upcoming Tasks** slide-in pane appears.
- Step 8** Click the number of devices in the **Devices Scheduled** column to view the devices for which the image update task is scheduled.
- Step 9** Select the devices for which tasks failed by checking check boxes and click **Retry** to retry the image update.
The **Image Upgrade** window is displayed. From this window, you can schedule an image update task immediately or later. For more information, see [Provision a Software Image, on page 415](#).
-

View Image Update Workflow

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Step 2** From the **Focus** drop-down list, choose **Software Images**.
- Step 3** From the **Actions** drop-down list, choose **Software Images > Image Update Status**.
- Step 4** In the **Image Update Status** window, click the name of a device to view detailed information about the image upgrade.
- Step 5** Click the **Operations** tab.
- The slide-in pane shows the status of each task that is associated with the **Distribution** and **Activation** operations and the time taken to complete each operation.
- Step 6** Expand **Distribution** to view the status of the following tasks that are associated with the **Distribution** operation and the time taken to complete each task.
- **Verify Image Availability** (only for legacy devices): Verifies the software image in the image repository.
 - **Image Integrity Verification (KGV)**: Compares the software and hardware platform checksum value of the software image with the checksum value identified for the platform in the Known Good Values (KGV).
 - **Pre Distribution Operation**: Performs all prechecks chosen for software image distribution.
 - **Distribution**: Distributes the software image through the primary external image distribution server. If the software image distribution fails through the primary external image distribution server, the software image is distributed through the secondary image distribution server. If the distribution fails through both external servers, the software image is distributed through the internal Catalyst Center server.
 - **Post Distribution Operation**: Performs all postchecks chosen for software image distribution.
 - **Image Checksum Verification On Device**: Verifies the checksum value of the software image on the device.
 - **Unpack Image** (only for Polaris): Executes the **install-add** command in the CLI. Unpack image is performed only when the image is in install mode.
 - **AP Pre-Image Download** (only for APs): Shows details about the distribution process of all the APs associated with the device.
- Step 7** Expand **Activation** to view the status of the following tasks that are associated with the **Activation** operation and the time taken to complete each task.
- **Pre Activation Operation**: Performs all prechecks chosen for software image activation.
 - **Image Activation**: Executes the **install-activate** command in the CLI. This step shows detailed information about the image activation process.
- Note** For Cisco Catalyst 9000 Series stack switches, the Validate Stack precheck verifies the state of all the stack members in a switch. If any stack member is not running the golden image, the **auto-upgrade** command is executed.
- **Staggered AP Upgrade** (only for APs): Shows details about the activation process of all the APs associated with the device.
 - **Install Commit** (only for Polaris): Executes the **install-commit** command in the CLI.

- **Remove Inactive Images:** Removes all the previous software images saved on the device and stores only the running image.
- **Collect Running Image Details:** Collects the running image details.
- **Verify Image Activation:** Verifies whether the software image is upgraded properly.
- **Post Activation Operation:** Performs all postchecks chosen for software image activation.

Note

- For Cisco Catalyst 9800 Embedded Wireless Controller devices and Cisco Catalyst 9000 Series Switches running on IOS-XE software, the software image is upgraded in three steps (by executing three commands): **install-add** (Unpack Images step in Distribution), **install-activate** (Image Activation step in Activation), and **install-commit** (Install Commit step in Activation).
 - If the device is in Inactive state, the **install-add** command is executed first in the CLI. Subsequently, the **install-activate** and **install-commit** commands are executed. If the device is in Uncommitted state, the **install-commit** command is executed directly.
 - The **install-activate** and **install-commit** commands are executed sequentially in separate milestones during activation, so you can cancel, roll back, or commit the update.

Step 8

Expand **PSIRT SMU Activation** to view the status of the following tasks that are associated with the PSIRT SMU Activation operation and time taken to complete each task.

- **Pre Activation Script Execution.**
- **Activation.**
- **Post Activation Script Execution.**

Step 9

Expand **APSP Distribution** to view the status of the following tasks that are associated with the Distribution operation and time taken to complete each task.

- **Image Integrity Verification:** Compares the software and hardware platform checksum value of the software image with checksum value identified for the platform in the Known Good Values (KGV).
- **Pre Distribution Operation:** Performs all prechecks chosen for software image distribution.
- **Distribution:** Distributes the software image through primary external image distribution server.
- **Post Distribution Operation:** Performs all post checks chosen for software image distribution.
- **Image Checksum Verification On Device:** Verifies the checksum value of software image on device.
- **Unpack Image (only for Polaris):** Executes the install-add command in the CLI. Unpack image is performed only when the image is in install mode.
- **AP Pre-Image Download (only for APs):** Shows details about the AP pre-image download task for all the APs associated with the device.

Step 10

Click the **Tasks** tab, which shows the status and details of prechecks and postchecks that are associated with the task.

Step 11

In the **Differences** column, click the number of differences, corresponding to each script, to view the differences between prechecks and postchecks.

Auto Flash Cleanup

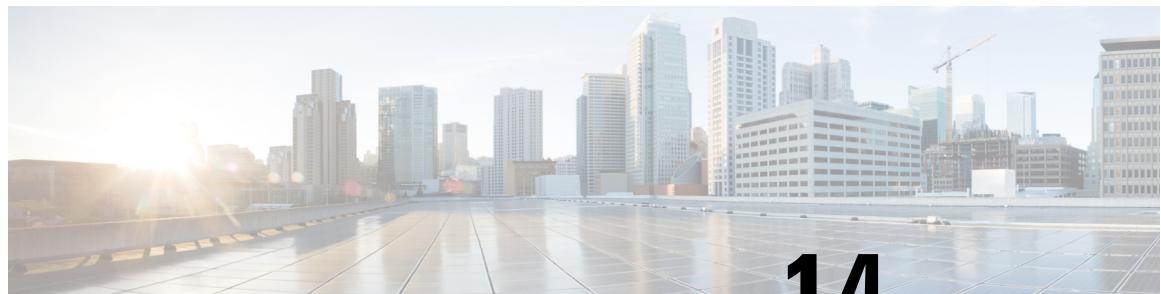
During the device upgrade readiness precheck, the flash check verifies whether there is enough space on the device to copy the new image. If there is insufficient space:

- **For devices that support auto flash cleanup,** the flash check fails with a warning message. For these devices, the auto cleanup is attempted during the image distribution process to create the sufficient space. As a part of the auto flash cleanup, Catalyst Center identifies unused .bin, .pkg, and .conf files and deletes them iteratively until enough free space is created on the device. Image distribution is attempted after the flash cleanup. You can view these deleted files in **Activities > Audit Logs**.

**Note**

Auto flash cleanup is supported on all devices except Nexus switches and wireless controllers.

- **For devices that do not support auto flash cleanup,** the flash check fails with an error message. You can delete files from the device flash to create space before starting the image upgrade.



CHAPTER 14

Compliance Audit for Network Devices

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Compliance Overview

Compliance helps in identifying any intent deviation or *out-of-band* changes in the network that may be injected or reconfigured without affecting the original content.

A network administrator can conveniently identify devices in Catalyst Center that do not meet compliance requirements for the different aspects of compliance, such as software images, PSIRT, network profiles, and so on.

Compliance checks can be automated or performed on demand.

- Automated compliance check: Uses the latest data collected from devices in Catalyst Center. This compliance check listens to the traps and notifications from various services, such as inventory and SWIM, to assess data.
- Manual compliance check: Lets you manually trigger the compliance in Catalyst Center.
- Scheduled compliance check: A scheduled compliance job runs every day at 11:00 pm and triggers the compliance check for devices on which the compliance check was not run in the past seven days.

Types of Compliance

Compliance Type	Compliance Check	Compliance Status
Startup versus Running Configuration	<p>This compliance check helps in identifying whether the startup and running configurations of a device are in sync. If the startup and running configurations of a device are out of sync, compliance is triggered and a detailed report of the out-of-band changes is displayed. The compliance for startup vs. running configurations is triggered within 2 minutes of any out-of-band changes.</p> <p>Note Catalyst Center must be configured as a syslog server in the Design > Network Settings > Telemetry > Syslogs window for syslog-based collection to work.</p>	<ul style="list-style-type: none"> Noncompliant: The startup and running configurations are not the same. In the detailed view, the system shows different startup vs. running between or running vs. previous running. Compliant: The startup and running configurations are the same. NA (Not Applicable): The device, such as AireOS, is not supported for this compliance type.

Compliance Type	Compliance Check	Compliance Status
Software Image	<p>This compliance check helps a network administrator to see if the tagged golden image in Catalyst Center is running on the device. It shows the difference between the golden image and the running image for a device. When there is a change in the software image, the compliance check is triggered immediately without any delay.</p>	<ul style="list-style-type: none"> Noncompliant: The device is not running the tagged golden image of the device family. Compliant: The device is running the tagged golden image of the device family. NA (Not Applicable): The golden image is not available for the selected device family. <p>For Fabric Devices:</p> <ul style="list-style-type: none"> Noncompliant: The device is not running the tagged golden image of the device family, or the current software image version is not compatible for the network device. <p>See the Cisco SD-Access Compatibility Matrix for the supported and recommended software image versions for your device.</p> <ul style="list-style-type: none"> Compliant: The device is running the tagged golden image of the device family, or the current software image version is compatible with the device. NA (Not Applicable): The golden image is not available for the selected device family, or the device is not added to a fabric site.
	<p>For Cisco Switch Stacks: Catalyst Center allows the network administrator to check if the tagged golden image is running on the primary switch and members of switch stacks.</p>	<ul style="list-style-type: none"> Noncompliant: The tagged golden image is not running on the primary switch and member switches. <p>Also, the device will be noncompliant if golden tagging is not applicable for the device and the member switches are not running on the image version as that of the primary switch.</p> <ul style="list-style-type: none"> Compliant: The tagged golden image is running on the primary switch and member switches. <p>Also, the device will be compliant if no golden tagging is applicable for the device and the member switches are running on the same image version as that of the primary switch.</p> <ul style="list-style-type: none"> NA (Not Applicable): The golden image is not applicable for the device, and the device is not a stacked switch.

Types of Compliance

Compliance Type	Compliance Check	Compliance Status
Critical Security (PSIRT)	This compliance check enables a network administrator to check whether the network devices are running without critical security vulnerabilities.	<ul style="list-style-type: none"> Noncompliant: The device has critical advisories. A detailed report displays various other information. Compliant: There are no critical vulnerabilities in the device. NA (Not Applicable): The security advisory scan has not been done by the network administrator in Catalyst Center, or the device is not supported.
Network Profile	<p>Catalyst Center allows you to define its intent configuration using network profiles and push the intent to the device. If any violations are found at any time due to <i>out-of-band</i> or any other changes, this check identifies, assesses, and flags it off. The violations are shown to the user under Network Profiles in the compliance summary window.</p> <p>Note Network profile compliance is applicable for routers, switches, and wireless controllers.</p>	<ul style="list-style-type: none"> Noncompliant: The device is not running the intent configuration of the profile. Compliant: While applying a network profile to the device, the device configurations that are pushed through Catalyst Center are actively running on the device. Error: The compliance could not compute the status because of an underlying error. For details, see the error log.
Fabric (SDA) This feature is in beta.	<p>Fabric compliance helps to identify fabric intent violations, such as any out-of-band changes for fabric-related configurations.</p> <p>The fabric compliance status does not participate in determining the overall compliance status of the device, as the feature is in the beta stage.</p>	<ul style="list-style-type: none"> Noncompliant: The device is not running the intent configuration. Compliant: The device is running the intent configuration.
SD-Access Unsupported Configuration This feature is in beta.	<p>This compliance check enables you to identify unsupported SD-Access configurations. When a device is added to a fabric site, the compliance check is triggered immediately.</p> <p>To view the unsupported SD-Access configurations on a noncompliant device, click Unsupported Configuration. Under the Unsupported Configuration area, unsupported SD-Access configurations are highlighted in red.</p> <p>Note For devices that are not added to a fabric site, this compliance check is not used.</p>	<ul style="list-style-type: none"> Noncompliant: The device is running some configurations that are not supported for SD-Access. Compliant: The device is running the configurations that are supported for SD-Access.

Compliance Type	Compliance Check	Compliance Status
Application Visibility	<p>Catalyst Center allows you to create an application visibility intent and provision it to a device through CBAR and NBAR. If there is an intent violation on the device, this check identifies, assesses, and shows the violation as compliant or noncompliant under the Application Visibility window.</p> <p>The automatic compliance checks are scheduled to run after 5 hours of receiving traps.</p>	<ul style="list-style-type: none"> Noncompliant: The CBAR/NBAR configuration is not running on the device. Compliant: The intent configuration of CBAR/NBAR is running on the device.
Model Config	<p>This compliance check enables the network administrator to check any mismatch from the designed intent of Model Config. The mismatch is shown under Network Profile in the Compliance Summary window.</p>	<ul style="list-style-type: none"> Noncompliant: There is a mismatch in the actual and intended value of the attributes in Model Config. Compliant: The attributes in Model Config match the intended value.

Compliance Type	Compliance Check	Compliance Status
<p>CLI Template</p> <p>Catalyst Center allows the network administrator to compare the CLI template with the running configuration of the device. The mismatch in the configuration is flagged. This mismatch is shown under Network Profile in the Compliance Summary window.</p> <p>To view the flagged CLI commands, do the following:</p> <ol style="list-style-type: none"> 1. Click the Network Profile tile. 2. From the CLI Deviations area, choose the CLI template for which you want to view the mismatch. 3. The CLI commands are displayed in the Realize Template area, and the flagged commands are highlighted in red. <p>Note Click the View CLI Template Best Practices link to view some of the best practices that must be used in a CLI template to minimize compliance issues.</p> <p>The running configuration for CLI template compliance is taken from the latest archive that is available for the device. Event-based archive takes at least 2 minutes to update after traps are received. For accurate results, we recommend that you wait at least 2 minutes before running compliance manually after a configuration change.</p> <p>Catalyst Center must be configured as a syslog server in the Design > Network Settings > Telemetry > Syslogs window for syslog-based collection to work.</p> <p>Note There are some limitations in CLI template compliance. See Limitations in CLI Template Compliance, on page 437.</p>		<ul style="list-style-type: none"> • Noncompliant: There is a mismatch between the CLI template and the running configuration of the device. • Compliant: There is no mismatch between the CLI template and the running configuration of the device.

Compliance Type	Compliance Check	Compliance Status
EoX - End of Life	<p>Catalyst Center allows you to check the compliance status for the hardware, software, and module of EoX devices. You can check the EoX compliance status from the Compliance Summary > EoX - End of Life tile.</p> <p>You can also view the EoX status of devices from the Inventory window, under the EoX Status column.</p> <p>Note To enable access to the EoX feature, authorize the CX Cloud Consent to Connect agreement through the Catalyst Center dashboard.</p>	<ul style="list-style-type: none"> Noncompliant: The device is noncompliant if the last date of support has ended. Compliant: The device is compliant if enough time remains until the last date of support. Compliant with Warning: The device is compliant with warning if the last date of support is nearing.
Network Settings	<p>Catalyst Center allows you to define its intent configuration settings using network settings and to push the intent to the device. If any violations are found at any time due to out-of-band or any other changes, the compliance check identifies, assesses, and flags it off.</p> <p>You can view the violations under Network settings in the Compliance Summary window.</p> <p>Note Post UI upgrade, compliance for network settings will get triggered after 6 hours.</p>	<ul style="list-style-type: none"> Noncompliant: The device is not running the intent configuration. Compliant: The intent configuration that was pushed is actively running on the device. NA (Not Applicable): The device is not configured with network settings, or the device is not assigned to the site.
Cisco Umbrella	<p>Catalyst Center allows you to identify deviation from the intent Cisco Umbrella configuration that is pushed to the device by Catalyst Center. If any violations are found, compliance check identifies, assesses, and flags it off.</p> <p>You can view the violations under Workflow in the Compliance Summary window.</p> <p>Note The Cisco Umbrella compliance check is applicable for Switches or Cisco Embedded Wireless Controllers. Ensure that the device provisioning is completed.</p> <p>Also, Cisco Umbrella must be provisioned on the devices. For more information, see Provision Cisco Umbrella on Network Devices, on page 675.</p>	<ul style="list-style-type: none"> Noncompliant: The device is not running the intent configuration. Compliant: The intent configuration that was pushed is actively running on the device. NA (Not Applicable): Cisco Umbrella is not configured for the device.

View Compliance Summary

The inventory page shows an aggregated status of compliance for each device.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The compliance column shows the aggregated compliance status of each device.

Step 2 Click the compliance status to launch the compliance summary window, which shows the following compliance checks applicable for the selected device:

- Startup versus Running Configuration
- Software Image
- Critical Security Vulnerability
- Network Profile
- Network Settings
- Fabric
- SD-Access Unsupported Configuration
- Application Visibility
- EoX - End of Life
- Cisco Umbrella

Note Network Settings, Network Profile, Fabric, SD-Access Unsupported Configuration, and Application Visibility are optional and are displayed only if the device is provisioned with the required data.

Manual Compliance Run

You can trigger a compliance check manually in Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 For a bulk compliance check, do the following:

- a) Choose all the applicable devices.
- b) From the **Actions** drop-down list, choose **Compliance > Run Compliance**.

Step 3 For a per-device compliance check, do the following:

- a) Choose the devices for which you want to run the compliance check.
- b) From the **Actions** drop-down list, choose **Compliance > Run Compliance**.
- c) Alternatively, click the compliance column (if available) and then click **Run Compliance**.

Step 4 To view the latest compliance status of a device, do the following:

- a) Choose the device and inventory. See [Resynchronize Device Information, on page 124](#).
- b) From the **Actions** drop-down list, choose **Compliance > Run Compliance**.

Note

- A compliance run cannot be triggered for unreachable or unsupported devices.
- If compliance is not run manually for a device, the compliance check is automatically scheduled to run after a certain period of time, which depends on the type of compliance.
- CLI Template Compliance compares the realized templates against the running configuration of the device. The running configuration is taken from the latest archive that is available for the device.
- Event-based archive takes at least 2 minutes to update after traps are received. For accurate results, we recommend that you wait for at least 2 minutes before running compliance manually after a configuration change.
- Catalyst Center must be configured as a Syslog server in **Design > Network Settings > Telemetry > Syslogs** window for Syslog based collection to work.

Generate a Compliance Audit Report for Network Devices

Catalyst Center allows you to retrieve a consolidated Compliance Audit Report that shows the compliance status of individual network devices. With this report, you can get complete visibility of your network.

For more information, see "Run a Compliance Report" in the [Cisco Catalyst Center Platform User Guide](#).

Acknowledge Compliance Violations

Catalyst Center lets you acknowledge less-important compliance violations of the device and opt-out the violations from the compliance status calculation. If required, you can also choose to opt-in the violation for the compliance status calculation.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2 Click the device name to open a dialog box that provides high-level information for that device. Click **View Device Details** link in the dialog box.

The device details window is displayed.

Step 3 In the left pane, choose **Compliance > Summary**.

Step 4 In the **Compliance Summary** window, click the compliance tile for which you want to acknowledge the violations.

You can view the following information under **Open Violations** and **Acknowledged Violations** table:

- Model Name
- Attribute
- Status: This column shows one of the following status:
 - **Added:** The attribute is added in the device.
 - **Changed:** The intent value does not match the device value.

Synchronize Startup and Running Configurations of a Device

- **Removed:** The intent is removed from the device.
- Intended Value: Shows the intended value as configured by Catalyst Center.
- Actual Value: Shows the value currently configured on the device.
- Action: Shows **Acknowledge** link for open violations and **Move to Open Violations** link for acknowledged violations.

Do the following to opt-out the violation from the compliance status calculation:

- a) Click the **Open Violations** tab.
- b) Choose the violation and click **Acknowledge** in the **Actions** column.
- c) To acknowledge the violations in bulk, check the check box at the top of the table, or choose multiple violations and click **Acknowledge**.
- d) In the confirmation window, click **Confirm**.
The violation is moved to the **Acknowledged Violations** tab.

Do the following to opt-in the violation for the compliance status calculation:

- a) Click the **Acknowledged Violations** tab.
- b) Choose the violation and click **Move to Open Violations** in the **Actions** column.
- c) To move the violations in bulk, check the check box at the top of the table, or choose multiple violations and click **Move to Open Violations**.
- d) In the confirmation window, click **Confirm**.
The violation is moved to **Open Violations** tab.

Step 5

To see a list of attributes that you opted out from the Compliance status calculation, click the **View Preference for Acknowledged Violations** link in **Compliance Summary** window.

Step 6

In the **Acknowledge Violation Preferences** slide-in pane, do the following to opt-in the attribute for the compliance status calculation:

- a) Choose the attribute and click **Unlist** in the **Actions** column.
- b) For bulk selection, check the check box at the top of the table, or choose multiple violations and click **Unlist**.

The **Models** tab shows attributes that are acknowledged for Model Config, Routing, Wireless, Application Visibility, or Fabric. Acknowledged templates are shown under the **Templates** tab.

- | | |
|-------------|---|
| Note | <ul style="list-style-type: none"> • In Acknowledge Violation Preferences window, a model with an empty (-) attribute means that the entire model, including its child attributes, are acknowledged. • When a violation with the status, Added or Removed is acknowledged, Catalyst Center automatically acknowledges similar attributes and their child attributes. • An acknowledged child attribute cannot be moved to open violations when a similar violation with the status, Added or Removed is overriding. |
|-------------|---|
-

Synchronize Startup and Running Configurations of a Device

When there is a mismatch in the startup and running configurations of a device, you can do a remediation synchronization to match the configurations.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Inventory**.

Step 2

For a bulk remediation, do the following:

- a) Choose all the applicable devices.
- b) From the **Actions** drop-down list, choose **Compliance > Write Running Config to Startup Config**.

For a per-device remediation, do the following:

- a) Choose the devices for which you want to do a remediation synchronization.
- b) From the **Actions** drop-down list, choose **Compliance > Write Running Config to Startup Config**.

Alternatively, click the link under **Compliance** column and then choose **Compliance Summary > Startup vs Running Configuration > Sync Device Config**.

Step 3

To view the remedial status of the device, do the following:

- a) From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- b) From the **Actions** drop-down list, choose **Compliance > Check Startup Config Write Status**.

Fix Compliance Violations

Catalyst Center allows you to maintain a compliant network by providing an automated fix for device compliance violations. Any deviation from the intent in the device that is identified in the Catalyst Center compliance check is fixed with this procedure.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The compliance column shows the aggregated compliance status of each device.

Step 2

Click the compliance status to launch the **Compliance Summary** window.

Step 3

Click **Fix All Configuration Compliance Issues** link, at the top of the window.

The **Fix Configuration Compliance Issues** slide-in pane is displayed.

Note The link for fixing compliance violations is visible only if the supported category has violations. Otherwise, the link is not shown.

Step 4

In **Fix Configuration Compliance Issues** slide-in pane do the following:

- a) In the **Summary of Issues to be Fixed** area, review the compliance violations for the network devices. The **Issues Identified** column lists the aggregated count of open and acknowledged violations. Click **Schedule the Fix**.
- b) Depending on the Visibility and Control of Configurations settings, choose an available option.
 - To immediately deploy the configuration, click **Now**.
 - To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
 - To preview the configurations, click **Generate configuration preview**.

Compliance Behavior After Device Upgrade

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations, on page 132](#).

- c) Edit the default **Task Name**, if required.
- d) Click **Apply**.

Step 5

(Optional) If you chose **Generate configuration preview** in the **Fix Configuration Compliance Issues** slide-in pane, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:

- a. Review the device configuration.
- b. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note If **Save Intent** displays instead of **Deploy** or **Submit for Approval**, the parameters that you chose during the workflow are already present on the device. To save those parameters to the database, click **Save Intent**. Because no configuration will be pushed to the device, ITSM approval isn't required.

- c. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- d. Click **Submit**.

Note In Catalyst Center Release 2.3.7 and later, In IPDT, whenever there is a device role change or protocol endpoint is discovered, and for SNMP trap configuration, if SNMP user group change is detected from the system, intent is updated at Catalyst Center side instead of pushing the configuration directly to the device.

Step 6

On completion of the process, Success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will be deployed at the scheduled time, which you can view on the **Tasks** window.

Note

- Routing, Wireless Controller HA Remediation, Software Image, Security Advisories, and Workflow-related compliance issues are not addressed in this fix. You can address these separately by following the actions in their respective sections.
- CLI template compliance has some limitations, because of which some CLI templates may remain noncompliant. For more information, see [Limitations in CLI Template Compliance, on page 437](#).

Compliance Behavior After Device Upgrade

- A compliance check for all applicable devices (devices for which compliance never ran in the system) is triggered after successful device upgrade.
- Compliance calculates and shows the status of the devices in the inventory, except the Startup vs Running type.

- After upgrade, the Startup vs Running tile shows as NA with the text "Configuration data is not available."
- After a day of successful upgrade, a one-time scheduler runs and makes configuration data available for devices. The Startup vs Running tile starts showing the correct status (Compliant/Noncompliant) and detailed data.
- If any traps are received, the config archive service collects configuration data and the compliance check runs again.



Note In the upgrade setup, ignore any compliance mismatch for the **Flex Profile** interface. For the interface name, **1** maps to **management**.

Limitations in CLI Template Compliance

Catalyst Center allows you to compare a CLI template with the running configuration of the device, so as to identify any mismatch from the intent. Note the following comparator engine limitations:

- The CLI Template comparator supports use of uppercase letters for variables and values. But, you must avoid using uppercase letters for command keywords.
- The CLI Template comparator supports use of aliases.
- Avoid using abbreviated or shorthand commands, which are flagged as noncompliant.
- If a command is missing and it is at the section level, the section-level commands succeeding the missing command are also flagged. To avoid this problem, use indentation.

For example, the following CLI Template comparator output shows commands without indentation:

Realized Template	Running Configuration	Output
#interface Vlan111 #description SVI interface kan-111 #ip address 111.2.3.4 255.255.255.0 #ip helper-address 7.7.7.8 #no mop enabled #no mop sysid #!	#interface Vlan111 # description SVI interface kan-111 # ip address 111.2.3.4 255.255.255.0 # ip helper-address 7.7.7.7 # ip helper-address 7.7.7.8 # no mop enabled # no mop sysid #!	The following commands are marked as missing: # ip helper-address 7.7.7.7 # ip helper-address 7.7.7.8 # no mop enabled # no mop sysid

The following CLI Template comparator output shows commands with indentation:

Realized Template	Running Configuration	Output
#interface Vlan111 # description SVI interface kan-111 # ip address 111.2.3.4 255.255.255.0 # ip helper-address 7.7.7.8 # no mop enabled # no mop sysid #!	#interface Vlan111 # description SVI interface kan-111 # ip address 111.2.3.4 255.255.255.0 # ip helper-address 7.7.7.7 # ip helper-address 7.7.7.8 # no mop enabled # no mop sysid #!	The comparator flags only the missing command: #ip helper-address 7.7.7.7

Limitations in CLI Template Compliance

- Interactive and enable mode commands are not compared for compliance. You can use an alternative form of interactive commands by mentioning all the options and values with the commands.

For example, if the template code is as follows, where #ENABLE and #INTERACTIVE mode command are given together, the commands are not compared.

```
#MODE_ENABLE
#INTERACTIVE
    mkdir <!Q>Create directory<R>xyz
#ENDS_INTERACTIVE
#MODE_END_ENABLE
#end
```

- Avoid using ranges in commands, which are flagged by the comparator. Ranges must be used in expanded form.
- Overriding commands within the same template are flagged. You can avoid mismatch by enclosing the commands within *ignore - compliance* syntax, as shown in the following example.

Realized Template	Running Configuration	Output
#no banner motd #Welcome to Cisco .: :.# #banner motd #Welcome to Cisco .: :.#	#banner motd ^CWelcome to Cisco .: :.^C	<ul style="list-style-type: none"> The following command is flagged as missing: no banner motd #Welcome to Cisco .: :.# The following command is also marked as missing, because the running command is already compared with the preceding command. banner motd #Welcome to Cisco .: :.#

You can do the following to avoid mismatch:

Realized Template	Running Configuration	Output
#! @start-ignore-compliance #no banner motd #Welcome to Cisco .: :.# #! @end-ignore-compliance #banner motd #Welcome to Cisco .: :.#	#banner motd ^CWelcome to Cisco .: :.^C	There is no mismatch, because the command enclosed in the syntax is not compared.

- For later releases of Cisco IOS XE, some default commands are shown only when **show run all** command is issued, instead of the **show run** command. Therefore, these commands do not appear in the running configuration and are flagged as noncompliant.



Note To ignore these default commands from compliance check, open a support case with the Cisco Technical Assistance Center (TAC).

- Password-bearing commands are flagged by the comparator, because they are stored in encrypted form on the device.

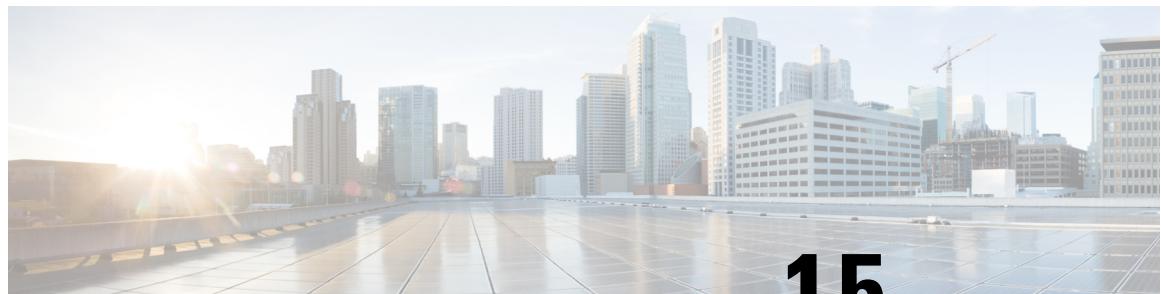


Note You can avoid a mismatch for password-bearing commands and some default commands by enclosing the commands in the following syntax:

```
! @start-ignore-compliance  
! @end-ignore-compliance
```

Then, reprovision the template for the changes to appear.

To avoid a mismatch between the CLI template and the running configuration of the device, we recommend that you use commands similar to the running configuration.



CHAPTER 15

Run Diagnostic Commands on Devices

- [Command Runner Overview, on page 441](#)
- [Run Diagnostic Commands on Devices, on page 441](#)

Command Runner Overview

The Command Runner tool allows you to send diagnostic CLI commands to selected devices. Currently, **show** and other read-only commands are permitted.

Run Diagnostic Commands on Devices

Command Runner lets you run diagnostic CLI commands on selected devices and view the resulting command output. Command Runner supports only a subset of the shortcuts that are available as part of a standalone terminal.

Before you begin

Begin using Command Runner, do the following:

1. From the top-left corner, click the menu icon and choose **System > Software Updates > Installed Apps**.
2. Find the **Command Runner** application and click **Install**.
3. After installation, run a Discovery job to populate Catalyst Center with devices. You are presented with a list of devices from which to run diagnostic CLI commands.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Command Runner**.

Step 2 In the **Search** field of the **Command Runner** window, click the drop-down arrow to search by **Device IP** or **Device Name**.

Step 3 Choose a device or devices on which to run diagnostic CLI commands.

Device List displays your selection.

Step 4 (Optional) Select another device to add to the list. You can select up to 20 reachable devices.

Note Although the device list displays everything available in inventory, Command Runner is not supported for wireless access points and Cisco Meraki devices. If you choose an access point device or Cisco Meraki device, a warning message appears, stating that no commands will be executed on them.

Step 5 In the **Select/Enter commands** field, enter a CLI command and click **Add**.

Command Runner supports type ahead. As you begin typing, Command Runner displays the commands available for you to choose. You can also type a new, valid command.

Step 6 Click **Run Command(s)**.

If successful, a `Command(s) executed successfully` message appears.

Step 7 Click the command displayed underneath the device to view the command output.

Note The complete command output is displayed in the **Command Runner** window. Any sensitive information, such as passwords, is masked in the command output.

Step 8 (Optional) Click **Export all CLI Output** to export the command output to a text file that you can save locally.

Step 9 Click **Go Back** to return to the previous window.

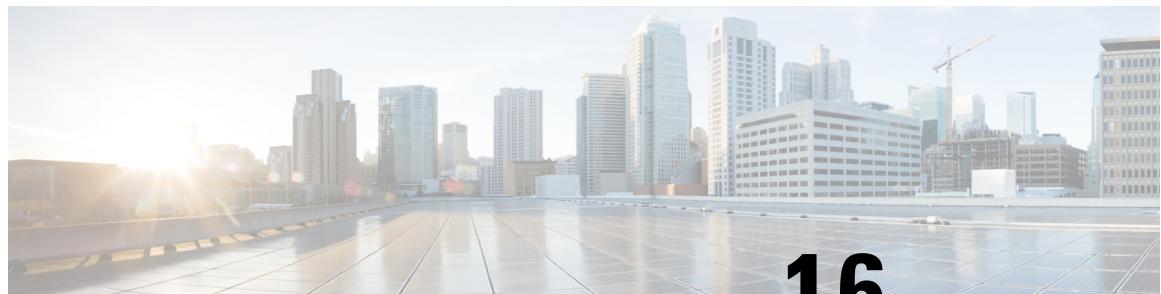
Note If necessary, click the **x** next to a device name to remove the device from the device list. Similarly, click the **x** next to a command to remove the command from the list.



PART **V**

Provision Your Network

- [Onboard and Provision Devices with Plug and Play, on page 445](#)
- [Provision Wireless Devices, on page 469](#)
- [Provision a Routing Profile, on page 543](#)
- [Provision Firewall Profiles, on page 547](#)
- [Provision a LAN Underlay, on page 549](#)
- [Provision Fabric Networks, on page 561](#)
- [Provision Services, on page 639](#)



CHAPTER 16

Onboard and Provision Devices with Plug and Play

- [Plug and Play Provisioning Overview](#), on page 445
- [Plug and Play Provisioning Prerequisites](#), on page 447
- [Plug and Play Deployment Guidelines](#), on page 452
- [View Devices](#), on page 452
- [Add or Edit a Device](#), on page 455
- [Add Devices in Bulk](#), on page 456
- [Register or Edit a Virtual Account Profile](#), on page 457
- [Add Devices from a Smart Account](#), on page 458
- [Provision a Device with Plug and Play](#), on page 459
- [Delete a Device](#), on page 467
- [Reset a Device](#), on page 467

Plug and Play Provisioning Overview

Plug and Play provisioning provides a way to automatically and remotely provision and onboard new network devices with minimal network administrator and field personnel involvement.

Using Plug and Play provisioning, you can do the following:

- Provision devices by assigning a site, deploying site settings, installing a device software image, and applying a custom onboarding configuration.
- Plan devices before their installation by entering device information and choosing provisioning operations. When the device comes online, it contacts Catalyst Center and Plug and Play provisions and onboards the device automatically.
- Provision unclaimed network devices, which are new devices that appear on the network, without prior planning.
- Synchronize the device inventory from the Cisco Plug and Play Connect cloud portal in a Cisco Smart Account to Plug and Play, so that all the devices appear in Catalyst Center.
- Display the detailed onboarding status of network devices.

The following sections describe typical use cases and workflows for Plug and Play provisioning.

Planned Provisioning

An administrator can plan the provisioning of a new site or other group of network devices as follows:

1. We recommend that you define the site within the network hierarchy. See [Network Hierarchy Overview, on page 157](#).
2. Define Onboarding Configuration templates to be applied to devices. Such templates contain basic network configuration commands to onboard a device so that it can be managed on the network. In many cases, such templates are not necessary unless you need to customize the day-zero configuration. See [Create Templates to Automate Device Configuration Changes, on page 359](#).



- Note** Day-zero templates do not support Interactive commands.

3. Define network profiles for the types of devices you are deploying. See [Network Profiles Overview, on page 333](#).
4. We recommend that you define the device credentials (CLI and SNMPv2c/SNMPv3) for the devices you are deploying. If you are using SNMPv2c, both Read and Write credentials must be provided.



- Note** Missing credentials will lead to the devices not being able to be added to inventory after they are provisioned.

5. Ensure that software images for the devices to be provisioned are uploaded and marked as golden in the Image Repository. See [Import a Software Image, on page 409](#).
6. Add details about planned devices one at a time or in bulk with a CSV file. See [Add or Edit a Device, on page 455](#) or [Add Devices in Bulk, on page 456](#).
7. Devices boot up and are automatically provisioned.

Unclaimed Provisioning

If a new network device is added to the network before it can be planned, it is labeled as an unclaimed device. An unclaimed device can be added manually by an administrator, or automatically through one of the discovery methods described in [Plug and Play Provisioning Prerequisites, on page 447](#). An administrator can provision the device as follows:

1. Find the device on the devices list by filtering on unclaimed devices or searching for it by name. See [View Devices, on page 452](#).
2. Claim the device by assigning a site, image, configuration template, or profile. See [Provision a Device with Plug and Play, on page 459](#). You can also claim the device without assigning a site.



- Note** Global device credentials are required for devices with no site assigned. Global device credentials at site level are required for devices with sites assigned.

Cisco Smart Account Synchronization and Provisioning

Network devices can be automatically registered through a Cisco Smart Account with the Cisco Plug and Play Connect cloud service. An administrator can synchronize the device inventory from Cisco Plug and Play Connect to Catalyst Center Plug and Play, so that all the devices appear in Catalyst Center. These devices can then be claimed and provisioned.

1. Register a Smart Account and virtual account with which to synchronize. See [Register or Edit a Virtual Account Profile, on page 457](#).
2. Synchronize the device inventory from the Smart Account. See [Add Devices from a Smart Account, on page 458](#).
3. Find the device on the devices list by filtering on unclaimed devices or searching for it by name. See [View Devices, on page 452](#).
4. Claim the device by assigning a site, image, configuration template, or profile. See [Provision a Device with Plug and Play, on page 459](#).
5. Devices boot up and are automatically provisioned.

Plug and Play Provisioning Prerequisites

Before using Plug and Play provisioning, make sure the required prerequisites are met for all device types. In addition, if you are deploying wireless or sensor devices, make sure those prerequisites are met. Other prerequisites are optional, but if you decide to do them, they must be done before you use Plug and Play to provision devices.

Prerequisites for All Devices

Make sure all device types meet the following prerequisites:

- Make sure devices can automatically discover the Catalyst Center controller in one of the following ways:
 - DHCP: See [DHCP Controller Discovery, on page 449](#).
 - DNS: See [DNS Controller Discovery, on page 450](#).
 - Cisco Plug and Play Connect cloud service: See [Plug and Play Connect Controller Discovery, on page 451](#).
- Set the Cisco.com credentials in the main Catalyst Center settings by using **System > Settings > Cisco.com Credentials**.
If needed, set the Cisco Smart Account credentials in **System > Settings > Smart Account**.
- Accept the End User License Agreement (EULA) in the main Catalyst Center settings by using **System > Settings > Device EULA Acceptance**.
- Ensure that Cisco network devices to be provisioned have a supported software release and are in a factory default state. If you are using a network device that was previously configured or is in an unknown state, see the device clean-up and reset details in [Network Plug and Play Troubleshooting Guide for Cisco Catalyst Center](#).

Prerequisites for Wireless or Sensor Devices

In addition to the previous prerequisites, make sure any wireless or sensor devices meet the following requirements:

- For wireless AP devices, ensure that the Cisco Wireless Controller that is managing the wireless APs has been added to the inventory and assigned to the site where the wireless APs are going to be assigned. This requirement is not needed for Mobility Express APs.
- For wireless AP devices, define the wireless radio frequency profiles. See [Create a Wireless Radio Frequency Profile, on page 277](#). This requirement is not needed for Mobility Express APs.
- For Mobility Express APs, define an IP address pool and a management interface. See [Configure IP Address Pools, on page 247](#).
- For ROW APs, we recommend that you create an AP profile with the necessary country code and configure custom site tags. See [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices, on page 315](#) and [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).
- You can configure the AP location for PnP onboarding in the **PnP AP Location** window using the **Configure AP Location** check box. This check box is unchecked by default. If necessary, check this check box to configure the site assigned during PnP claim as the AP location during PnP onboarding. For more information, see "Configure AP Location for PnP Onboarding" in the [Catalyst Center Administrator Guide](#).
- For sensors, ensure that the sensor is reachable through the Catalyst Center enterprise IP address (private/enp9s0). A DHCP option 43 string makes the device reachable in unclaimed mode in Catalyst Center; however, to claim the device, it must be reachable from the interface enp9s0 IP address. In the DHCP server, configure the NTP server (DHCP option 42) and the vendor-specific DHCP option 43 with ACSII value "5A1D;B2;K4;I172.16.x.x;J80;", where 172.16.x.x is the virtual IP address of Catalyst Center associated with the enp9s0 interface.

Optional Prerequisites

The following prerequisites are optional, but help to automate the Plug and Play provisioning process:

- Define the site within the network hierarchy. See [Network Hierarchy Overview, on page 157](#).
- Define the CLI and SNMP credentials for the devices. See [Configure Global Device Credentials, on page 235](#).



Note

You can claim wireless devices using CLI, SNMPv2c, or SNMPv3 credentials. If you use SNMPv2c, provide both Read Only and Read Write credentials.

- Ensure that software images for the devices to be provisioned are uploaded and marked as golden in the Image Repository, if you want to deploy images. See [Import a Software Image, on page 409](#).



Note The image deployment process used by Plug and Play during day-zero provisioning is not the same as that used when updating a device image later, which is described in [Provision a Software Image, on page 415](#). During Plug and Play provisioning, there are no device prechecks, auto flash cleanup, or post-checks done, as it is expected that devices are in the factory default state.

- Define Onboarding Configuration templates to be applied to devices. Such templates contain basic network configuration commands to onboard a device so that it can be managed on the network. See [Create Templates to Automate Device Configuration Changes, on page 359](#).



Note You can use the `ip http client source-interface` CLI command in the Onboarding Configuration template, which makes Catalyst Center use that IP address as the management IP address for the device, especially for the scenario of multiple IPs or VRFs.

- Define network profiles for the devices. See [Network Profiles Overview, on page 333](#).

DHCP Controller Discovery

When a Cisco network device first starts up with no startup configuration, it attempts to discover the Catalyst Center controller by using DHCP Option 43.

The prerequisites for the DHCP discovery method are as follows:

- New devices can reach the DHCP server.
- The DHCP server is configured with Option 43 for Cisco Plug and Play. This option informs the network device of the IP address of the Catalyst Center controller.

When the DHCP server receives a DHCP discover message from the device, with Option 60 containing the string “ciscopnp”, it responds to the device by returning a response that contains the Option 43 information. The Cisco Plug and Play IOS Agent in the device extracts the Catalyst Center controller IP address from the response and uses this address to communicate with the controller.

DHCP Option 43 consists of a string value that is configured as follows on a Cisco router CLI that is acting as a DHCP server:

```
ip dhcp pool pnp_device_pool      <-- Name of DHCP pool
network 192.168.1.0 255.255.255.0 <-- Range of IP addresses assigned to clients
default-router 192.168.1.1        <-- Gateway address
option 43 ascii "5A1N;B2;K4;I172.19.45.222;J80;"    <-- Option 43 string
```

The Option 43 string has the following components, delimited by semicolons:

- 5A1N;—Specifies the DHCP suboption for Plug and Play, active operation, version 1, no debug information. It is not necessary to change this part of the string.
- B2;—IP address type:

- B1 = hostname
 - B2 = IPv4 (default)
 - Ixxxx.xxx.xxx.xxx;—IP address or hostname of the Catalyst Center controller (following a capital letter i). In this example, the IP address is 172.19.45.222.
 - Jxxxx—Port number to use to connect to the Catalyst Center controller. In this example, the port number is 80. The default is port 80 for HTTP and port 443 for HTTPS.
 - K4;—Transport protocol to be used between the device and the controller:
 - K4 = HTTP (default)
 - K5 = HTTPS
 - T*TrustedCertificateBundleURL*;—Optional parameter that specifies the external URL of the trusted certificate bundle if it is to be retrieved from a different location than the default, which is the Catalyst Center controller, which gets the bundle from the Cisco InfoSec cloud (<http://www.cisco.com/security/pki/>). For example, to download the bundle from a TFTP server at 10.30.30.10, you would specify the parameter like this: Tftp://10.30.30.10/ios.p7b
- If you are using trusted certificate security and you do not specify the T parameter, the device retrieves the trusted certificate bundle from the Catalyst Center controller.
- Zxxxx.xxx.xxx.xxx;—IP address of the NTP server. This parameter is mandatory when using trusted certificate security to ensure that all devices are synchronized.

See the *Cisco IOS Command Reference* for additional details on DHCP configuration.

If DHCP Option 43 is not configured, the device cannot contact the DHCP server, or this method fails for another reason, the network device attempts discovery using DNS. For more information, see [DNS Controller Discovery, on page 450](#).

If the Catalyst Center system certificate has an FQDN-only SAN field, you must edit the DHCP pool on the seed device to contain the Option 43 string with FQDN, B2 to B1, dns-server, and domain-name before starting PnP.

If the DHCP pool relies on Cisco switches or routers, a sample configuration is as follows:

```
ip dhcp pool PnP_Pool
network 214.2.64.0 255.255.255.0
default-router 214.2.64.1
option 43 ascii "5A1D;B1;K4;I<FQDN>;J80;" 
domain-name sitdns.com
dns-server 17.1.104.100
```

DNS Controller Discovery

If DHCP discovery fails to get the IP address of the Catalyst Center controller, the network device falls back on the DNS lookup method. Based on the network domain name returned by the DHCP server, it constructs a fully qualified domain name (FQDN) for the controller, using the preset hostname pnpserver. The NTP server name is based on the preset hostname pnntpserver.

For example, if the DHCP server returns the domain name “customer.com”, the network device constructs the controller FQDN of pnpserver.customer.com. It then uses the local name server to resolve the IP address for this FQDN. The NTP server name FQDN would be pnntpserver.customer.com.

The prerequisites for the DNS discovery method are as follows:

- New devices can reach the DHCP server.
- The Catalyst Center controller is deployed with the hostname “pnpserver”.
- The NTP server is deployed with the hostname pnntpserver.

Plug and Play Connect Controller Discovery

In situations where using the DHCP or DNS discovery methods is not an option, the Cisco Plug and Play Connect cloud service allows devices to discover the IP address of the Catalyst Center controller. When the network device boots up, if it cannot locate the controller through DHCP or DNS, then it tries Plug and Play Connect by contacting devicehelper.cisco.com to obtain the IP address of the appropriate controller that is defined for your organization. To secure the communications, the first thing that the device does when contacting Plug and Play Connect is to download and install the Cisco trusted certificate bundle.

The following steps summarize how to use Cisco Plug and Play to deploy a Cisco network device by using Plug and Play Connect for discovery.

Before you begin

Cisco network devices are running Cisco IOS images that support Cisco Plug and Play and have connectivity to the Cisco Plug and Play Connect cloud service.

-
- Step 1** The network administrator configures the controller profile for the appropriate Catalyst Center controller for your organization by using Plug and Play Connect in the Cisco Smart Account web portal. For more information, see the Smart Account documentation in the web portal.
- Step 2** If you order plug and play network devices through Cisco Commerce Workspace (CCW), these network devices are automatically registered with Plug and Play Connect as long as a Cisco Smart Account is assigned to the order and you include the NETWORK-PNP-LIC option for each device that you want to use with Cisco Plug and Play.
- This option causes the device serial number and PID to be automatically registered in your Smart Account for plug and play. If you have specified a default controller, then the devices are automatically assigned to that controller when the order is processed.
- Step 3** Alternatively, you can manually add devices in the Plug and Play Connect web portal.
- Step 4** Register the Catalyst Center controller as a controller for Cisco Plug and Play Connect in a Cisco Smart Account, for redirection services. See [Register or Edit a Virtual Account Profile, on page 457](#).
- This step is required if you order plug and play network devices through CCW and these network devices are automatically registered with Plug and Play Connect through your Smart Account.
- Step 5** Synchronize the device inventory from the Smart Account in the Cisco Plug and Play Connect cloud portal to Catalyst Center Plug and Play.
- Devices registered in the Plug and Play Connect web portal are synced to the controller and appear in the plug and play device list with a source of SmartAccount.
- Step 6** Claim the newly synced devices. See [Provision a Device with Plug and Play, on page 459](#).
- Step 7** The device installer installs and powers up the Cisco network device.

Step 8

The device discovers the Catalyst Center controller by querying the Plug and Play Connect service, identifies itself by serial number to Plug and Play in Catalyst Center, then is provisioned according to what was planned for it during the claim process.



Note The device will fail to contact Plug and Play Connect if the device cannot synchronize with the predefined NTP servers **time-pnp.cisco.com** or **pool.ntp.org**. To resolve this problem, either unblock NTP traffic to these two hostnames, or map these two NTP hostnames to local NTP server addresses on the DNS server.

Plug and Play Deployment Guidelines

Follow these recommendations when using Plug and Play:

- Device bring up order: In general, routing and upstream devices should be brought up first. Once the router and all upstream devices are up and provisioned, switches and downstream devices can be brought up. The Plug and Play agent in a device attempts to auto-discover the Catalyst Center controller only during initial device startup. If at this time, the device cannot contact the controller, device provisioning fails, so upstream devices should be provisioned first.
- Cisco Router Trunk/Access Port Configuration: Typical branch networks include routers and switches. One or more switches are connected to the WAN router and other endpoints like IP phones and access points connect to the switches. When a switch connects to an upstream router, the following deployment models are supported for Plug and Play:
 - Downstream switch is connected to the router using a switched port on the router. In this type of connection, the switched port on the router can be configured as a trunk or access port.
 - Downstream switch is connected to the router using a routed port on the router. In this case, the routed port can support multiple VLANs using sub-interfaces. During the Plug and Play process, the switch would automatically configure its port as a trunk port. In a large branch scenario, it becomes necessary to carry multiple VLANs between the router and the downstream switch. To support this use case, the switch must be connected to a routed port.
- Non-VLAN 1 configuration: Plug and Play supports devices using VLAN 1 by default. If you want to use a VLAN other than 1, adjacent upstream devices must use supported releases and you must configure the following global CLI command on the upstream device to push this CLI to the upcoming Plug and Play device: **pnp startup-vlan x**. When you execute this command on an adjacent upstream device, the VLAN membership change does not happen on that device. However, the active interfaces on the upcoming Plug and Play device that are connected to the upstream device are changed to the specified VLAN. This guideline applies to both routers and switches and should be used only for trunk mode scenarios and not access mode.

View Devices

You can view information about devices in the **Plug and Play** window.

In addition, you can perform several tasks from this window. For information, see the following topics:

- [Add or Edit a Device, on page 455](#)
- [Add Devices in Bulk, on page 456](#)
- [Add Devices from a Smart Account, on page 458](#)
- [Provision a Device with Plug and Play, on page 459](#)
- [Reset a Device, on page 467](#)
- [Delete a Device, on page 467](#)

Step 1 From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

The **Plug and Play** window displays a table with the following device information:

Table 33: Device Information

Column	Description
#	Row number.
Device Name	Hostname of the device. Click this link to open the device details window. A stack icon indicates a switch stack.
Serial Number	Device serial number.
Product ID	Device product ID.
IP Address	Device IP address.
Source	Source of the device entry: <ul style="list-style-type: none"> • User: User added the device through the GUI or API. • Network: Unclaimed device that has contacted the controller. • SmartAccount: Device was synced from a Smart Account.
State	<ul style="list-style-type: none"> • Unclaimed: Device successfully completed initialization and is ready to be claimed or put in Planned state. • Planned: User provided device configuration or provisioning parameters and the device is ready to be provisioned. • Onboarding: Device onboarding is in progress. • Provisioned: Device is successfully onboarded and added to inventory. For APs and sensors, the state changes to Provisioned after the device is successfully assigned to a wireless controller. • Error: Device had an error and could not be provisioned.

Column	Description
Onboarding State	<p>Onboarding state of the device:</p> <ul style="list-style-type: none"> • Not Contacted: Device has not called in. A user might have added or reset the device. • Connecting: Device called in. • Initializing: Executing system workflow. Basic device information is collected. Stack license and version mismatches are corrected. • Initialized: System workflow completed. • Executing Workflow: Any tasks that are selected during the claim are applied in this state. Stacks support renumbering and license update based on the product and image version. • Executed Workflow: User workflow completed. • Connection Error: Could not install certificates to secure a connection. • Authentication Error: Could not verify the SUDI certificate. • Authorization Error: Could not verify the user-provided SUDI serial number. • Initialization Error: Error executing system workflow. • Workflow Execution Error: Error executing user workflow. • Executing Reset: Executing reset workflow. You must manually reset the errored device, which reloads the device. • Reset Execution Error: Error executing reset workflow. <p>Click the progress bar to go to the device history.</p>
Site	Site with which the device is associated.
Last Contact	Last date and time the device contacted Plug and Play.
Smart Account	Cisco Smart Account with which the device is associated.
Virtual Account	Virtual Account (within the Cisco Smart Account) with which the device is associated.
Created	Date and time when the device was added to Plug and Play.

The Device table displays the information shown in the following table for each device. Some of the columns support sorting.

- Note**
- Certain columns, such as **Device Name** and **Serial Number**, are displayed in the **Default** focus view.
 - You can customize the **Devices** table to display or hide columns. Click the settings icon (⚙️) to display the **Table Settings** slide-in pane, and from the **Edit Table Columns** tab, choose which columns to display or hide. Click **Apply** to save the changes.

Step 2 From the **Plug and Play** window, you can control the display of device information in the following ways:

- To sort the rows in ascending or descending order, click any column header with a carrot arrow icon ▲ .
- To display devices in a particular state, from the **Device Status** filter, choose **Unclaimed**, **Error**, **Provisioned** or **All**.
- To focus the view, from the **Focus** drop-down list, choose **Default** or **All**.
- To change when table information is refreshed, click the **Auto-Refresh** drop-down list and choose the desired auto-refresh time. By default, the devices table refreshes every 30 seconds.
- To find specific devices, use the **Filter** or **Find** option.
- To view device details, click the name of a device.

To view additional details, from the window that opens, click the **Details**, **History**, or **Configuration** tabs. For a switch stack, you can also click the **Stack** tab. Some tabs have additional links that you can click for even more information.

Note To delete the stack member from a switch stack, under the **Stack** tab, check the check box next to the desired member and click **Delete Member**.

Add or Edit a Device

This procedure shows how to add or edit a device from the Plug and Play Devices list. Alternatively, you can edit a device from the device details window by clicking **Edit**.

Table 34: Device Fields

Field	Description
Serial Number	Device serial number (read only if you are editing a device).
Product ID	Device product ID (read only if you are editing a device).
Device Name	Device name.
Enable SUDI Authorization	Enables secure unique device identifier (SUDI) authorization on devices that support it. When enabled, when a device attempts to connect to a Plug and Play server, the server compares the serial number on the SUDI certificate with the user-provided serial number. When the serial numbers match, the device is verified and connects to the Plug and Play server.
SUDI Serial Numbers	Devices that support SUDI have two serial numbers: the chassis serial number and the SUDI serial number (called the License SN on the device label). Enter one or more comma-separated SUDI serial numbers in this field when adding a device that uses SUDI authorization. This field appears only if Enable SUDI Authorization is checked.
This Device Represents a Stack	Device represents a stack (this item is read only if you are editing a device). Applicable only for supported stackable switches.

Add Devices in Bulk**Before you begin**

If the device requires credentials, be sure that the global device credentials are set in the **Design > Network Settings > Device Credentials** page. For more information, see [Add Global CLI Credentials, on page 236](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2 View the devices in the table.

You can filter on device state by using one of the **Device State** buttons, or use the **Filter** option to find specific devices. Click **Refresh** to refresh the device list.

Step 3 Add or edit a device as follows:

- To add a device, click **Add Devices** and then click **Single Device**.
- To edit a device, check the check box next to the name of the device you want to edit and choose **Actions > Edit** in the menu bar above the device table. The **Edit Device** dialog is displayed.

Step 4 Set the fields as needed, referring to the preceding table for more information.

Step 5 Save the settings by doing one of the following:

- If you are adding a device and will claim it later, click **Add Device**.
- If you are adding a device and want to claim it immediately, click **Add + Claim**. For more information on claiming a device, see [Provision a Device with Plug and Play, on page 459](#).
- If you are editing a device, click **Edit Device**.

Add Devices in Bulk

This procedure shows how to add devices in bulk from a CSV file.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2 Click **Add Devices**.

The **Add Devices** dialog is displayed.

Step 3 Click **Bulk Devices**.

Step 4 Click **Download File Template** to download the file template.

See the file template for information on which fields are mandatory and optional for different devices.

Step 5 Add the information for each device to the file and save the file. Note that certain fields are required, depending on the device type.

Step 6 Upload the CSV file by doing one of the following actions:

- Drag and drop the file to the drag and drop area.
- Click where it says "click to select" and select the file.

Step 7 Click **Import Devices**.

The devices in the CSV file are listed in a table.

Step 8 Check the box next to each device to import, or click the check box at the top to select all devices.

Step 9 Add the devices by doing one of the following:

- To add the devices and claim them later, click **Add Devices**.
 - To add the devices and claim them immediately, click **Add + Claim**. For more information on claiming a device, see [Provision a Device with Plug and Play, on page 459](#).
-

Register or Edit a Virtual Account Profile

For redirection services, in a Cisco Smart Account, register Catalyst Center as a controller for Cisco Plug and Play Connect. This lets you add the device inventory from the Cisco Plug and Play Connect cloud portal to Cisco Plug and Play in Catalyst Center.

You can register a Smart Account, virtual account, and the relevant server profile information with the Plug and Play system and database. The devices in the registered virtual account are synchronized with the Plug and Play database.

Table 35: Virtual Account Fields

Field	Description
Select Smart Account	Cisco Smart Account name.
Select Virtual Account	Virtual account name. Virtual accounts are subaccounts within a Cisco Smart Account.
IP or FQDN	IP address or fully qualified domain name of this Catalyst Center controller.
Profile Name	Controller profile name.
Use as Default Controller Profile	<i>Default controller profile</i> means that any new device that is added to a virtual account, or any existing device that doesn't have a default controller assigned, will be assigned to this redirection profile.

Step 1 From the top-left corner, click the menu icon and choose **System > Settings > PnP Connect**.

Step 2 View the virtual accounts in the table.

The table lists all of the registered Plug and Play Connect virtual account profiles.

Step 3 Either register or edit a virtual account profile, as follows:

- To register a virtual account, click **Register**. The Register Virtual Account pane is displayed.
- To edit a registered virtual account profile, click the radio button next to the name of the profile that you want to edit and click **Edit Profile**. The Edit Profile pane is displayed.

Step 4 Set the fields as needed.

Step 5 Save the settings by doing one of the following:

- If you are registering a new virtual account profile, click **Register**.

Add Devices from a Smart Account

- If you are editing a virtual account profile, click **Save**.
-

What to do next

Synchronize the device inventory from the Cisco Plug and Play Connect cloud portal to Catalyst Center Plug and Play. For more information, see [Add Devices from a Smart Account, on page 458](#).

Add Devices from a Smart Account

This task allows you to synchronize the device inventory from a Smart Account in the Cisco Plug and Play Connect cloud portal to Catalyst Center Plug and Play.

The Virtual Accounts table displays the following information for each profile.

Table 36: Virtual Accounts Information

Column	Description
Virtual Accounts	Virtual account name.
Smart Accounts	Smart account that the virtual account is associated with.
Profile	Profile name.
Controller	Controller IP address.

Before you begin

Before you can synchronize the device inventory from the Cisco Plug and Play Connect cloud portal, you must register a virtual account. See [Register or Edit a Virtual Account Profile, on page 457](#). You can go directly to the PnP Connect settings page by clicking the **PnP Connect** link in the **Add Devices > Smart Account Devices** dialog.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2

Click **Add Devices**.

Step 3

Click **Smart Account Devices**.

Step 4

If you need to enter a Cisco.com ID (Cisco.com ID shows as Not Associated), do the following:

- Click the **Add** link.
- Enter the Cisco.com username and password.
- Click **Save For Later** if you want to save the credentials permanently in Catalyst Center, or leave this check box unchecked to use these credentials one time only.
- Click **Submit**.

Step 5

Choose the Smart Account and virtual account that you want to register with Plug and Play.

If you need to register a PnP Connect virtual account profile, click the **PnP Connect** link. If you want to change the Cisco ID, click the **Not me?** link.

- Step 6** From the Devices table, choose the devices that you want to add, and then click **Add Devices**.
Added devices appear in the Plug and Play Devices table with the source set to SmartAccount.

What to do next

Claim the newly added devices. For more information on claiming a device, see [Provision a Device with Plug and Play, on page 459](#).

Provision a Device with Plug and Play

When you claim a device, you begin the process of provisioning it. When a device is provisioned, Catalyst Center performs the following actions:

1. Deploys an image to the device.
2. Deploys system configuration CLI commands that configure the following settings:
 - Device credentials (CLI and SNMP)
 - Enable SSH v2 and SCP server
 - Disable HTTP and HTTPS servers
 - For switches, vtp mode transparent is enabled
3. Deploys a device on boarding configuration template that corresponds to the type of device:
 - For wired devices, Catalyst Center deploys the on boarding configuration (day-zero) template that you defined.
 - For wireless devices, Catalyst Center deploys a configuration based on the network profile assigned to the site.

If your on boarding configuration template has any of the same system configuration CLI commands, the system configuration CLI commands are overridden, because the on boarding configuration template is applied to the device after the system configuration CLI commands.

4. Deploys Application Quality of Service (QoS) policy on the wired devices, if you configure QoS policy on the site to which the device is provisioned. For more information, see [Create an Application Policy, on page 732](#).
5. Pushes the NETCONF configuration on port 830 during device on boarding. The NETCONF port information is saved in the global credentials and network settings.



Note If the device is not assigned to a site during the claiming process, NETCONF is not configured on the device.

Automatic NETCONF enablement support is available only for Cisco Catalyst 9000 Series switches running Cisco IOS-XE 17.3 or later.

6. Application Telemetry and Controller-Based Application Recognition (CBAR) is enabled on the applicable network devices.

Provision a Switch or Router Device

7. Adds the device to the inventory.



Note When Device Controllability is enabled for a device (it is enabled by default), additional configurations are pushed to the device when it is added to the inventory or assigned to a site. For more information, see the Device Controllability section in the *Cisco Catalyst Center Administrator Guide*.

When you claim a device that has not yet booted for the first time, the device is automatically provisioned when it boots up. This process is referred to as device *planning*.

The procedure for provisioning a device depends on the type of device, as follows:

- Switches and routers: See [Provision a Switch or Router Device, on page 460](#)
- Cisco Wireless Controllers, access points, and sensors: See [Provision a Wireless or Sensor Device, on page 464](#)

Provision a Switch or Router Device

This procedure shows how to claim a device from the **Plug and Play Devices** list. Alternatively, you can claim a device from the device **Details** window by clicking **Claim**.

Before you begin

Make sure that the Plug and Play provisioning prerequisites have been met. For information, see [Plug and Play Provisioning Prerequisites, on page 447](#).

Step 1

From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2

View the devices in the table.

From the **Focus** drop-down list, choose **Default** or **All** to view the devices.

By default, the devices table is refreshed every 30 seconds. Click the **Auto-Refresh** drop-down list and choose a refresh time.

Use the **Filter** or **Find** option to find specific devices.

Step 3

Check the check box next to the device or devices that you want to claim.

Step 4

Choose **Actions > Claim** in the menu bar above the device table.

Step 5

(Optional) In the **Assign Site** window, do the following:

- a) Change the device hostname, if needed.
- b) Assign a site by doing any of the following:

- To assign a different site to each device, click **Assign**, and from the **Select a Site** drop-down list, choose a site.
- To assign the same site as the first device to all other devices, in the **Actions** column, hover your cursor over the ellipsis icon **...** and choose **Apply Site to All**.
- To assign a site from any device to some other devices, in the **Actions** column, hover your cursor over the ellipsis icon **...** and choose **Assign this Site to Other Devices**, choose the devices, and click **Assign**.

- To clear the site assigned to the devices, click **Clear Site**.

c) Click **Next**.

Step 6

In the **Assign Configuration** window, do the following:

- a) In the **Configuration** column, click **Assign** for the device that you want to configure.
- b) If the device configuration doesn't need any changes, click **Cancel** and proceed to the next step. Otherwise, change or configure any of the following settings:

- **Device Name:** Change the device hostname, if needed.

- **Image:** From this drop-down list, choose a golden software image to apply to the device. If there is only one golden image for this device type in the image repository, it is chosen by default.

Note If the device software image version or golden tagged version is 17.14.1 or later, the device claim is blocked if the selected site is configured with MD5 authentication for SNMP credentials.

To claim the device, you must also configure SHA authentication for SNMP credentials, or the software image version must be earlier than 17.14.1. For information on how to configure SHA authentication, see [Edit Global Device Credentials, on page 245](#).

- **Template:** From this drop-down list, choose an onboarding configuration template to apply to the device. If there is only one onboarding configuration template defined for this device type, it is chosen by default.

Note If you have not assigned the device to a site, you must choose a template for the device to proceed.

- **Apply the PKCS12 device certificate on the device:** Check this check box to deploy a PKCS12 certificate to the device. This option is available only for routers.

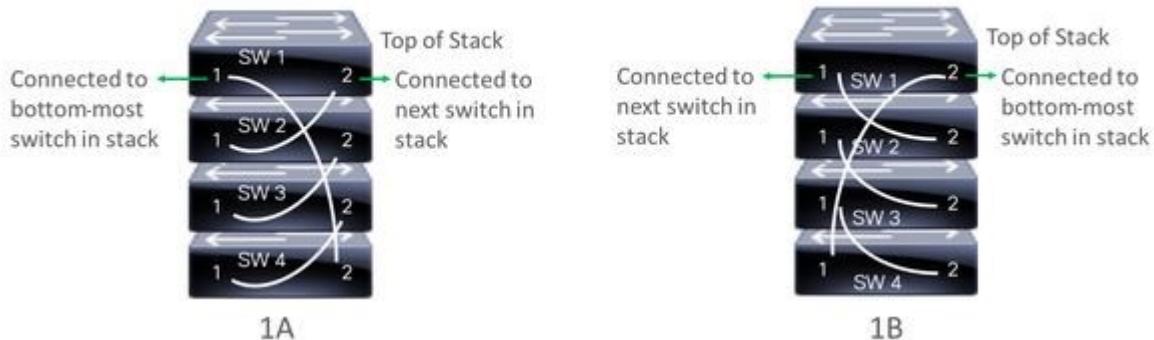
- **RTU License Level:** From this drop-down list, choose **Lanbase** or **IP Services**. This option is available only for Cisco Industrial Ethernet (IE) 4000 and 5000 Series Switches.

Note To choose **IP Services**, accept the End User License Agreement (EULA) in **System > Settings > Device EULA Acceptance**.

- **Select a Cabling Scheme:** From this drop-down list, choose the stack cabling scheme, if you want to renumber the stack.

This item appears only for switches that support stacking, and only if they are connected, as shown in one of the following cabling schemes.

Figure 21: Cabling Schemes

Supported Stack Switch Wiring Schemes:

- **Select a Top of Stack Serial Number:** The top-of-stack serial number autopopulates with the user-entered stack member serial number. If you don't want to use the autopopulated serial number, click the serial number, and in the **Select a Top of Stack Serial Number** field, click the drop-down arrow. Click the X icon to deselect the serial number.

This option appears only for switches that support stacking, and only if they are connected as shown in the preceding image.

For a *planned device*, the top-of-stack serial number is set as the default.

For an *unclaimed device*, the top-of-stack serial number is not set as the default. Choose the top-of-stack serial number from the drop down.

- **Select a License Level:** From this drop-down list, choose the stack license level. Click the X icon to deselect the license level.

This item is displayed only for switches that support stacking.

- Click **Save**.
- From the **Clear Configuration** drop-down list, choose any of the following options:
 - **Clear Device Certificates:** Choose this option and check the check box next to each of the devices that you want to clear the certificate from, and click **Clear**.
 - **Clear Images:** Choose this option and check the check box next to each of the devices that you want to clear the image from, and click **Clear**.
 - **Clear Templates:** Choose this option and check the check box next to each of the devices that you want to clear the template from, and click **Clear**.
 - **Clear License Levels:** Choose this option and check the check box next to each of the devices that you want to clear the license level from, and click **Clear**.

- To apply an image or template from one device to other devices, in the **Actions** column, hover your cursor over the ellipsis icon **...** and choose **Apply Image to Other Devices** or **Apply Template to Other Devices**.

For stacked devices, you can apply the device license level to other devices by clicking **Apply License Level to Other Devices**.

- f) If you selected multiple devices to provision, click **Assign** for the next device in the list and repeat the configuration steps, until you have done this for all devices.
- g) After you have configured all the devices, click **Next**.

Step 7

To configure template parameter values for all the devices in bulk, skip to the next step. To configure template parameter values for devices one at a time, from the **Provision Templates** window, do the following:

- a) Click the name of the device that you want to configure.
- b) If the device was assigned a configuration template, specify the values for the parameters that were defined in the template.

Enter the values for each parameter in the fields for each device. A red asterisk indicates a required field.

- c) If you want to copy the running configuration to the startup configuration on the selected device, check the **Copy running config to startup config** check box.
- d) If you selected multiple devices to provision, click the next device in the list at the left side of the window and enter the parameter values, until you have done this for all the devices.

- e) Click **Next**.

Step 8

To specify parameter values for all the devices in bulk, in the **Provision Templates** window, do the following:

- a) Click **Export** to save the CSV template file.
- b) Add the values for each of the parameters to the file and save the file.
- c) Click **Import**.
- d) Drag and drop the file to the drag-and-drop area, or click "click to select" and select the file.
- e) Click **Import**.
- f) Click **Next**.

Step 9

In the **Summary** window, view details about the devices and their configuration preview status.

Step 10

Verify the **Day-0 Config** column for each device to see whether the configuration preview succeeded.

If the preview shows an error, click the **Actions** link in the error message above the table to see what actions you need to take. You can click an action to open a new tab with the window where a change is needed.

To avoid provisioning errors, resolve issues, if any, before claiming the device. You may need to go back to the **Provision Templates** step and change the parameter values, and the template, revisit the **Design** area to update network design settings, or resolve network connectivity issues, if any.

After you resolve the problem, return to the **Day-0 Config** column, click **Retrying getting Day-0 configuration preview for failed device(s)**, and click **OK**.

Step 11

Click a link in the **Day-0 Config** column to see more information about the device, its configuration, and configuration preview errors, if any.

Step 12

Click **Claim**.

Step 13

In the confirmation dialog box, click **Yes** to claim the devices.

What to do next

If you have configured network settings, provision these settings on the devices. For more information, see [Complete the Provisioning Process, on page 466](#).

Provision a Wireless or Sensor Device

This procedure explains how to claim a device from the Plug and Play Devices list. Alternatively, you can claim a device from the device **Details** window by clicking **Claim**.

Before you begin

Make sure that the Plug and Play provisioning prerequisites have been met. For information, see [Plug and Play Provisioning Prerequisites, on page 447](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2 View the devices in the table.

You can use the search bar to find specific devices.

Step 3 Check the check box next to the device or devices that you want to claim.

Step 4 From the menu bar above the device table, choose **Actions > Claim**.

Step 5 (Optional) In the **Assign Site** window, do the following:

- Change the device hostname, if needed.
- Assign a site by doing any of the following:

- To assign a different site to each device, click **Assign**, and from the **Select a Site** drop-down list, choose a site.
- To assign the same site as the first device to all other devices, in the **Actions** column, hover your cursor over the ellipsis icon  and choose **Apply Site to All**.
- To assign a site from any device to some other devices, in the **Actions** column, hover your cursor over the ellipsis icon  and choose **Assign this Site to Other Devices**, choose the devices, and click **Assign**.
- To clear the site assigned to the devices, click **Clear Site**.

If the wireless network profile associated with the assigned site has an onboarding template, Catalyst Center uses this template for PnP onboarding. For more information, see [Add Templates to a Network Profile, on page 342](#).

Note In the **System > Settings > Device Settings > PnP AP Location** window:

- If the **Configure AP Location** check box is checked, Catalyst Center assigns this site as the AP location during PnP onboarding.
- If the **Configure AP Location** check box is unchecked, Catalyst Center does not configure this site as the AP location during PnP onboarding. You can configure the AP location using the **Configure Access Points** workflow. For more information, see [Configure APs, on page 851](#).

For more information, see "Configure AP Location for PnP Onboarding" in the [Cisco Catalyst Center Administrator Guide](#).

- Click **Next**.

Step 6 In the **Assign Configuration** window, do the following:

- In the **Configuration** column, click **Assign** for the device that you want to configure.
- If the device configuration doesn't need any changes, click **Cancel** and proceed to the next step. Otherwise, change or configure any of the following settings:

- **Device Name:** Change the device hostname, if needed.

- **Image:** From this drop-down list, choose a golden software image to apply to the device. If there is only one golden image for this device type in the image repository, it is chosen by default.

Note If the device software image version or golden tagged version is 17.14.1 or later, the device claim is blocked if the selected site is configured with MD5 authentication for SNMP credentials.

To claim the device, you must also configure SHA authentication for SNMP credentials, or the software image version must be earlier than 17.14.1. For information on how to configure SHA authentication, see [Edit Global Device Credentials, on page 245](#).

- **Template:** From this drop-down list, choose an onboarding configuration template to apply to the device. If there is only one onboarding configuration template defined for this device type, it is chosen by default.

Note If you have not assigned the device to a site, you must choose a template for the device to proceed.

- **Catalyst Wireless LAN Controller Settings:** For a wireless controller, enter values in the following fields: **Wireless management IP**, **Subnet mask**, **Gateway**, **IP interface name**, and optionally, **VLAN ID**.

- For an AP device, in the **Radio Frequency Profile** drop-down list, choose a radio frequency profile to apply to the device. This may be set if you designated one profile as a default.

- For a Mobility Express device, enter values in the following fields: **Wireless management IP**, **Subnet mask**, and **Gateway**.

- For a wireless sensor device, in the **Sensor Settings** drop-down list, choose the sensor device profile (backhaul) to apply to the device.

Note For Cisco Aironet 1800s Active Sensor earlier than 1.3.1.2, make sure that you do not choose the sensor device profile **CiscoProvisioningSSID**. Instead, choose your own SSID for backhaul purposes.

- If you made any changes, click **Save**; otherwise, click **Cancel** to return to the list and configure other devices.

- c) From the **Clear Configuration** drop-down list, choose any the following options:

- **Clear Device Certificates:** Choose this option and check the check box next to each of the devices that you want to clear the certificate from, and click **Clear**.

- **Clear Images:** Choose this option and check the check box next to each of the devices that you want to clear the image from, and click **Clear**.

- **Clear Templates:** Choose this option and check the check box next to each of the devices that you want to clear the template from, and click **Clear**.

- **Clear License Levels:** Choose this option and check the check box next to each of the devices that you want to clear the license level from, and click **Clear**.

- d) To apply an image or template from one device to other devices, in the **Actions** column, hover your cursor over the ellipsis icon and choose **Apply Image to Other Devices** or **Apply Template to Other Devices**.

For wireless controller devices, you can apply the device license level to other devices by clicking **Apply License Level to Other Devices**.

- e) If you selected multiple devices to provision, click **Assign** for the next device in the list and repeat the configuration steps, until you have done this for all devices.

Complete the Provisioning Process

f) After you have configured all the devices, click **Next**.

Step 7 In the **Provision Templates** window, select the template from the **Devices** area, enter your domain name in the **domain** field, and click **Next**.

Step 8 In the **Summary** window, view details about the devices and their configuration preview.

Step 9 Check the **Device Configuration** column for each device to see if the configuration preview succeeded.

If the preview shows an error, you can click the **Actions** link in the error message above the table to see what actions you need to take. You can click an action to open a new tab with the window where a change is needed. You must resolve any issues before claiming the device, to avoid provisioning errors. You may need to go back to the **Assign Configuration** step and change the configuration, revisit the **Design** area to update network design settings, or resolve any network connectivity issues. After you have resolved the problem, you can go back to this tab, click **Retrying getting Day-0 configuration preview for failed device(s)**, and click **OK**. Ensure that the wireless controller that is managing a device has been added to the inventory and assigned to the site where the wireless device is assigned.

Step 10 In the **Device Configuration** column, click **Preview Configuration** to review the configuration.

Step 11 Click **Claim**.

Step 12 In the confirmation dialog box, click **Yes** to claim the devices and start the provisioning process.

Note If there is a conflicting operation for the selected site, to proceed with the current configuration, you must either wait for the existing, scheduled, or pending-review operations to complete or discard the operations.

What to do next

If you have configured network settings, provision these settings on the devices. For more information, see [Complete the Provisioning Process, on page 466](#).

Complete the Provisioning Process

During Plug and Play provisioning, only the device credentials and the onboarding configuration are pushed to the device. No other network settings are pushed. After Plug and Play provisioning is completed, you can complete the provisioning process by pushing the network settings that are configured in the **Design** area.

The network settings include AAA server settings, if these are configured. In the case of Cisco ISE, Catalyst Center configures the device on Cisco ISE as a AAA client for RADIUS or TACACS.

For wireless and sensor devices, the network settings include wireless settings, such as RF profiles and antenna radio profiles, if these are configured. For more information, see [Wireless Device Provisioning Overview, on page 469](#).

Before you begin

- Ensure that the device has been provisioned (onboarded) using one of the following procedures:
 - [Provision a Switch or Router Device, on page 460](#)
 - [Provision a Wireless or Sensor Device, on page 464](#)
- Configure network settings. For information, see [Configure Network Settings, on page 231](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- Step 2** Select the device and choose **Actions > Provision > Provision Device**.
- Step 3** Proceed through the steps in the workflow.
- Step 4** In the **Summary** window, review the remaining network settings. To make any changes, click **Edit** next to the relevant category; otherwise, click **Deploy**.

Note If the device software image version or golden tagged version is 17.14.1 or later, the device claim is blocked if the selected site is configured with MD5 authentication for SNMP credentials.

To claim the device, you must also configure SHA authentication for SNMP credentials, or the software image version must be earlier than 17.14.1. For information on how to configure SHA authentication, see [Edit Global Device Credentials, on page 245](#).

- Step 5** (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).
-

Delete a Device

Deleting a device removes it from the Plug and Play database but does not reset the device. Use **Reset** if you want to reset a device that is in the Error state.

This procedure explains how to delete a device from the Plug and Play Devices list. Alternatively, you can delete a device from the device details window by clicking **Delete**.



Note If a device is in the Provisioned state, it can be deleted only from the **Inventory** tab.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.
- Step 2** View the devices in the table.
- You can filter on device state by using one of the **Device State** buttons, or use the **Filter** option to find specific devices. Click **Refresh** to refresh the device list.
- Step 3** Check the check box next to one or more devices that you want to delete.
- Step 4** From the menu bar above the device table, choose **Actions > Delete**.
- Step 5** Click **Yes** to confirm that you want to delete the devices.
-

Reset a Device

Resetting a device applies only to devices in the Error state and resets its state to Unclaimed and reloads the device, but does not remove it from the Plug and Play database. Use **Delete** if you want to delete a device.

**Note**

If the saved configuration on the device is the factory default or a similar minimal configuration, then this option causes the device to restart the provisioning process. However, if the device has a previously saved startup configuration, then this could prevent the device from restarting the provisioning process and it will need to be reset to factory defaults. On wireless and sensor devices, only the device state is reset and the device is not reloaded.

This procedure shows how to reset a device from the Plug and Play Devices list. Alternatively, you can reset it from the device details window by clicking **Reset**.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.

Step 2 View the devices in the table.

You can filter on device state by using one of the **Device State** buttons, or use the **Filter** option to find specific devices. Click **Refresh** to refresh the device list.

Step 3 Check the check box next to one or more devices that you want to reset.

Step 4 Click **Actions > Reset** in the menu bar above the device table.

A confirmation dialog box is displayed.

Step 5 Choose one of the following options:

- **Reset and keep current claim parameters**—Keep the current claim parameters and the device goes to the Planned state.
- **Reset and remove all claim parameters**—Remove the current claim parameters and the device goes to the Unclaimed state.

Step 6 Click **Reset**.



CHAPTER 17

Provision Wireless Devices

- [Wireless Device Provisioning Overview, on page 469](#)
- [About Wireless Devices and Country Codes, on page 469](#)
- [Visibility and Control of Wireless Device Configurations, on page 470](#)
- [Prerequisites for Provisioning a Cisco AireOS Controller, on page 477](#)
- [Provision a Cisco AireOS Controller, on page 478](#)
- [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#)
- [Enable ICMP Ping on APs in FlexConnect Mode, on page 489](#)
- [Day-Zero Workflow for Cisco AireOS Mobility Express APs, on page 490](#)
- [Provision Cisco AireOS Controllers in the Existing Deployment, on page 491](#)
- [Configure and Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 494](#)
- [Configure and Provision a Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches, on page 525](#)
- [Inter-Release Controller Mobility Introduction, on page 532](#)
- [Prerequisites for Provisioning a Meraki Device, on page 535](#)
- [Provision a Meraki Device, on page 536](#)
- [Provision Remote Teleworker Devices, on page 537](#)

Wireless Device Provisioning Overview

The following sections provide information about how to provision various Cisco wireless devices.

About Wireless Devices and Country Codes

Controllers and access points are designed for use in many countries with varying regulatory requirements. The radios within the access points are assigned to a specific regulatory domain at the factory (such as -E for Europe), but the country code enables you to specify a particular country of operation within that regulatory domain (such as FR for France or ES for Spain). Configuring a country code ensures that each radio's broadcast frequency bands, interfaces, channels, and transmit power levels are compliant with country-specific regulations.

Catalyst Center provisions controllers with country codes according to the site they are assigned. In the case of controllers, they can be assigned to more than one site. So, they can be assigned more than one country code. During provisioning, Catalyst Center assigns sites to the controller along with the sites' country codes. For example, a controller that manages both India and US sites is assigned the IN and US country codes.

Visibility and Control of Wireless Device Configurations

When access points are provisioned, they are assigned to a floor. If the access point is a ROW AP, Catalyst Center gets the country code for the site and assigns it to the AP. Any additional APs on the same floor are assigned the same country code.

During AP provisioning with an RF profile selected, out of all the DCA Channels configured on the RF profile, only the supported channels as per the country code are considered for Dynamic Channel Assignment (DCA). You can see the list of unsupported DCA channels in the AP preprovision summary step of the AP provision workflow on Catalyst Center.

The country code information is displayed on the **Device 360** window for controllers and access points.

For a complete list of country codes supported per product, see

<https://www.cisco.com/c/dam/assets/prod/wireless/wireless-compliance-tool/index.html>.

Visibility and Control of Wireless Device Configurations

The Visibility and Control of Configurations feature provides a solution to further secure your planned network configurations before deploying them onto your devices. With enhanced visibility, you can enforce the previewing of device configurations (CLI and NETCONF commands) before deploying them. With enhanced control, you can ensure only authentic and authorized configurations are provisioned onto your network devices through an IT Service Management (ITSM) check. These two options also offer you the flexibility to preview configurations at your own pace. You can preview the configurations immediately in a visibility-and control-supported workflow or later in the **Activities > Tasks** window.

By default, the Visibility and Control of Configurations settings are configured as follows:

- Visibility of Configurations (**Configuration Preview**) is enabled.
- Control of Configurations (**ITSM Approval**) is disabled.

To enable or disable these settings, see "Enable Visibility and Control of Configurations" in the *Cisco Catalyst Center Administrator Guide*.



Note

If a provisioning workflow supports Visibility and Control of Configurations, the following banner message is displayed when you schedule the deployment of your task:

This workflow supports enforcing network administrators and other users to preview configurations before deploying them on the network devices. To configure this setting, go to **System > Settings > Visibility and Control of Configurations**.

Visibility and Control of Configurations Workflow

When it's time to schedule your task during a provisioning workflow, depending on the Visibility and Control of Configurations settings, you can do the following:

- If **Configuration Preview** is enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because you must preview the device configurations before deploying them.
- If **Configuration Preview** and **ITSM Approval** are enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because

you must preview the device configurations and submit them to an IT administrator for approval before deploying them.

- If **Configuration Preview** and **ITSM Approval** are disabled, you can choose any available option (**Now**, **Later**, or **Generate configuration preview**).

If you choose **Generate configuration preview**, Catalyst Center performs the following the high-level steps:

	Step	Description
1	Catalyst Center performs a set of network provisioning prechecks to ensure a seamless provisioning operation.	<p>On the Performing Initial Checks window, Catalyst Center checks for and notifies you of any Pending Operations and Device Compliance issues.</p> <p>You must address all the identified issues and perform a recheck to ensure all the validations are successful. For more information, see Network Provisioning Prechecks, on page 137.</p>
2	Catalyst Center prepares the chosen devices to generate the configurations.	<p>On the Preparing Devices and Configuration Models window, if the provisioning workflow supports the workflow progression view, the steps the system takes to prepare a listed device are displayed. Otherwise, an in-progress message is displayed.</p> <p>Because this preparation step can take some time, you can exit the workflow and return to it later while the system continues the process in the background.</p>
3	Catalyst Center displays the device configurations for the first listed device.	<p>On the Preview Configuration window, Catalyst Center displays a side-by-side comparison of the running configuration and the planned configuration for the first listed device.</p> <p>You can review the device configurations and then, when you're ready, deploy them or submit them for ITSM approval.</p>

While reviewing the configurations on the **Preview Configuration** window, you can do the following:

To...	Do this...
Preview a device's configurations.	Choose a device in the left pane.
Filter the data in the configuration preview pane.	From the View by Configuration Source drop-down list, choose an available option.
View a side-by-side comparison of the planned configuration and the running configuration, or view only the planned configuration.	<p>Click the view switcher ().</p> <p>Note Viewing YANG configurations in the side-by-side comparison view isn't supported.</p>

To...	Do this...
Highlight corresponding commands between the running and planned configurations.	<p>Click one command in one configuration to highlight the corresponding command in the other configuration.</p> <p>Note Keep the following limitations in mind:</p> <ul style="list-style-type: none"> • The system supports only side-by-side highlighting for first-level commands, not sublevel commands. • All commands must be a complete match for the system to display the side-by-side highlighting between configurations. • If you click any commands starting with <code>no</code> in one configuration, the system will ignore the <code>no</code> portion when checking for a match in the other configuration.
Search for a value in the displayed configuration.	Use the Search configuration field.
Preview the YANG configuration in a tree view for Cisco Catalyst 9800 Series Wireless Controllers.	<p>Click the Tree View () button.</p> <p>Note The View by Configuration Source drop-down list isn't available in the tree view.</p>

To...	Do this...
Generate the IOS CLI from the YANG configuration for Cisco Catalyst 9800 Series Wireless Controllers running Cisco IOS XE Release 17.13.1 or later.	

To...	Do this...
	<p>Click the Generate CLI from Yang Configuration () button.</p> <p>Note Keep the following limitations in mind:</p> <ul style="list-style-type: none"> The time taken to generate the IOS CLI varies based on the scale of your network and the type of the current operation. IOS CLI generation from YANG configuration isn't supported for Embedded Wireless Controller on Catalyst 9000 Series Switches If the Candidate Configuration feature with candidate datastore is enabled on the wireless controller, IOS CLI generation from the YANG configuration isn't supported. When you modify a configuration and generate the IOS CLI, the CLI change on the device after applying the YANG configuration is displayed in the configuration preview. You can't use the generated CLI on the wireless controller. For example, if the current device configuration already matches the YANG configuration, the generated IOS CLI in the configuration preview doesn't contain any commands. If the validation fails, the IOS CLI isn't generated from the YANG configuration in the configuration preview. The admin state for some of the objects must be changed to the shutdown state before applying the modified configuration. The admin state of the object is returned to the no shutdown state at the end of the CLI sequence for such modifications. For these configurations, the configuration preview doesn't contain the CLIs in sequence for the shutdown command. For example, for configuring the media stream, broadcast SSID, and radio in WLAN, the YANG configuration handles the shutdown and activation internally. The following is an example of the ideal

To...	Do this...
	<p>CLI sequence for this configuration:</p> <pre>wlan test4 shutdown broadcast-ssid dot11bg 11g media-stream multicast-direct no shutdown</pre> <p>However, the CLI generated from the YANG configuration may not include the shutdown command. The following is an example CLI generated from the YANG configuration:</p> <pre>wlan test4 broadcast-ssid dot11bg 11g media-stream multicast-direct no shutdown</pre> <p>Therefore, the CLI generated in the configuration preview may not work on the wireless controller when used in Virtual TeleType (VTY).</p>
Display the workflow progression view.	<p>Choose a device in the left pane, and then click Back to workflow progress in the top-right corner of the right pane. To return to the configuration preview pane, click Go to generated config.</p> <p>Note Back to workflow progress and Go to generated config are only available if the workflow supports the workflow progression view.</p>
Exit the workflow and review the device configurations later.	<p>Click Exit and Preview Later. When you're ready to continue reviewing the configurations, go to the Activities > Tasks window and open the relevant work item.</p>

After reviewing the configurations, depending on the Visibility and Control of Configuration settings, you can do the following:

To...	Do this...
Discard the work item permanently.	Click Discard and, in the Warning dialog box, click Yes . If you discard it, you can't recover it later.

To...	Do this...
Retain any generated configurations and discard all other resources.	<p>Click Discard and, in the Discard dialog box, check the Retain generated configs (if any) check box and click Accept.</p> <p>Tip If a configuration preview fails, consider retaining any generated configurations and discarding all other resources so that you or your IT administrator can inspect the issue.</p> <p>If you retain any generated configurations and discard all other resources, Exit displays instead of Exit and Preview Later because you've previewed all the configurations and discarded the nongenerated ones.</p>

To...	Do this...
Deploy the configurations or submit them for ITSM approval.	<p>Click Deploy or Submit for ITSM Approval.</p> <p>Note</p> <ul style="list-style-type: none"> If Save Intent displays instead of Deploy, the parameters that you chose during the workflow are already present on the device. To save those parameters to the database, click Save Intent. No configuration is pushed to the device because the device already has the required configuration. If there are multiple devices, you must click each device to preview its configuration. However, when you click Deploy, the configurations are pushed to all the devices even if the configurations have not been previewed on all devices. <p>In the slide-in pane, schedule the time and date of the deployment and, if you're submitting the configurations for ITSM approval, add notes for the IT administrator. Then click Submit.</p> <p>You can check the work item's approval status or the task's deployment status on the Tasks window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it is deployed at the scheduled time.</p> <p>Note</p> <p>When you preview the configurations, Catalyst Center creates a snapshot of the configuration previews. If there are any changes in the network settings or network profiles after this operation is scheduled for deployment, the changes are not included during the device provisioning.</p>

Prerequisites for Provisioning a Cisco AireOS Controller

- Make sure that you have defined the following global network settings before provisioning a Cisco Wireless Controller:
 - Network servers, such as AAA, DHCP, and DNS.

For more information, see [Configure Global Network Servers](#), on page 234.

- Device credentials, such as CLI, SNMP, HTTP, and HTTPS.

For more information, see [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).

- IP address pools.

For more information, see [Configure IP Address Pools, on page 247](#).

- Wireless settings, such as SSIDs, wireless interfaces, and wireless radio frequency profiles.



Note

When you upgrade from an earlier release:

- For WPA3-Enterprise SSIDs, Catalyst Center enables the Dot1x-SHA256 authentication key management settings for the SSIDs.
- For WPA2-WPA3-Enterprise SSIDs, Catalyst Center enables both Dot1x and Dot1x-SHA256 authentication key management settings for the SSIDs.

This configuration might change the intended configuration for the Cisco AireOS Wireless Controllers and wireless controllers running Cisco IOS XE Release 17.6 or earlier. You can update the **Auth Key Management** settings for the SSIDs before reprovisioning the wireless controllers.

For more information, see [Configure Global Wireless Settings, on page 252](#).

- Make sure that you have the wireless controller in your inventory. If not, use the **Discovery** feature to discover the controller.
- Make sure that the wireless controller is added to a site. For more information, see [Add a Device to a Site, on page 108](#).
- You cannot reuse any pre-existing VLANs on devices. Provisioning fails if Catalyst Center pushes the same VLAN that already exists on the device.
- You cannot make any configuration changes to the wireless controller that is being managed by the Catalyst Center manually. You must perform all configurations from the Catalyst Center GUI.

Provision a Cisco AireOS Controller

Before you begin

Ensure the prerequisite is met. For more information, see [Prerequisites for Provisioning a Cisco AireOS Controller, on page 477](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2 Expand the **Global** site in the left pane, and select the site, building, or floor that you are interested in.

The available devices in the selected site is displayed in the **Inventory** window.

Step 3 From the **DEVICE TYPE** list, click the **WLCs** tab, and from the **Reachability** list, click the **Reachable** tab to get the list of wireless controllers that are discovered and reachable.

Step 4 Check the check box next to the device name that you want to provision.

Step 5 From the **Actions** drop-down list, choose **Provision > Provision Device**.

The **Assign Site** window is displayed.

Step 6 Click **Choose a site** to assign a site for the wireless controller.

Step 7 In the **Add Sites** window, check the check box next to the site name to associate the wireless controller, and click **Save**.

Step 8 Click **Apply**.

Step 9 Click **Next**.

The **Configuration** window is displayed.

Step 10 Select a role for the wireless controller: **Active Main WLC** or **Guest Anchor WLC**.

Step 11 Click **Select Primary Managed AP Locations** to select the managed AP location for the wireless controller.

Step 12 In the **Managed AP Location** window, check the check box next to the site name. You can either select a parent site or the individual sites. If you select a parent site, the children under that parent site are automatically selected.

Note Inheritance of managed AP locations allows you to automatically choose a site along with the buildings and floors under that site. One wireless controller can manage only one site.

Step 13 Click **Save**.

Step 14 (Optional) Check the **AP Authorization List** check box to choose the authorization list for AP authorization, and do the following:

Note This check box is displayed only if an AP authorization list is available. For more information about AP authorization list, see [Create an AP Authorization List, on page 305](#).

- From the **AP Authorization List Name** drop-down list, choose an AP authorization list. Based on the content of the AP authorization list, Catalyst Center displays a message indicating the corresponding primary authorization type and fallback mechanism.
- (Optional) To view the entries for the selected AP authorization list, click **View Entries**.
- If the wireless controller manages both mesh and nonmesh APs, Catalyst Center displays the **Authorize Only Mesh Access Points** and **Authorize All Access Points** check boxes.

To enable authorization for only mesh APs, check the **Authorize Only Mesh Access Points** check box.

To enable authorization for all APs, check the **Authorize All Access Points** check box.

Step 15 Under **Interface and VLAN Configuration**, click **+ Add** and configure the interface and VLAN details for an active main wireless controller.

Interface and VLAN configuration is applicable for nonfabric wireless controller provisioning only.

The **Configure Interface and VLAN** window is displayed.

Step 16 From the **Interface Name** drop-down list, choose the interface name.

Note An info icon (ⓘ) is displayed next to the additional interfaces. For more information about additional interfaces, see [Configure Additional Interfaces for a Network Profile, on page 355](#).

- Step 17** In the **VLAN ID** field, enter a value for the VLAN.
- Step 18** In the **Interface IP Address** field, enter a value for the interface IP address.
- Step 19** In the **Interface Net Mask (in bits)** field, enter the subnet mask for the interface.
- Step 20** In the **Gateway IP Address** field, enter the gateway IP address.
- Step 21** From the **LAG/Port Number** drop-down list, choose the link aggregation or the port number.
- Step 22** Click **OK**.
- Step 23** (Optional) For a guest anchor wireless controller, change the VLAN ID configuration by changing the **VLAN ID** under **Assign Guest SSIDs to DMZ site**.
- Step 24** Under **Mobility Group**, click **Configure** to configure the wireless controller as the mobility peer.
- Step 25** In the **Configure Mobility Group** slide-in pane, from the **Mobility Group Name** drop-down list, you can either add a new mobility group by clicking +, or choose a mobility group from the existing mobility groups.
- Information about the existing mobility peers is loaded from the intent available in the Catalyst Center.
- Note** If you choose the default mobility group from the drop-down list, you cannot add mobility peers.
- Step 26** In the **RF Group Name** text box, enter a name for the RF group.
- Step 27** Under **Mobility Peers**, click **Add** to configure the wireless controller as a mobility peer.
- Step 28** In the **Add Mobility Peer** slide-in pane, configure the following:
- Choose one of the following types of mobility peers:
 - To include mobility peers that are managed by Catalyst Center, click **Managed WLC**.
 - To include mobility peers that are not managed by Catalyst Center, click **External WLC**.
 - If you choose **Managed WLC**, from the **Device Name** drop-down list, choose the controller.
After the device is provisioned, Catalyst Center creates a mobility group in device, assigns the RF group, and configures all ends of peers. The mobility group configuration is deployed automatically to all the selected peer devices.
 - If you choose **External WLC**, configure the following:
 - In the **Device Name** field, enter the device name.
 - (Optional) From the **Device Series** drop-down list, choose the device series.
 - In the **Public IP Address** field, enter the public IP address.
 - (Optional) In the **Private IP Address** field, enter the private IP address.
 - In the **MAC Address** field, enter the MAC address of the device.
 - In the **Mobility Group Name** field, enter the mobility group name.
 - (Optional) In the **Hash** field, enter the hash for the Cisco Catalyst 9800 Series Wireless Controller.
 - Note** This field is available only for Cisco Catalyst 9800-CL Wireless Controller.
- Step 29** Click **Configure Mobility**.
- Step 30** To reset the mobility group name and the RF group name, you can do one of the following:

- In the **Configure Mobility Group** slide-in pane, choose **default** from the **Mobility Group Name** drop-down list.
- In the **Configure Mobility Group** slide-in pane, click **Reset Mobility**.
- On the **Provision > Configuration** window, under **Mobility Group**, click **Reset**.

This automatically sets the **RF Group Name** to **default** and removes all peers. After provisioning, the mobility on the device is set and the device is removed from all other peers.

Step 31 Click **Next**.

The **Model Configuration** window is displayed.

Step 32 In the **Devices** pane, you can either search for a model config design by entering its name in the **Find** field, or expand the device and select a model configuration design.

The selected model configuration design is displayed in the right pane.

Step 33 Check the check box next to the **Design Name** that you want to provision, and click **Configure** to edit the model configuration design.

You cannot edit all the configurations at this step.

Step 34 After making the necessary changes, click **Apply**.

Step 35 Click **Next**.

The **Advanced Configuration** window is displayed, which is where you can enter the values for predefined template variables.

Step 36 Search for the device or the template in the **Devices** panel.

Step 37 Enter a value for the predefined template variable in the **wlanid** field.

Step 38 Click **Next**.

Step 39 In the **Summary** step, review the device details, and click **Next** to provision the device.

Step 40 In the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now:** Immediately deploy the configurations.

- **Later:** Schedule the date and time and define the time zone of the deployment.

- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 41 Click **Apply**.

Step 42 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 43 If you chose **Generate configuration preview** in the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Note

- When you provision, Catalyst Center pushes the configurations to the wireless controller and configures the device based on the network intent. During reprovisioning, if there are any out-of-band configurations on the device, Catalyst Center doesn't overwrite these configurations unless they are part of the intent.
- After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Step 44 Provision the secondary controller.

Step 45 The **Status** column in the **Device Inventory** window shows **SUCCESS** after a successful deployment.

After provisioning, if you want to make any changes, click **Design**, change the site profile, and provision the wireless controller again.

Step 46 After the devices are deployed successfully, the **Provision Status** changes from **Configuring** to **Success**.

Step 47 In the **Device Inventory** window, click **See Details** in the **Provision Status** column to get more information about the network intent or to view a list of actions that you need to take.

Step 48 Click **See Details** under **Device Provisioning**.

Step 49 Click **View Details** under **Deployment of network intent**, and click the device name.

- Step 50** Expand the **Configuration Summary** area to view the operation details, feature name, and the management capability. The configuration summary also displays any errors that occurred while provisioning the device.
- Step 51** Expand the **Provision Summary** area to view details of the exact configuration that is sent to the device.

Configure Cisco Wireless Controller High Availability

Cisco Wireless Controller High Availability (HA) can be configured through Catalyst Center. Currently, both the formation and breaking of wireless controller HA is supported; switchover options are not supported.

Prerequisites for Configuring Cisco Wireless Controller High Availability

- The Discovery and Inventory features of wireless controller 1 and wireless controller 2 must be successful. The devices must be in the Managed state.
- The service ports and the management ports of wireless controller 1 and wireless controller 2 must be configured.
- The redundancy ports of wireless controller 1 and wireless controller 2 must be physically connected.
- The management address of wireless controller 1 and wireless controller 2 must be in the same subnet. The redundancy management address of wireless controller 1 and wireless controller 2 must also be in the same subnet.
- Manually configure the following boot variables on the wireless controller:

```
config t  
boot system bootflash::<device_iosxe_image_filename>  
config-register 0x2102  
  
show boot. (IOSXE cli)  
  
BOOT variable = bootflash:<device_iosxe_image_filename>,12;  
Configuration register is 0x2102
```

Configure Cisco Wireless Controller HA

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**. The **Inventory** window is displayed with the discovered devices listed.
- Step 2** Check the check box next to the controller name that you want to configure as the primary controller.
- Step 3** From the **Actions** drop-down list, choose **Provision > Configure WLC HA**. The **High Availability** slide-in pane is displayed.
- Note** A warning is displayed at the top of the pane if the controller you selected hasn't been assigned to a site. Catalyst Center will not push its telemetry configuration to the controller until it's a site member.
- Step 4** Enter the **Redundancy Management IP** and the **Peer Redundancy Management IP** address in the respective text boxes.

What Happens During or After the High Availability Process is Complete

The IP addresses used for redundancy management IP and peer redundancy management IP should be configured in the same subnet as the management interface of the Cisco Wireless Controller. Ensure that these IP addresses are unused IP addresses within that subnet range.

Step 5 From the **Select Secondary WLC** drop-down list, choose the secondary controller.

Note When you choose the secondary controller, based on the wireless management interface IP subnet of the primary controller, the redundancy management IP is auto populated, and an **i** icon is displayed at the top of the **High Availability** window, along with the following message:

Ensure that the Redundancy Management IP and Peer Redundancy Management IP are not assigned to any other network entities. If the IPs are in use, change the IP accordingly and configure.

Step 6 Click **Configure HA**.

The HA configuration is initiated in the background using the CLI commands. First, the primary wireless controller is configured. On success, the secondary wireless controller is configured. After the configuration is complete, both wireless controllers reboot. This process may take up to 2.5 minutes to complete.

Step 7 To verify the HA configuration, on the **Devices > Inventory** window, click the device that you configured as an HA device.

Step 8 Click the **Wireless Info** tab.

The **Redundancy Summary** displays the **Sync Status** as **In Progress**. When Catalyst Center finds that HA pairing succeeded, the **Sync Status** changes to **Complete**.

This is triggered by the inventory poller or manual resynchronization. By now, the secondary wireless controller (wireless controller 2) is deleted from Catalyst Center. This flow indicates a successful HA configuration on the wireless controller.

What Happens During or After the High Availability Process is Complete

1. Cisco wireless controller 1 and wireless controller 2 are configured with redundancy management, redundancy units, and SSO. The wireless controllers reboot in order to negotiate their role as active or standby. Configuration is synced from active to standby.
2. On the **Show Redundancy Summary** window, you can see these configurations:
 - SSO is enabled.
 - The wireless controller is active.
 - The wireless controller is in hot standby.
3. The management port of the active wireless controller is shared by both the controllers and will be pointing to the active controller. The user interface, Telnet, and SSH on the standby wireless controller will not work. You can use the console and service port interface to control the standby wireless controller.

Commands to Configure and Verify High Availability

Catalyst Center sends the following commands to configure Cisco Wireless Controller HA.

Catalyst Center sends the following commands to wireless controller 1:

- **config interface address redundancy-management 198.51.100.xx peer-redundancy-management 198.51.100.yy**

- **config redundancy unit primary**
- **config redundancy mode sso**

Catalyst Center sends the following commands to wireless controller 2:

- **config interface address redundancy-management 198.51.100.yy peer-redundancy-management 198.51.100.xx**
- **config redundancy unit secondary**
- **config port adminmode all enable**
- **config redundancy mode sso**

Enter the following commands to verify the HA configuration from the wireless controller:

- To check HA-related details: **config redundancy mode sso**
- To check the configured interfaces: **show redundancy summary**

Disable High Availability Configured Device in the Existing Deployment

The Catalyst Center Disable HA feature is supported on Cisco Catalyst 9800 Series Wireless Controllers and Cisco AireOS Controllers.

Before you begin

Ensure that the HA device in the existing deployment is configured outside of Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Device > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2 Check the check box next to the name of the wireless controller that has the HA feature that you want to disable.

Step 3 From the **Actions** drop-down list, choose **Provision > Configure WLC HA**.

The **High Availability** slide-in pane is displayed.

High Availability slide-in pane shows the **REDUNDANCY SUMMARY** of selected wireless controller configured from outside Catalyst Center.

Step 4 In the **Warning** window, click **OK**.

A success message appears at the bottom of the screen indicating that the HA feature has been successfully disabled for the selected wireless controller.

Provision a Cisco AP—Day 1 AP Provisioning

Before you begin

- Make sure that you have Cisco APs in your inventory. If not, use the Discovery feature to discover APs. For more information, see [Discover Your Network, on page 43](#).
- If you add new AP zones or SSIDs, you must reprovision the wireless controller. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- If you update the AP zone configurations, you must reprovision the wireless controller. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- If you’re using N+1 HA and modify any nonflex SSIDs that are already provisioned on the primary and secondary controllers to flex SSIDs (or conversely), make sure that the states of WLANs are consistent across both the primary and secondary controllers on the corresponding site.

For example, *SSID1* is configured on a network profile as flex SSID, provisioned on both the primary and secondary controllers, and later modified as nonflex SSID. If you reprovision only the primary controller without reprovisioning the secondary controller, *SSID1* becomes nonflex SSID on the primary controller but remains flex SSID on the secondary controller. If you provision an AP on a site shared by both the primary and secondary controllers, the provisioning fails. To ensure consistency, you must reprovision the secondary controller. When you reprovision the secondary controller, *SSID1* changes to nonflex SSID on the secondary controller too and both controllers have the same state for *SSID1* before provisioning the AP.

- For ROW APs, we recommend that you create an AP profile with the necessary country code and configure custom site tags. For more information, see [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices, on page 315](#) and [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window displays the device information that is gathered during the discovery process.
- Note** You can either search for a site by entering its name or expand **Global** to select the site. Devices that are available in the selected site are displayed in the **Inventory** window.
To filter the devices based on various criteria, such as **Device Family** or **Reachability Status**, click **Filter**, make your selections, and then click **Apply**.
- Step 2** Check the check box next to the AP that you want to provision.
Step 3 From the **Actions** drop-down list, choose **Provision > Provision Device**.
Step 4 In the **Assign Site** step, configure the following parameters:
 - Click **Choose a floor** and assign an AP to the site.
 - In the **Choose a floor** slide-in pane, select the floor where the AP resides, and click **Save**.
 - Click **Next**.

Note Catalyst Center doesn't configure this site as the AP location during AP provision. You can configure the AP location using the **Configure Access Points** workflow. For more information, see [Configure APs, on page 851](#).

Step 5 In the **Configuration** step, configure the following parameters:

- Click **Advanced Configuration** to configure radio antenna profiles on antenna slots.

Note Advanced configuration is supported on Cisco Catalyst 9130AXE Unified Access Points with Cisco Catalyst 9800 Series Wireless Controller software release 17.6 or later. Global tri-radio mode is enabled on the wireless controller and configured during AP provisioning.

- Configure the beam selection value for AP radio slot 1 and slot 2 from the **Slot 1** and **Slot 2** drop-down list.
- Click **Save**.

- From the **AP Zone Name** drop-down list, choose an AP zone.

Note This drop-down list is enabled only when AP zones are added to the network profile for the site.

If you choose an AP zone, the RF profile is inherited from the AP zone configuration.

- From the **RF Profile** drop-down list, use the default settings or choose a different value from the list.

The default RF profile is the custom profile that you marked as default under the **Design > Network Settings > Wireless > RF Profiles > Basic RF Profile** tab.

Note This drop-down list is disabled if you choose an AP zone from the **AP Zone** drop-down list.

- In the **Mesh Role** drop-down list, choose **Root** or **Mesh**.

- Click **Next**.

Step 6 In the **Summary** step, review the device details, and click **Next** to provision the AP.

Step 7 In the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.

- Now:** Immediately deploy the configurations.
- Later:** Schedule the date and time and define the time zone of the deployment.
- Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 8 Click **Apply**.

Step 9 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations:** Wait for all pending operations to deploy or discard them.
- Device Compliance:** Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

Migrate APs from a Wireless Controller to Another Wireless Controller

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 10 If you chose **Generate configuration preview** in the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Note After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Step 11 You're prompted with a message that the creation or modification of an AP group is in progress and then a message that APs will reboot after provisioning. Click **OK**.

The **Last Sync Status** column in the **Inventory** window shows **SUCCESS** for a successful deployment.

Migrate APs from a Wireless Controller to Another Wireless Controller

Use this procedure to migrate APs from one wireless controller to another wireless controller with the same floors in the network hierarchy.

Before you begin

- Ensure that the old wireless controller (for example, *WC1*) is provisioned with the required sites (for example, *Building-1* with *Floor-1*, *Floor-2*, and *Floor-3*) as the primary-managed AP location.
- Ensure that the APs that need to be migrated are provisioned on the floors managed by the old wireless controller (for example, *Building-1/Floor-1*, *Building-1/Floor-2*, *Building-1/Floor-3* managed by *WC1*).

-
- Step 1** Add a new building and floor to the network hierarchy (for example, *Building-New* with *Floor-New*). For more information, see [Add, Edit, and Delete a Building, on page 168](#) and [Add, Edit, and Delete a Floor, on page 169](#).
- Step 2** Create a wireless network profile and assign it to the newly added floor (*Floor-New*). For more information, see [Create Network Profiles for Wireless, on page 339](#).
- Step 3** Reprovision the old wireless controller with the newly added floor (*Floor-New*) as the primary-managed AP location and remove the old sites (*Floor-1*, *Floor-2*, and *Floor-3*). For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- Step 4** Provision the new wireless controller (for example, *WC2*) with the old sites (*Floor-1*, *Floor-2*, and *Floor-3*) as the primary-managed AP locations. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- Step 5** Use the **Configure Access Points** workflow to change the primary wireless controller name and IP address. In the **Configure AP Parameters** window of this workflow, do the following:
- Check the **High Availability** check box.
 - From the **Select Primary Controller Name** drop-down list, choose the new wireless controller (*WC2*).
 - In the **Primary Controller IP Address** field, enter the IP address of the new wireless controller (IP address of *WC2*).
- For more information, see [Configure APs, on page 851](#).
- Step 6** Do the following to ensure that the APs have joined the new wireless controller (*WC2*):
- From the top-left corner, click the menu icon and choose **Provision > Inventory**.
 - Click the **Access Points** device family button at the top of the **Inventory** window.
 - Hover your cursor over the **Focus** drop-down list, and choose **Inventory**.
 - Under the **Associated WLC IP** column, check the IP address of the corresponding wireless controller for the APs.
- If this column isn't displayed, click the gear icon at the top-right corner of the window and customize the table settings to display the column. For more information, see [Display Information About Your Inventory, on page 63](#).
- Step 7** Reprovision the APs to deploy the latest configuration. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).
-

Enable ICMP Ping on APs in FlexConnect Mode

You can enable Internet Control Message Protocol (ICMP) ping on APs that are in FlexConnect mode and in an unreachable state. Catalyst Center uses the ICMP to ping FlexConnect APs that are in unreachable state every 5 minutes to enhance reachability and then updates the reachability status in the **Inventory** window.

-
- Step 1** From the top-left corner, click the menu icon and choose **System > Settings > Device Settings > ICMP Ping**.
- Step 2** Check the **Enable ICMP ping for unreachable access points in FlexConnect mode** check box to enable the ICMP ping.
- Step 3** Click **Save**.
- A success message is displayed: **ICMP Ping status updated successfully**.
- Catalyst Center starts pinging FlexConnect APs that are disassociated from Cisco Wireless Controllers but are reachable. You can view the reachability status in the **Inventory** window.

Day-Zero Workflow for Cisco AireOS Mobility Express APs

Step 4 To view the reachability status, choose **Provision > Inventory**.

Step 5 The **Reachability** column shows **Ping Reachable** when the device is reachable by the ICMP ping.

Day-Zero Workflow for Cisco AireOS Mobility Express APs

Before you begin

The Cisco Mobility Express wireless network solution comprises at least one 802.11ac Wave 2 Cisco Aironet Series access point with an in-built, software-based wireless controller managing other APs in the network. The AP acting as the wireless controller is referred to as the *primary AP*. The other APs in the Cisco Mobility Express network, which are managed by this primary AP, are referred to as *subordinate APs*.

- Design your network hierarchy with sites, buildings, floors, and so on. For more information, see [Create, Edit and Delete a Site, on page 167](#), [Add, Edit, and Delete a Building, on page 168](#), and [Add, Edit, and Delete a Floor, on page 169](#).
- Define the device credentials, such as CLI, SNMP, HTTP, and HTTPS at the global level. The credentials that are defined at the global level are inherited by the sites. For more information, see [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), and [Add Global SNMPv3 Credentials, on page 237](#).
- Create WLANs, interfaces, and RF profiles.
- Configure the DHCP server with Option #43 or Option #60. This is the IP address of the Catalyst Center Plug and Play server. Using this IP address, the APs contact the PnP server and download the configuration.
- Make sure that you have Mobility Express APs in the inventory. If not, discover them using the Discovery feature. For more information, see [Discover Your Network Using CDP, on page 53](#), [Discover Your Network Using an IP Address Range or CIDR, on page 55](#), and [About Inventory, on page 62](#).
- The APs should be in the factory reset state without any Cisco Wireless Controller configurations.

Step 1 The Cisco Mobility Express contacts the DHCP server and connects to the Catalyst Center Plug and Play server.

Step 2 The DHCP server allocates the IP address with Option #43, which is the IP address of the Catalyst Center Plug and Play server.

Step 3 The Mobility Express AP starts the PnP agent and contacts the PnP server.

Note If you have a set of Mobility Express APs in the network, they go through an internal protocol. The protocol selects one Mobility Express AP, which will be configured on the Cisco Wireless Controller as the primary AP to reach the PnP server.

Step 4 Find the unclaimed AP in the **Provision > Network Devices > Plug and Play** tab.

The table lists all the unclaimed devices. The **State** column shows as **Unclaimed**. Use the **Filter** or **Find option** to find specific devices.

You must wait for the **Onboarding Status** to become **Initialized**.

Step 5 To claim the AP, check the check box next to the AP device name.

- Step 6** Choose **Actions > Claim** in the menu bar above the device table.
The **Claim Devices** window is displayed.
- Step 7** In the **Site Assignment** window, choose a site from the **Site** drop-down list.
Claiming the selected AP to this particular site also applies the associated configurations.
- Step 8** Click **Next**.
- Step 9** To configure a device, click the device name in the **Configuration** window.
- Step 10** In the **Configuration for device name** window, assign the static IP details for the device:
- **Management IP**
 - **Subnet Mask**
 - **Gateway**
- Step 11** Click **Save**.
- Step 12** Click **Next**.
The **Summary** window is displayed.
- Step 13** Click **Claim** in the **Summary** window.
After the Mobility Express AP is claimed, the configured IP address is assigned to the Mobility Express AP.
The claimed device, which is an AP, and the wireless controller are now available under **Provision > Device Inventory > Inventory**.
- Step 14** (Optional) Add devices in bulk from a CSV file.
For more information, see [Add Devices in Bulk, on page 456](#).
When you bulk import Mobility Express APs through a CSV file, all the Mobility Express APs appear on the **Devices > Plug and Play** window. Based on the VRRP protocol, only one Mobility Express AP among the imported ME APs becomes the primary AP. The remaining APs become subordinate APs. After claiming the primary AP, you don't need to claim the subordinate APs. Catalyst Center does not clear the subordinate APs from the **Plug and Play** window. You must delete those subordinate APs manually from the **Devices > Plug and Play** window.
- Step 15** To provision the Cisco Wireless Controller, see [Provision a Cisco AireOS Controller, on page 478](#).

Provision Cisco AireOS Controllers in the Existing Deployment

Before you begin

With Catalyst Center, you can add and provision the Cisco Wireless Controller, which belongs to existing sites with pre-existing infrastructure.

- Start by running a Discovery job on the device. All your devices are displayed on the **Inventory** window. For more information, see [Discover Your Network, on page 43](#) and [About Inventory, on page 62](#).
- The wireless controller should be reachable and in the Managed state on the **Inventory** window. For more information, see [About Inventory, on page 62](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window is displayed with the discovered devices listed.
- Step 2** Click **Filter** and enter the appropriate values in the selected filter field. For example, for the **Device Name** filter, enter the name of the device.
The data that is displayed in the **Devices** table is automatically updated according to your filter selection.
- Step 3** Check the check box next to the wireless controller device name that you want to provision.
- Step 4** From the **Actions** drop-down list, choose **More > Learn Device Config**.
The **Site Assignment** window opens and the **Learn Device Configuration** workflow begins.
- Note** You can also start this workflow by doing the following:
- From the **Inventory** window, click the device's link to open a pop-up window that provides high-level information for that device.
 - Click **View Device Details** to open the device's details page.
 - Click **Learn WLC Config**.
- Step 5** Associate a site to the controller in the **Assign Site** step:
 - Click **Choose a site** to assign a site to the controller.
 - In the **Choose a site** slide-in pane, select a site to which you want to associate the wireless controller, and click **Save**.
 - Click **Next**.
- Step 6** The **Resolve Conflict** step shows any conflicting configurations in Catalyst Center that you need to resolve.
- Step 7** Click **Next**.
- Step 8** The **Design Object** window lists all the learned configurations.
 - Click **Network** in the left pane.
The right pane displays network configurations that were learned as a part of device configuration learning and shows the following information:
 - AAA Server** details.
 - Systems Settings**, with details about the IP address and protocol of the AAA server.
 - DHCP Server** details.
 - Enter the **Shared Secret** for the AAA server.
 - Click **Wireless** in the left pane.
The right pane lists the enterprise SSIDs, guest SSIDs, antenna radio profiles, and wireless interface details.
For an SSID with a preshared key (PSK), enter the **passphrase key**.
 - Click **Discarded Config** in the left pane.
The right pane lists the conflicting or the existing configurations on Catalyst Center. The discarded configuration entries are categorized as:

- Duplicate design entity
 - Unknown device configuration for Radio Policy
- d) Click **Next**.
- The **Network Profile** window lists the network profile or site profile that is created based on the AP and WLAN combination.
- e) Click **Save**.
- Step 9** Choose **Design > Network Profiles** to assign a site to the network profile.
- Step 10** In the **Network Profiles** window, configure the following:
- a) Click **Assign Site** to add sites to the selected profile.
 - b) In the **Add Sites to Profile** window, choose a site from the drop-down list, and click **Save**.
- Step 11** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- a) Click **Filter** to locate the device that you want to provision.

The data that is displayed in the **Devices** table is automatically updated according to your filter selection.

- b) Check the check box next to the controller device name that you want to provision.
- c) From the **Actions** drop-down list, choose **Provision**.
- d) Review the details in the **Assign Site** window, and click **Next**.

The **Configurations** step is displayed.

- e) Under **Interface and VLAN Configuration**, click **+Add** to configure interface and VLAN details.
- f) In the **Configure Interface and VLAN** window, configure the required fields, and click **OK**.
- g) Click **Next**.

Step 12 In the **Summary** window, review the configuration settings.

Step 13 Click **Deploy**.

Step 14 In the **Provision Devices** slide-in pane, do the following to preview the CLI configuration:

- a) Click the **Generate Configuration Preview** radio button.
- b) In the **Task Name** field, enter a name for the CLI preview task and click **Apply**.
- c) In the **Task Submitted** dialog box, click the **Work Items** link.

Note This dialog box displays for a few seconds and then disappears. To navigate to the **Tasks** window, click the menu icon and choose **Activities > Tasks**.

- d) In the **Tasks** window, click the CLI preview task for which you submitted the configuration preview request.
- e) View the CLI configuration details and click **Deploy**.
- f) To immediately deploy the device, click the **Now** radio button, and click **Apply**.
- g) To schedule the device deployment for a later date and time, click the **Later** radio button and define the date and time of the deployment.
- h) In the **Information** dialog box, do the following:
 1. Click **Yes** if you want to delete the CLI preview task from the **Tasks** window.
 2. Click **No** if you want to retain the task in the **Tasks** window.

Note The CLI task will be marked as completed in the **Tasks** window. You can view the CLI configuration for this task, but you cannot deploy it again.

Note After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Configure and Provision a Cisco Catalyst 9800 Series Wireless Controller

Cisco Catalyst 9800 Series Wireless Controller Overview

The Cisco Catalyst 9800 Series Wireless Controller is the next generation of wireless controllers built for intent-based networking. The Cisco Catalyst 9800 Series Wireless Controller is Cisco IOS XE based and integrates the RF excellence from Aironet with the intent-based networking capabilities of Cisco IOS XE to create the best-in-class wireless experience for your organization.

The Cisco Catalyst 9800 Series Wireless Controller is built on a modular operating system and uses open, programmable APIs that enable automation of day-zero and day-*n* network operations.

The Cisco Catalyst 9800 Series Wireless Controller is available in multiple form factors:

- Catalyst 9800-40 Wireless Controller.
- Catalyst 9800-80 Wireless Controller.
- Catalyst 9800-CL Cloud Wireless Controller: Deployable on private cloud (ESXi, KVM, Cisco ENCS, and Hyper-V) and manageable by Catalyst Center.
- Catalyst 9800 Embedded Wireless Controller for Catalyst 9300 Series Switches, Catalyst 9400 Series Switches, and Catalyst 9500H Series Switches.
- Cisco Catalyst 9800-L Wireless Controller: Provides seamless software updates for small- to mid-size enterprises. The Cisco Catalyst 9800-L Wireless Controller is available in two variations. You can choose between copper and fiber uplinks, which gives you flexibility in your network.

The following table lists the supported virtual and hardware platforms for the Cisco Catalyst 9800 Series Wireless Controller:

Platform	Description
Cisco Catalyst 9800-80 Wireless Controller	<p>Supports up to 6000 access points and 64,000 clients.</p> <p>Supports up to 80 Gbps throughput and occupies a 2-rack unit space.</p> <p>Modular wireless controller with up to 100-GE uplinks and seamless software updates.</p>
Cisco Catalyst 9800-40 Wireless Controller	<p>A fixed wireless controller with seamless software updates for mid-sized organizations and campus deployments.</p> <p>Supports up to 2000 access points and 32,000 clients.</p> <p>Supports up to 40 Gbps throughput and occupies a 1-rack unit space.</p> <p>Provides four 1-GE or 10-GE uplink ports.</p>

Platform	Description
Cisco Catalyst 9800-CL Cloud Wireless Controller	<p>Cisco Catalyst 9800-CL Cloud Wireless Controller can be deployed in a private cloud or a public cloud as Infrastructure as a Service (IaaS).</p> <p>Cisco Catalyst 9800-CL Cloud Wireless Controller is the next generation of enterprise-class virtual wireless controllers built for high availability and security.</p> <p>A virtual form factor of Cisco Catalyst 9800-CL Cloud Wireless Controller for private cloud supports ESXi, KVM, Cisco ENCS, and Hyper-V hypervisors.</p>
Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches	<p>Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches bring the wired and wireless infrastructure together with consistent policy and management.</p> <p>This deployment model supports only Cisco SD-Access, which is a highly secure solution for small campuses and distributed branches. The embedded controller supports access points (APs) only in Fabric mode.</p>
Cisco Catalyst 9800-L Wireless Controller	<p>Cisco Catalyst 9800-L Wireless Controller provides seamless software updates for small to mid-size enterprises. The Cisco Catalyst 9800-L Wireless Controller is available in two variations. You can choose between copper and fiber uplinks, which gives you flexibility in your network.</p> <ul style="list-style-type: none"> • Cisco Catalyst 9800-L Copper Series Wireless Controller (9800-L-C RJ45) • Cisco Catalyst 9800-L Fiber Series Wireless Controller 9800-L-F SFP)

The following table lists the host environments supported by the Cisco Catalyst 9800 Series Wireless Controller:

Host Environment	Software Version
VMware ESXi	<ul style="list-style-type: none"> • VMware ESXi vSphere 6.0 • VMware ESXi vSphere 6.5³ • VMware ESXi vCenter 6.0 • VMware ESXi VCenter 6.5
KVM	<ul style="list-style-type: none"> • Linux KVM based on Red Hat Enterprise Linux 7.1 and 7.2 • Ubuntu 14.04.5 LTS, Ubuntu 16.04.5 LTS
NFVIS	Cisco ENCS 3.8.1 and 3.9.1

³ Installing the .ova file of C9800-CL using ESXi vSphere does not work. This is not limited to the C9800 ova but affects other products. Cisco and VMware are actively working to fix the issue. Contact your Cisco account representative to see if the problem is fixed. There are issues specific to VMware 6.5 and C9800-CL OVA file deployment in which deployment fails with the warning "A required disk image was missing" and the error "Failed to deploy VM: postNFCData failed: Cannot POST to non-disk files." To install C9800-CL on VMware ESXi 6.5, do one of the following: 1) Install the .iso file of C9800-CL using the ESXi embedded GUI (ESXi 6.5 client version 1.29.0 is tested and required). 2) Install the .ova file of C9800-CL using the OVF tool.

The following table lists the Cisco Enterprise Network Function Virtualization Infrastructure Software (NFVIS) versions supported in Catalyst Center:

Configure a Cisco Catalyst 9800 Series Wireless Controller in Catalyst Center

**Note**

Cisco Enterprise NFVIS devices support the N-1 to N upgrade path only. For example, upgrade from Cisco Enterprise NFVIS 3.11.x to Cisco Enterprise NFVIS 3.12.x only is supported. Upgrade from Cisco Enterprise NFVIS 3.11.x to Cisco Enterprise NFVIS 4.1.x is not supported.

Cisco Enterprise NFVIS Version	Enterprise Network Compute System Device Platform	Notes
4.1.2	ENCS 5400	Catalyst Center supports the following NFVIS upgrade paths: NFVIS v3.11.1 > 3.11.2 > 3.11.3 > 3.12.3 > 4.1.1 > 4.1.2.
4.1.1	UCS-E	
3.12.3	UCS-C	Cisco Enterprise NFVIS 3.12.1 is not supported on any versions of Catalyst Center.
3.11.3		Upgrade to Cisco Enterprise NFVIS 3.12.1 from Cisco Enterprise NFVIS 3.11.x using Catalyst Center is not supported.
3.11.2		Upgrade to Cisco Enterprise NFVIS 3.12.2 from Cisco Enterprise NFVIS 3.12.1 using Catalyst Center is not supported.
3.11.1		Upgrade to Cisco Enterprise NFVIS 3.12.2 from 3.11.2 is supported using Catalyst Center. Cisco Enterprise NFVIS 3.12.2 is supported on Catalyst Center.
3.12.2	ENCS 5100	Cisco 5100 ENCS does not support Cisco Enterprise NFVIS 3.10.x.
3.11.3		
3.11.2		
3.11.1		

Configure a Cisco Catalyst 9800 Series Wireless Controller in Catalyst Center

1. Install Catalyst Center.
For more information, see the [Cisco Catalyst Center Installation Guide](#).
2. For information on software image upgrade, see [Software Image Upgrade Support for Cisco Catalyst 9800 Series Wireless Controller, on page 500](#).
3. Log in to the Catalyst Center GUI and verify that the applications you need are in the **Running** state.
From the top-left corner, click the menu icon and choose **System Settings > Software Updates > Installed Apps**.
4. Integrate Cisco Identity Services Engine with Catalyst Center. After integration, any devices that Catalyst Center discovers along with relevant configurations and data are pushed to Cisco ISE.
5. Discover the Cisco Catalyst 9800 Series Wireless Controller.
You must enable NETCONF and set the port to 830 to discover the Cisco Catalyst 9800 Series Wireless Controller. NETCONF provides a mechanism to install, manipulate, and delete configurations of network devices.

For more information, see [Discover Your Network Using CDP](#), on page 53 or [Discover Your Network Using an IP Address Range or CIDR](#), on page 55.

You must add the wireless management IP address manually.



Note On the Cisco Catalyst 9800 Series Wireless Controller, you must configure a static IP address for the wireless management interface to prevent provisioning failure.

While performing discovery using the Cisco Discovery Protocol (CDP) or an IP address range in the **Discovery** window, choose **Use Loopback** from the **Preferred Management IP** drop-down list to specify the device's loopback interface IP address.

6. Make sure that the discovered devices appear in the **Device Inventory** window and are in the **Managed** state.

For more information, see [About Inventory](#), on page 62 and [Display Information About Your Inventory](#), on page 63.

You must wait for the devices to move to a **Managed** state.

7. To verify the Assurance connection with the Cisco Catalyst 9800 Series Wireless Controller, use the following commands:

- **#show crypto pki trustpoints | sec DNAC-CA**

```
Trustpoint DNAC-CA
  Subject Name:
  cn=kube-ca
  Serial Number (hex): 00E*****
  Certificate configured.
```

- **#show crypto pki trustpoints | sec sdn-network**

```
Trustpoint sdn-network-infra-iwan:
  Subject Name:
  cn=sdn-network-infra-ca
  Serial Number (hex): 378*****
  Certificate configured.
```

- **#show telemetry ietf subscription all**

```
Telemetry subscription brief
```

ID	Type	State	Filter type
<hr/>			
1011	Configured	Valid	tdl-uri
1012	Configured	Valid	tdl-uri
1013	Configured	Valid	tdl-uri

- **#show telemetry internal connection**

```
Telemetry connection
```

```
Address Port Transport State Profile
```

```
-----  
IP address 25103 tls-native Active sdn-network-infra-iwan
```

- **#show network-assurance summary**

Configure a Cisco Catalyst 9800 Series Wireless Controller in Catalyst Center

Network-Assurance	:	True
Server Url	:	https://10.***.***.**
ICap Server Port Number	:	3***
Sensor Backhaul SSID	:	
Authentication	:	Unknown

8. Configure a TACACS server while configuring authentication and policy servers.

Configuring TACACS is not mandatory if you have configured the username locally on the Cisco Catalyst 9800 Series Wireless Controller.

9. Design your network hierarchy by adding sites, buildings, and floors so that later you can easily identify where to apply design settings or configurations.

You can either create a new network hierarchy, or if you have an existing network hierarchy on Cisco Prime Infrastructure, you can import it into Catalyst Center.

To import and upload an existing network hierarchy, see [Import Your Site Hierarchy to Catalyst Center, on page 161](#).

To create a new network hierarchy, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

10. Add the location information of APs, and position them on the floor map to visualize the heatmap coverage.

For more information, see [Work with APs on a Floor Map, on page 180](#).

11. Define network settings, such as AAA (Cisco ISE is configured for Network and Client Endpoint), NetFlow Collector, NTP, DHCP, DNS, syslog, and SNMP traps. These network servers become the default for your entire network. You can add a TACACS server while adding a AAA server.

For more information, see [Network Settings Overview, on page 231](#), [Configure Global Network Servers, on page 234](#), and [Add Cisco ISE or Other AAA Servers](#).

12. Create a wireless radio frequency profile with the parent profile as custom.

For more information, see [Create a Wireless Radio Frequency Profile, on page 277](#).

13. Create IP address pools at the global level.

Catalyst Center uses IP address pools to automate the configuration and deployment of SD-Access networks.

To create an IP address pool, see [Configure IP Address Pools, on page 247](#).

You must reserve an IP address pool for the building that you are provisioning. For more information, see [Provision a Network Through LAN Automation](#).

14. Create enterprise and guest wireless networks. Define the global wireless settings once; Catalyst Center then pushes the configurations to various devices across geographical locations.

Designing a wireless network is a two-step process. First, you must create SSIDs, and then associate the created SSID to a wireless network profile. This profile helps you to construct a topology, which is used to deploy devices on a site.



Note When you upgrade from an earlier release:

- For WPA3-Enterprise SSIDs, Catalyst Center enables the Dot1x-SHA256 authentication key management settings for the SSIDs.
- For WPA2-WPA3-Enterprise SSIDs, Catalyst Center enables both Dot1x and Dot1x-SHA256 authentication key management settings for the SSIDs.

This configuration might change the intended configuration for the Cisco AireOS Wireless Controllers and wireless controllers running Cisco IOS XE Release 17.6 or earlier. You can update the **Auth Key Management** settings for the SSIDs before reprovisioning the wireless controllers.

For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) and [Create SSIDs for a Guest Wireless Network, on page 264](#). For information about other wireless settings, see [Configure Global Wireless Settings, on page 252](#).

15. Configure the backhaul settings. For more information, see [Manage Backhaul Settings, on page 321](#).
16. Configure the following in the **Policy** window for the Cisco Catalyst 9800 Series Wireless Controller:
 - Create a virtual network. The virtual network segments your physical network into multiple logical networks.
 - Create a group-based access control policy and add a contract. For more information, see [Create Group-Based Access Control Policy, on page 695](#).
17. Configure high availability.

For more information, see [Configure High Availability for the Cisco Catalyst 9800 Series Wireless Controller, on page 501](#).
18. Provision the Cisco Catalyst 9800 Series Wireless Controller with the configurations added during the design phase.

For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
19. Configure and deploy application policies on the Cisco Catalyst 9800 Series Wireless Controller.

For more information, see [Create an Application Policy, on page 732](#), [Deploy an Application Policy, on page 737](#), and [Edit an Application Policy, on page 736](#).



Note You must provision Cisco Catalyst 9800 Series Wireless Controller devices before deploying an application policy.

For Cisco Catalyst 9800 Series Wireless Controller devices, two different policies with different business relevance for two different SSIDs do not work. The last deployed policy always takes precedence when you are setting up relevance.

For Cisco Catalyst 9800 Series Wireless Controller devices, changing the default business relevance for an application does not work in FlexConnect mode.

You can apply an application policy only on a nonfabric SSID.

Software Image Upgrade Support for Cisco Catalyst 9800 Series Wireless Controller

Before you begin

- Discover the Cisco Catalyst 9800 Series Wireless Controller.

Enable NETCONF and set the port to 830 to discover Cisco Catalyst 9800 Series Wireless Controller. NETCONF enables wireless services on the controller and provides a mechanism to install, manipulate, and delete the configuration of network devices.

For more information, see [Discover Your Network Using CDP, on page 53](#), or [Discover Your Network Using an IP Address Range or CIDR, on page 55](#).

- Make sure that the devices appear in the device inventory and are in the **Managed** state.

For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).

Step 1 From the top-left corner, click the menu icon and choose **Design > Image Repository**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2 Import the Cisco Catalyst 9800 Series Wireless Controller software image from your local computer or from a URL.

For more information, see [Import a Software Image, on page 409](#).

Step 3 Assign the software image to a device family.

For more information, see [Assign a Software Image to a Device Family, on page 410](#).

Step 4 You can mark a software image as Golden by clicking the star for a device family or a particular device role.

For more information, see [Specify a Golden Software Image, on page 412](#).

Step 5 Provision the software image.

From the top-left corner, click the menu icon and choose **Provision > Device > Inventory**.

Step 6 In the **Inventory** window, check the check box next to the Cisco Catalyst 9800 Series Wireless Controller whose image you want to upgrade.

Step 7 From the **Actions** drop-down list, choose **Software Image > Image Update**.

For more information, see [Provision a Software Image, on page 415](#).

Configure High Availability for the Cisco Catalyst 9800 Series Wireless Controller

Before you begin

Configuring High Availability (HA) on the Cisco Catalyst 9800 Series Wireless Controller involves the following prerequisites:

- Both the Cisco Catalyst 9800 Series Wireless Controller devices are running the same software version and have the active software image on the primary Catalyst 9800 Series Wireless Controller.
- The service port and management port of Catalyst 9800 Series Wireless Controller 1 and Catalyst 9800 Series Wireless Controller 2 are configured.
- The redundancy port of Catalyst 9800 Series Wireless Controller 1 and Catalyst 9800 Series Wireless Controller 2 are physically connected.
- Preconfigurations such as interface configurations, route addition, ssh line configurations, netconf-yang configurations are completed on the Catalyst 9800 Series Wireless Controller appliance.
- The management interface of Catalyst 9800 Series Wireless Controller 1 and Catalyst 9800 Series Wireless Controller 2 are in the same subnet.
- The discovery and inventory of Catalyst 9800 Series Wireless Controller 1 and Catalyst 9800 Series Wireless Controller 2 devices are successful from Catalyst Center.
- The devices are reachable and are in the **Managed** state.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2

To view devices available in a particular site, expand the **Global** site in the left pane, and select the site, building, or floor that you are interested in.

All the devices available in that selected site are displayed in the **Inventory** window.

Step 3

From the **Device Type** list, click the **WLCs** tab, and from the **Reachability** list, click the **Reachable** tab to get the list of wireless controllers that are discovered and reachable.

Step 4

In the **Inventory** window, click the desired Cisco Catalyst 9800 Series Wireless Controller name to configure as a primary controller.

Step 5

Click the **High Availability** tab.

The selected Catalyst 9800 Series Wireless Controller by default becomes the primary controller and the **Primary C9800** field is grayed out.

Step 6

From the **Select Primary Interface** and **Secondary Interface** drop-down lists, choose the interface that is used for HA connectivity.

The HA interface serves the following purposes:

- Enables communication between the controller pair before the IOSd boots up.
- Provides transport for IPC across the controller pair.

Configure High Availability for the Cisco Catalyst 9800 Series Wireless Controller

- Enables redundancy across control messages exchanged between the controller pair. The control messages can be HA role resolution, keepalives, notifications, HA statistics, and so on.

Step 7 From the **Select Secondary C9800** drop-down list, choose the secondary controller to create an HA pair.

Note When you choose the secondary controller, based on the wireless management interface IP subnet of the primary controller, the redundancy management IP is auto populated, and an **i** icon is displayed at the top of the **High Availability** window, along with the following message:

Ensure that the Redundancy Management IP and Peer Redundancy Management IP are not assigned to any other network entities. If the IPs are in use, change the IPs accordingly and configure.

Step 8 Enter the **Redundancy Management IP** and **Peer Redundancy Management IP** addresses in the respective fields.

Note

- The IP addresses used for the redundancy management IP and peer redundancy management IP should be configured in the same subnet as the management interface of the Cisco Catalyst 9800 Series Wireless Controller. Ensure that these IP addresses are unused IP addresses within the subnet range.
- Catalyst Center only pushes the management IP address of the Cisco Catalyst 9800 Series Wireless Controller to the Cisco ISE network access device list. Whereas the standby controller uses the redundancy management IP address to initiate AAA requests. So, you must add the redundancy management IP addresses to the AAA servers for a seamless client authentication and standby monitoring.

Step 9 In the **Netmask** field, enter the netmask address.

Step 10 Click **Configure HA**.

The HA configuration is initiated at the background using the CLI commands. First, the primary controller is configured. On success, the secondary controller is configured. Both the devices reboot once the HA is enabled. This process may take up to 2.5 minutes to complete.

Step 11 After the HA is initiated, the **Redundancy Summary** under **High Availability** tab displays the **Sync Status** as **HA Pairing is in Progress**. When Catalyst Center finds that the HA pairing is successful, the **SyncStatus** becomes **Complete**.

This is triggered by the inventory poller or manual resynchronization. By now, the secondary controller (Catalyst 9800 Series Wireless Controller 2) is deleted from Catalyst Center. This flow indicates successful HA configuration in the Catalyst 9800 Series Wireless Controller.

Step 12 To manually resynchronize the controller, on the **Provision > Inventory** window, select the controller that you want to synchronize manually.

Step 13 From the **Actions** drop-down list, choose **Resync**.

Step 14 The following is the list of actions that occur after the process is complete:

- Catalyst 9800 Series Wireless Controller 1 and Catalyst 9800 Series Wireless Controller 2 are configured with redundancy management, redundancy units, and Single sign-on (SSO). The devices reboot in order to negotiate their role as an active controller or a standby controller. The configuration is synchronized from active to standby.

Note If you've configured a AAA server or Cisco ISE server for client and endpoint authentication in Catalyst Center then in a HA setup, the CTS credentials for active and standby controllers are synchronized and hence, during a HA switchover, Catalyst Center does not update the CTS credentials for the wireless controllers on Cisco ISE.

- On the **Show Redundancy Summary** window, you can see these configurations:

- SSO is enabled.
- The Catalyst 9800 Series Wireless Controller 1 is in the active state.
- The Catalyst 9800 Series Wireless Controller 2 is in the standby state.

Information About High Availability

High Availability (HA) allows you to reduce the downtime of wireless networks that occurs because of the failover of controllers. You can configure HA on Cisco Catalyst 9800 Series Wireless Controller through Catalyst Center.

Commands to Configure High Availability on Cisco Catalyst 9800 Series Wireless Controllers

Step 1 Use the following commands to configure HA on the primary controller for Cisco Catalyst 9800 Series Wireless Controller:

- Run the **chassis ha-interface GigabitEthernet <redundancy interface num> local-ip <redundancy ip> <netmask> remote-ip <peer redundancy ip>** command to configure the HA chassis interface.

This example shows how to configure an HA chassis interface:

```
chassis ha-interface GigabitEthernet 3 local-ip 192.0.2.2 255.255.255.0  
remote-ip 192.0.2.3
```

- Run the **reload** command to reload devices for the changes to become effective.

Step 2 Use the following commands to configure HA on the secondary controller for Catalyst 9800 Series Wireless Controller:

- Run the **chassis ha-interface GigabitEthernet <redundancy interface num> local-ip <redundancy ip> <netmask> remote-ip <peer redundancy ip>** command to configure the HA chassis interface.

This example shows how to configure an HA chassis interface:

```
chassis ha-interface GigabitEthernet 2 local-ip 192.0.2.3 255.255.255.0  
remote-ip 192.0.2.2
```

Step 3 Run the **chassis clear** command to clear or delete all the HA-related parameters, such as the local IP, remote IP, HA interface, mask, timeout, and priority.

Note Reload the devices for changes to take effect by running the **reload** command.

Step 4 Use the following commands to configure HA on the primary controller for Cisco Catalyst 9800-40 Wireless Controller and Cisco Catalyst 9800-80 Wireless Controller devices:

- Run the **chassis ha-interface local-ip <redundancy ip> <netmask> remote-ip <peer redundancy ip>** command to configure the HA chassis interface.

This example shows how to configure an HA chassis interface:

```
chassis ha-interface local-ip 192.0.2.2 255.255.255.0 remote-ip 192.0.2.3
```

- Run the **reload** command to reload devices for the changes to become effective.

Commands to Verify Cisco Catalyst 9800 Series Wireless Controllers High Availability

Step 5 Use the following commands to configure HA on the secondary controller for Cisco Catalyst 9800-40 Wireless Controller and Cisco Catalyst 9800-80 Wireless Controller devices:

- Run the **chassis ha-interface local-ip <redundancy ip> <netmask> remote-ip <peer redundancy ip>** command to configure the HA chassis interface.

This example shows how to configure an HA chassis interface:

```
chassis ha-interface local-ip 192.0.2.3 255.255.255.0 remote-ip 192.0.2.2
```

Step 6 Run the **chassis clear** command to clear or delete all the HA-related parameters, such as the local IP, remote IP, HA interface, mask, timeout, and priority.

Note Reload the devices for changes to take effect by running the **reload** command.

Commands to Verify Cisco Catalyst 9800 Series Wireless Controllers High Availability

Use the following commands to verify the high availability configurations from Cisco Catalyst 9800 Series Wireless Controller:

- Run the **config redundancy mode sso** command to check the HA-related details.
- Run the **show chassis** command to view chassis configurations about the HA pair, including the MAC address, role, switch priority, and current state of each controller device in the redundant HA pair.
- Run the **show ip interface brief** command to view the actual operating redundancy mode running on the device, and not the configured mode as set by the platform.
- Run the **show redundancy states** command to view the redundancy states of the active and standby controllers.
- Run the **show redundancy summary** command to check the configured interfaces.
- Run the **show romvar** command to verify high availability configuration details.

N+1 High Availability

Overview of N+1 High Availability

Catalyst Center supports N+1 High Availability (HA) on Cisco AireOS wireless controllers and Cisco Catalyst 9800 Series Wireless Controllers.

Cisco AireOS wireless controllers have a dedicated stock-keeping unit (SKU) for their N+1 controllers. Cisco Catalyst 9800 Series Wireless Controllers don't have a dedicated SKU; the same model must be used for HA.

The N+1 HA architecture provides redundancy for controllers across geographically separated data centers with low-cost deployments.

N+1 HA allows Cisco Wireless Controllers to be used as backup controllers for multiple primary controllers. These wireless controllers are independent of each other and do not share configuration or IP addresses on any of their interfaces. When a primary wireless controller resumes operation, the APs fall back automatically from the backup wireless controller to the primary wireless controller if the AP fallback option is enabled.

Catalyst Center supports primary and secondary controller configurations for N+1 HA.

N+1 HA is configured at the AP level, not at the global level. Configurations are pushed directly to the AP.



Note The primary and secondary controllers must be of the same device type. For example, if the primary device is a Catalyst 9800 Series Wireless Controller, the secondary device must also be a Catalyst 9800 Series Wireless Controller.

APs with higher priority on the primary controller always connect first to the backup controller, even if they have to push out the lower priority APs.

The N+1 HA configuration has the following limitations:

- Auto provisioning of a secondary controller is not supported because of the VLAN ID configuration.
- You must reprovision the secondary controller manually with the latest design configuration if you made any changes to the primary controller.
- Catalyst Center does not support fault tolerance.
- Access Point Stateful Switch Over (AP SSO) functionality is not supported for N+1 HA. The AP Control and Provisioning of Wireless Access Points (CAPWAP) state machine is restarted when the primary controller fails.

Prerequisites for Configuring N+1 High Availability from Catalyst Center

- Discover primary and the secondary controller by running the Discovery feature.

For more information, see [Discover Your Network Using CDP, on page 53](#), or [Discover Your Network Using an IP Address Range or CIDR, on page 55](#).

- Make sure that the wireless controllers are reachable and in the Managed state.

For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).

- Verify the network connectivity between devices. If the primary controller goes down, the AP should be able to join the secondary controller through the N+1 configuration.

• Create two buildings to manage the primary and secondary locations for both devices. For example, create two buildings, *Building A* and *Building B*, where Building A is the primary managed location for controller-1 and also the secondary managed location for controller-2, and Building B is configured only as a primary managed location for controller-2.

For more information, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

- Add and position APs on a floor map to get a coverage heatmap visualization during the design phase.

For more information, see [Work with APs on a Floor Map, on page 180](#).

- Create two SSIDs and associate them as the backhaul SSIDs.

For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) and [Create SSIDs for a Guest Wireless Network, on page 264](#).

Configure N+1 High Availability from Catalyst Center

This procedure shows how to configure N+1 High Availability (HA) on Cisco Wireless Controller and Cisco Catalyst 9800 Series Wireless Controller.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window is displayed with the discovered devices listed.
- Step 2** Check the check box next to the desired controller to provision it as a primary controller.
- Step 3** From the **Actions** drop-down list, choose **Provision > Provision Device**.
The **Assign Site** window is displayed.
- Step 4** Click **Choose a site** to assign a primary managed AP location for the primary controller.
- Step 5** In the **Choose a site** window, select a site and click **Save**.
- Step 6** Click **Next**.
The **Configuration** window is displayed, which shows the primary AP managed location for the primary device.
- Step 7** Add or update the managed AP locations for the primary controller by clicking **Select Primary Managed AP Locations**.
- Step 8** In the **Managed AP Location** window, check the check box next to the site name, and click **Save**.
You can either select a parent site or the individual sites.
- Step 9** Configure the interface and VLAN details.
- Step 10** Under **Configure Interface and VLAN** area, configure the IP address and subnet mask details, and click **Next**.
- Step 11** In the **Advanced Configuration** window, configure values for the predefined template variables, and click **Next**.
- Step 12** In the **Summary** window, verify the managed AP locations for the primary controller and other configuration details, and click **Deploy**.
- Step 13** Click **Now** to deploy the device immediately. Click **Later** to schedule the deployment for a later time.
- Step 14** (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).
- Step 15** To provision the secondary controller, in the **Inventory** window, check the check box next to the desired controller to provision it as a secondary controller.
- Step 16** From the **Actions** drop-down list, choose **Provision > Provision Device**.
The **Assign Site** window is displayed.
- Step 17** Click **Choose a site** to assign the managed AP location for the secondary controller.
The managed AP location for the secondary controller should be same as the managed AP location of the primary controller.
- Step 18** In the **Choose a site** window, check the check box next to the site name to associate the secondary controller, and click **Save**.
- Step 19** Click **Next**.
The **Configuration** window is displayed, which shows the primary AP managed and secondary AP managed locations for the secondary device.
- Step 20** Add or update the managed AP locations for the secondary controller by clicking **Select Secondary Managed AP Locations**.

- Step 21** In the **Managed AP Location** window, check the check box next to the site name, and click **Save**. You can either select a parent site or the individual sites.
- Step 22** Configure the interface and VLAN details for the secondary controller.
- Step 23** Under the **Configure Interface and VLAN** area, configure the IP address and subnet mask details for the secondary controller, and click **Next**.
- Step 24** In the **Advanced Configuration** window, configure values for the predefined template variables, and click **Next**.
- Step 25** In the **Summary** window, verify the managed AP locations for the secondary controller and other configuration details, and click **Deploy**.
- Step 26** Click **Now** to deploy the device immediately. Click **Later** to schedule the deployment for a later time.
- Step 27** To verify the managed locations of the primary and secondary controllers, click the device name of the controllers that you provisioned on the **Provision > Network Devices > Inventory** window.
- Step 28** In the dialog box, click **View Device Details**.
- Step 29** In the device details window, click the **Managed ap locations** tab to view the primary and secondary managed location details.
- Step 30** Provision the AP for the primary controller.
- Step 31** On the **Network Devices > Inventory** window, check the check box next to the AP that you want to provision.
- Step 32** From the **Actions** drop-down list, choose **Provision > Provision Device**.
- Step 33** In the **Assign Site** window, click **Choose a Floor** to select the floor from the primary managed location.
- Step 34** Click **Next**.
The **Configuration** window is displayed.
- Step 35** By default, the custom RF profile that you marked as the default under **Design > Network Settings > Wireless > RF Profiles > Basic RF Profile** is chosen in the **RF Profile** drop-down list.
You can change the default RF profile value for an AP by selecting a value from the **RF Profile** drop-down list.
- Step 36** Click **Next**.
- Step 37** In the **Summary** window, review the configuration details.
- Step 38** Click **Deploy** to provision the primary AP.
- Step 39** You are prompted with a message that creation or modification of an AP group is in progress.
You are prompted with a message stating *After provisioning AP(s) will reboot. Do you want to continue?*
- Step 40** Click **OK**.
When deployment succeeds, the **Last Sync Status** column in the **Device Inventory** window shows **SUCCESS**.

Mobility Configuration Overview

The mobility configuration in Catalyst Center allows you to group a set of Cisco Wireless Controllers into a mobility group for a seamless roaming experience of wireless clients.

By creating a mobility group, you can enable multiple wireless controllers in a network to dynamically share information and forward traffic when inter-controller or inter-subnet roaming occurs. Mobility groups enable

you to limit roaming between different floors, buildings, or campuses in the same enterprise by assigning different mobility group names to different wireless controllers within the same wireless network.

Catalyst Center allows you to create mobility groups between various platforms, such as Cisco Catalyst 9800 Series Wireless Controller and Cisco AireOS Controllers.

The mobility configuration has the following guidelines and limitations:

- You cannot select multiple controllers for configuring mobility on the **Provision** window.
- You cannot create mobility groups with the group name as default. This resets the mobility and RF group names as default and deletes all the peers.
- You cannot configure a mobility group name on the anchor controller.
- You must reboot the wireless controller manually if there is a change to the virtual IP address when configuring mobility groups on Cisco AireOS Controllers.
- Wireless controllers with the same mobility group name are automatically grouped into a single mobility group and added as peers to each other.
- When configuring mobility groups on Cisco AireOS Controllers, if the wireless controllers do not have the IP address 192.0.2.1, Catalyst Center pushes the virtual IP address 192.0.2.1 to all the wireless controllers.
- Do not explicitly add guest anchor controllers to the mobility group. The provisioned guest anchor controllers do not appear in the drop-down list while adding peers in the mobility configuration window.
- If you provision a wireless controller as a guest anchor, ensure that it is not added to the mobility group.

Mobility Configuration Workflow

Here is the workflow that you can follow to configure mobility on Cisco Wireless Controller:

- To configure mobility, you must provision a wireless controller with the mobility group name, RF group name, and mobility peers.
- The configuration that is applied during the wireless controller provisioning is automatically replicated to all the mobility peers configured in that group.
- Resynchronize the wireless controllers to get the latest tunnel status.

Mobility Configuration Use Cases

The following use cases explain the steps to configure mobility between controllers.

Use Case 1

This use case assumes that wireless controller 1, wireless controller 2, and wireless controller 3 are newly added to Catalyst Center with the mobility group name, "Default." These wireless controllers aren't yet provisioned.

1. Provision wireless controller 1 by configuring the mobility group name, RF group name, and adding wireless controller 2 and wireless controller 3 as peers.
2. Provision wireless controller 2.

In the **Provision** window, the mobility configuration is automatically populated for wireless controller 2 with the group name and peers.

3. Provision wireless controller 3.
4. After provisioning all the wireless controllers, resynchronize the wireless controllers to receive the latest tunnel status.

Use Case 2

This use case assumes that wireless controller 1, wireless controller 2, and wireless controller 3 have already been added to Catalyst Center with different mobility group names. These wireless controllers are provisioned.

1. Provision wireless controller 1 by configuring the mobility group name, RF group name, and adding wireless controller 2 and wireless controller 3 as peers.
2. The mobility configuration is automatically replicated across other peers, such as wireless controller 2 and wireless controller 3.
 - After the successful provisioning of wireless controller 1, wireless controller 2 and wireless controller 3 are added as peers on the wireless controller 1.
 - On wireless controller 2, wireless controller 1 and wireless controller 3 are added as peers.
 - On wireless controller 3, wireless controller 1 and wireless controller 2 are added as peers.

Configure Mobility Group

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed, which lists all the discovered devices.

Step 2 Check the check box next to the Cisco Catalyst 9800 Series Wireless Controller name for which you want to configure mobility.

Step 3 From the **Actions** drop-down list, choose **Provision > Configure WLC Mobility**.

The **Configure Mobility Group** slide-in pane is displayed.

For more information, see [Mobility Configuration Overview, on page 507](#).

Step 4 From the **Mobility Group Name** drop-down list, you can either add a new mobility group by clicking +, or choose from the existing mobility groups.

Information about the existing mobility peers is loaded from the intent available in Catalyst Center.

Note If you choose the default mobility group from the drop-down list, you cannot add mobility peers.

Step 5 In the **RF Group Name** field, enter a name for the RF group.

Step 6 To enable Datagram Transport Layer Security (DTLS) data encryption, click the **Data Link Encryption** button on.

Step 7 To enable or disable Cipher configuration for mobility, use the **DTLS High Cipher Only** toggle button.

Cipher configuration is applicable for Cisco Catalyst 9800 Series Wireless Controller Release 17.5 or later. You must manually reboot the device for changes to take effect.

Configure Mobility Group

- Step 8** To manually reboot the device after making changes in the DTLS cipher configuration to take effect after provision, enable the **Restart for DTLS Ciphers to take effect** toggle button.
- Step 9** Under **Mobility Peers**, click **Add** to configure a mobility peer. You can add a maximum of 24 peer devices to a mobility group.
- Step 10** In the **Add Mobility Peer** slide-in pane, configure the following:
- Choose one of the following types of mobility peers:
 - To include mobility peers that are managed by Catalyst Center, click **Managed WLC**.
 - To include mobility peers that are not managed by Catalyst Center, click **External WLC**.
 - If you choose **Managed WLC**, from the **Device Name** drop-down list, choose the controller. After the device is provisioned, Catalyst Center creates a mobility group in the device, assigns the RF group, and configures all ends of peers. The mobility group configuration is deployed automatically to all the selected peer devices.
 - If you choose **External WLC**, configure the following:
 - In the **Device Name** field, enter the device name.
 - (Optional) From the **Device Series** drop-down list, choose the device series.
 - In the **Public IP Address** field, enter the public IP address.
 - (Optional) In the **Private IP Address** field, enter the private IP address.
 - In the **MAC Address** field, enter the MAC address of the device.
 - In the **Mobility Group Name** field, enter the mobility group name.
 - (Optional) In the **Hash** field, enter the hash for the Cisco Catalyst 9800 Series Wireless Controller.

Note This field is available only for Cisco Catalyst 9800-CL Wireless Controller.
 - Click **Save**.
- Step 11** Click **Configure Mobility**.
- Step 12** (Optional) You can reset the mobility group name and the RF group name using one of the following methods:
- In the **Configure Mobility Group** slide-in pane, choose **default** from the **Mobility Group Name** drop-down list.
 - In the **Configure Mobility Group** slide-in pane, click **Reset Mobility**.
- This step automatically sets the **RF Group Name** to **default** and removes all peers. After you provision, the mobility on the device is set and the device is removed from all other peers.
- Step 13** In the **Configure Mobility Group** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.
- Now:** Immediately deploy the configurations.
 - Later:** Schedule the date and time and define the time zone of the deployment.
 - Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 14 Click **Apply**.

Step 15 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 16 If you chose **Generate configuration preview** in the **Configure Mobility Group** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure AP Impersonation

Catalyst Center allows you to enable or disable AP Impersonation. AP Impersonation is a global setting that provides a quick and effective means to detect and report phishing incidents. AP Impersonation is supported for Catalyst 9800 Controllers.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click **Wireless > Security Settings**.

Step 3 In the left hierarchy tree, **Global** is selected by default. Expand the Global site and select the desired site, building, or floor.

Note The sites, buildings, and floors inherit the settings from the global level.

Step 4 Click the **AP Impersonation** tab.

Step 5 Check the **Enable AP Impersonation** check box to enable the AP impersonation.

Step 6 Select the type: **Auth IE** or **Infra MFP**.

Note **Infra MFP** type is selected by default.

Step 7 Click **Save**.

Step 8 (Optional) To disable the AP impersonation, uncheck the **Enable AP Impersonation** check box.

About DTLS Ciphersuites

Ciphersuites are a set of encryption and integrity algorithms designed to protect radio communication on your wireless LAN.

You can configure multiple DTLS (Data Datagram Transport Layer Security) Ciphersuites on Cisco Catalyst 9800 Series Wireless Controller, Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches, and Cisco Embedded Wireless Controller on Catalyst Access Points platforms running Release 17.5 or later.

Configure Multiple DTLS Ciphersuites

You can configure DTLS Ciphersuites either at the global level or site level.

Before you begin

- Make sure that the Device Controllability feature is enabled on the **System > Settings > Device Settings > Device Controllability** window.
- Discover Cisco Catalyst 9800 Series Wireless Controllers in your network using the **Discovery** functionality so that the discovered devices are listed in the **Inventory** window.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings > Wireless**.

Step 2 From the left hierarchy tree, choose **Global** to configure all sites with the same DTLS Ciphersuite configuration.

From the left hierarchy tree, choose a site to configure DTLS Ciphersuites at the site level. The DTLS Ciphersuite configuration will be pushed to the controller available on that particular site.

Step 3 Click **Security Settings**.

Step 4 Click the **Configure DTLS Ciphersuites** tab.

Step 5 Uncheck the **Skip DTLS Ciphersuite Config** check box to configure Ciphersuites as part of Device Controllability.

Step 6 Configure either default Ciphersuites or custom Ciphersuites.

By default, the **Default** Ciphersuite is selected.

The Default Ciphersuite box shows the list of default Ciphersuites and these Ciphersuites are configured as default on the device. You cannot change the priority of these default ciphersuites.

Step 7 To configure custom Ciphersuites, click the **Custom** button.

Custom Ciphersuite overrides the default Ciphersuites with priority.

Step 8 From the **Version** drop-down list, choose the DTLS version.

Based on the DTLS version, Catalyst Center shows the available Ciphersuites.

Step 9 Click the blue toggle button next to the Ciphersuite if you do not want to apply any of the Ciphersuites.

Step 10 To change the priority of Ciphersuites, drag each Ciphersuite.

Step 11 Click **Save**.

The message **DTLS Ciphersuite Config Saved successfully** is displayed.

Step 12 To apply the Ciphersuite configuration, you must provision the device.

For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).

About N+1 Rolling AP Upgrade

The Rolling AP Upgrade feature is supported on the Cisco Catalyst 9800 Series Wireless Controller in an N+1 High Availability setup. This feature helps you upgrade software images on the APs associated with the Cisco Catalyst 9800 Series Wireless Controller in your wireless LAN network. To achieve the zero downtime, it is possible to upgrade APs in a staggered way using the N+1 Rolling AP Upgrade feature.

The primary controller identifies the candidate APs through the radio resource management neighbor AP map. The upgrade process starts with the software image downloading to the primary controller while the image is predownloaded to the candidate APs. After the candidate APs have been upgraded and rebooted, they join the secondary controller in a staggered manner. After all the APs have joined the secondary controller, the primary controller reboots. The APs rejoin the primary controller in a staggered manner after it is rebooted.

Here are the prerequisites for configuring the Rolling AP Upgrade feature:

- An N+1 High Availability setup with two wireless controllers, one as the primary controller and the other one as the secondary.
- The primary and the N+1 controllers have the same configuration and manage the same location in the network.
- The N+1 controller is already running the Golden image so that Rolling AP Upgrade works with zero downtime.

Workflow to Configure a Rolling AP Upgrade

Golden images are standardized images for network devices and Catalyst Center automatically downloads the images from Cisco.com. Image standardization helps in device security and optimal device performance.

- The N+1 controller is reachable and in **Managed** state in Catalyst Center.
- Both the controllers are part of the same mobility group, and a mobility tunnel is established between the primary and N+1 controller. The upgrade information between the primary and N+1 controllers are exchanged through the mobility tunnel.


Note

If you have a cyclic N+1 HA deployment, where *wireless controller 1* is N+1 for *wireless controller 2* and *wireless controller 2* is N+1 for *wireless controller 1*, you cannot perform a rolling AP upgrade on both devices. Instead, one controller must go through a normal upgrade. You can perform a rolling AP upgrade on the other controller after the first controller is upgraded without the rolling AP upgrade.

Workflow to Configure a Rolling AP Upgrade

This procedure shows how to configure a Rolling AP Upgrade on Cisco Catalyst 9800 Series Wireless Controllers.


Note

N+1 Rolling AP Upgrade is supported on fabric and nonfabric deployments.

Step 1

Install Catalyst Center.

For more information, see the [Cisco Catalyst Center Installation Guide](#).

Step 2

Log in to the Catalyst Center GUI and verify that the applications you need are in the **Running** state.

From the top-left corner, click the menu icon and choose **System > Software Updates > Installed Apps**.

Step 3

Discover the wireless controller using the Discovery feature.

You must enable NETCONF and set the port to 830 to discover the Catalyst 9800 Series Wireless Controller. NETCONF provides a mechanism to install, manipulate, and delete the configurations on network devices.

For more information, see [Discover Your Network Using CDP](#), on page 53 or [Discover Your Network Using an IP Address Range or CIDR](#), on page 55.

Step 4

Make sure that the discovered devices appear in the **Device Inventory** window and are in the **Managed** state.

For more information, see [About Inventory](#), on page 62 and [Display Information About Your Inventory](#), on page 63.

You must wait for devices to move to a **Managed** state.

Step 5

Design your network hierarchy by adding sites, buildings, and floors so that later you can easily identify where to apply design settings or configurations.

You can either create a new network hierarchy, or if you have an existing network hierarchy on Cisco Prime Infrastructure, you can import it into Catalyst Center.

To import and upload an existing network hierarchy, see [Import Your Site Hierarchy to Catalyst Center](#), on page 161.

To create a new network hierarchy, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

- Step 6** Add the location information of APs, and position them on the floor map to visualize the heatmap coverage.
For more information, see [Work with APs on a Floor Map, on page 180](#).
- Step 7** Provision the primary controller with the primary managed AP location, Rolling AP Upgrade enabled, and mobility group configured with the secondary controller as its peer.
To do this, choose **Provision > Network Devices > Inventory**, and check the check box next to the primary controller name.
- Step 8** Configure the N+1 controller as the mobility peer in the Mobility Group configuration.
For more information, see [Mobility Configuration Overview, on page 507](#).
- Step 9** Provision the N+1 HA controller by configuring the primary controller's primary managed AP location as the N+1 controller's secondary managed AP location. This configures the secondary controller as the N+1 controller.
For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- Step 10** Provision the APs that are associated with the primary controller.
- Step 11** Import the software images to the repository.
For more information, see [Import a Software Image, on page 409](#).
- Step 12** Assign the software image to a device family.
For more information, see [Assign a Software Image to a Device Family, on page 410](#).
- Step 13** Mark the software image as Golden by clicking the star for a device family or a device role.
For more information, see [Specify a Golden Software Image, on page 412](#).
- Step 14** Before upgrading the image, make sure that the image readiness checks are successful for both devices.
Also make sure that the status of the **N+1 Device Check** and the **Mobility Tunnel Check** has a green tick mark.
 - To do the image update readiness check, choose **Provision > Network Devices > Software Images**.
 - From the **Focus** drop-down list, choose **Software Images**. Select the device whose image you want to upgrade.
 - If the prechecks are successful for a device, the **Status** link in the **Image Precheck Status** column has a green tick mark. If any of the upgrade readiness prechecks fail for a device, the **Image Precheck Status** link has a red mark, and you cannot update the OS image for that device. Click the **Status** link and correct any errors before proceeding.
- Step 15** Initiate the upgrade on primary controller.
- Step 16** On the **Software Images** window, check the check box next to the primary controller.
- Step 17** From the **Actions** drop-down list, choose **Software Image > Update Image**.
For more information, see [Provision a Software Image, on page 415](#).
- Step 18** To monitor the progress of the image upgrade, click **In Progress** in the **Software Image** column.
The **Device Status** window displays the following information:

- **Distribution Operation:** Provides information about the image distribution process. The image gets copied from Catalyst Center to the primary device. The activate operation starts after the distribution process is complete.
 - **Activate Operation:** Provides the activate operation details. The Rolling AP Upgrade starts during this process.
 - **Rolling AP Upgrade Operation:** Provides a summary of the Rolling AP Upgrade, such as whether the Rolling AP Upgrade task is complete, the number of APs pending, the number of rebooting APs, and the number of APs that have joined the N+1 controller.
- Click **View AP Status** to view details about the primary controller, N+1 controller, device names, current status, and iterations.

Provision a Cisco Catalyst 9800 Series Wireless Controller

Before you begin

Ensure that you have completed the steps in [Configure a Cisco Catalyst 9800 Series Wireless Controller in Catalyst Center, on page 496](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window is displayed, which lists all the discovered devices.
- Step 2** In the **Devices** table, check the check box next to the Catalyst 9800 Series Wireless Controller name that you want to provision.
- Step 3** From the **Actions** drop-down list, choose **Provision > Provision Device**.
- Step 4** In the **Assign Site** window, click **Choose a Site** to associate with a site.
- Step 5** In the **Choose a site** slide-in pane, check the check box next to the site name to associate a Catalyst 9800 Series Wireless Controller, and click **Save**.
You can choose either a parent site or individual sites. If you select a parent site, all the children under the parent site are also selected. You can uncheck the check box to deselect an individual site.
- Step 6** Click **Next**.
- Step 7** In the **Configuration** window, choose a role for the Cisco Catalyst 9800 Series Wireless Controller: **Active Main WLC** or **Anchor**.
- Step 8** Click **Select Primary Managed AP Locations** to choose the managed AP location for the primary controller.
- Step 9** Click **Select Secondary Managed AP Locations** to choose the managed AP location for the secondary controller.
- Step 10** You can choose either a parent site or individual sites, and click **Save**.
If you choose a parent site, all the children under the parent site are also chosen. You can uncheck the check box to deselect a particular site.
- Note** The inheritance of managed AP locations allows you to automatically choose a site along with the buildings and floors under that particular site. One site is managed by only one wireless controller.
- Step 11** (Optional) Check the **AP Authorization List** check box to choose the authorization list for AP authorization, and do the following:

Note This check box is displayed only if an AP authorization list is available. For more information about AP authorization list, see [Create an AP Authorization List, on page 305](#).

- From the **AP Authorization List Name** drop-down list, choose an AP authorization list. Based on the content of the AP authorization list, Catalyst Center displays a message indicating the corresponding primary authorization type and fallback mechanism.
- (Optional) To view the entries for the selected AP authorization list, click **View Entries**.
- If the wireless controller manages both mesh and nonmesh APs, Catalyst Center displays the **Authorize Only Mesh Access Points** and **Authorize All Access Points** check boxes.

To enable authorization for only mesh APs, check the **Authorize Only Mesh Access Points** check box.

To enable authorization for all APs, check the **Authorize All Access Points** check box.

Step 12 For an active main wireless controller, you need to configure the interface and VLAN details.

Step 13 In the **Assign Interface** area, do the following:

- **VLAN ID**: Enter the VLAN ID.
- **Interface IP Address**: Enter the interface IP address.
- **Gateway IP Address**: Enter the gateway IP address.
- **Subnet Mask (in bits)**: Enter the subnet mask details for the interface.

Note An info icon (ⓘ) is displayed next to the additional interfaces. For more information about additional interfaces, see [Configure Additional Interfaces for a Network Profile, on page 355](#).

- Assigning an IP address, gateway IP address, and subnet mask is not required for the Cisco Catalyst 9800 Series Wireless Controller.
- For the FlexConnect SSIDs, VLANs are not automatically created on the Cisco Catalyst 9800 Series Wireless Controllers during provisioning. The interface and VLANs mapped to the wireless network profile are created on the Flex profile during AP provisioning.

Step 14 (Optional) Check the **Skip AP Provision** check box to skip configuring the AP related commands while provisioning the Cisco Catalyst 9800 Series Wireless Controller.

For more information, see [Skip AP Provision During Wireless Controller Provisioning, on page 890](#).

Step 15 Click **Next**.

Step 16 In the **Devices** pane of the **Model Configuration** window, you can either search for a model configuration design by entering its name in the **Find** field, or expand the device and select a model configuration design.

The selected model configuration design is displayed in the right pane.

Step 17 Check the check box next to the **Design Name** that you want to provision, and click **Configure** to edit the model configuration design.

You cannot edit all the configurations at this step.

Step 18 After making the necessary changes, click **Apply**.

Step 19 Click **Next**.

- Step 20** In the **Devices** pane of the **Advanced Configuration** window, search for the device or template.
- Step 21** In the **wlanid** field, enter a value for the predefined template variable, and click **Next**.
- Step 22** In the **Summary** window, review the configuration settings, and click **Next**.
- Step 23** In the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Step 24** Click **Apply**.

- Step 25** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
- If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

- Step 26** (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

- Step 27** If you chose **Generate configuration preview** in the **Provision Device** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Note When you provision, Catalyst Center pushes the configurations to the wireless controller and configures the device based on the network intent. During reprovisioning, if there are any out-of-band configurations on the device, Catalyst Center doesn't overwrite these configurations unless they are part of the intent.

Step 28 To verify the configurations that are pushed from Catalyst Center to the device, use the following commands on the Cisco Catalyst 9800 Series Wireless Controller:

- **#show wlan summary**
- **#show run | sec line**
- **#show running-configuration**

Step 29 After the devices are deployed successfully, the **Provision Status** changes from **Configuring** to **Success**.

Step 30 In the **Inventory** window, from the **Focus** drop-down list, choose **Provision**.

Step 31 Under the **Provisioning Status** column, click a device's **See Details** link to view information about network intent or a list of actions.

Step 32 In the device slide-in pane, click **See Details** under **Device Provisioning**.

Step 33 Click **View Details** under **Deployment of network intent**, and click the device name.

Step 34 Click and expand the device name.

Step 35 Expand the **Configuration Summary** area to view the operation details, feature name, and management capability.

The configuration summary also displays any error (with failure reasons) that occurred while provisioning the device.

Step 36 Expand the **Provision Summary** area to view details of the configuration that is sent to the device.

Step 37 Provision the AP.

Configure Cisco Wireless Controllers on the Existing Infrastructure

With Catalyst Center, you can add and provision devices such as Cisco Wireless Controllers and Cisco Catalyst 9800 Series Wireless Controllers in the existing deployment.

Before you begin

- Start by running a Discovery job on the device. All your devices are displayed on the **Inventory** window. For more information, see [Discover Your Network, on page 43](#) and [About Inventory, on page 62](#).
- The wireless controller should be reachable and in Managed state on the **Inventory** window. For more information, see [About Inventory, on page 62](#).
- To discover Cisco Catalyst 9800 Series Wireless Controller, you must enable NETCONF and set the port to 830. For more information, see [Discovery Overview, on page 43](#).

Configure Cisco Wireless Controllers on the Existing Infrastructure

- Design your network hierarchy by adding sites, buildings, and floors so that later you can easily identify where to apply design settings or configurations. You can either create a new network hierarchy or, if you have an existing network hierarchy on Cisco Prime Infrastructure, import it into Catalyst Center.

For more information about importing and uploading an existing network hierarchy, see [Import Your Site Hierarchy to Catalyst Center, on page 161](#).

For more information about creating a new network hierarchy, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2 Click **Filter** and enter the appropriate values in the selected filter field. For example, for the **Device Name** filter, enter the name of the device.

The data that is displayed in the **Devices** table is automatically updated according to your filter selection.

Step 3 Check the check box next to the wireless controller device name that you want to provision.

Step 4 From the **Actions** drop-down list, choose **More > Learn Device Config**.

The **Site Assignment** window opens and the **Learn Device Configuration** workflow begins.

Note You can also start this workflow by doing the following:

- From the **Inventory** window, click the device's link to open a pop-up window that provides high-level information for that device.
- Click **View Device Details** to open the device's details page.
- Click **Learn WLC Config**.

Step 5 Follow Step 3 through Step 13 in [Learn Device Configurations from Devices with Pre-Existing Infrastructure, on page 864](#).

Step 6 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

Step 7 Click **Filter** to locate the device that you want to provision.

The data that is displayed in the **Devices** table is automatically updated according to your filter selection.

Step 8 Check the check box next to the wireless controller that you want to provision.

Step 9 From the **Actions** drop-down list, choose **Provision > Provision Device**.

Step 10 Review the details in the **Assign Site** step, and click **Next**.

Step 11 In the **Configuration** step, configure the following:

- Under **Interface and VLAN Configuration**, click **+Add** to configure interface and VLAN details.
- In the **Configure Interface and VLAN** window, configure the required fields, and click **OK**.
- Click **Next**.

Step 12 In the **Model Configuration** step, configure the following.

- In the **Devices** pane, you can either search for a model config design by entering its name in the **Find** field, or expand the device and select a model config design. The selected model config design is displayed in the right pane.

- Check the check box next to the **Design Name** that you want to provision, and click **Configure** to edit the model config design. You cannot edit all the configurations at this step.
- After making the necessary changes, click **Apply**.
- Click **Next**.

Step 13 In the **Advanced Configuration** window, you can enter values for the predefined template variables.

- Search for the device or the template in the Devices panel.
- Enter a value for the predefined template variable in the **wlanid** field, and click **Next**.

Step 14 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 15 To proceed, click **Deploy**.

Step 16 In the **Schedule** window, click **Now** or **Later** to indicate when you want to start the configuration, and click **Apply**.

Step 17 (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Step 18 Provision the AP. For information, see [Provision a Cisco AP—Day 1 AP Provisioning](#), on page 486.

Day-Zero Workflow for Cisco Embedded Wireless Controller on Catalyst Access Points

The Cisco Embedded Wireless Controller on Catalyst Access Points (EWC-APs) is the next-generation Wi-Fi solution, which combines the Cisco Catalyst 9800 Series Wireless Controller with Cisco Catalyst 9100 Series Access Points, creating the best-in-class wireless experience for the evolving and growing organization.

Before you begin

- Design your network hierarchy with sites, buildings, floors, and so on.

For more information, see [Create, Edit and Delete a Site](#), on page 167 and [Add, Edit, and Delete a Building](#), on page 168.

- Define the device credentials, such as CLI, SNMP, HTTP, and HTTPS at the global level. The credentials that are defined at the global level are inherited by the sites.

For more information, see [Add Global CLI Credentials](#), on page 236, [Add Global SNMPv2c Credentials](#), on page 236, and [Add Global SNMPv3 Credentials](#), on page 237.

- Create wireless SSIDs, wireless interfaces, and wireless Radio Frequency profiles.

For more information, see [Create SSIDs for an Enterprise Wireless Network](#), on page 253, [Create SSIDs for a Guest Wireless Network](#), on page 264, [Create a Wireless Interface](#), on page 276, and [Create a Wireless Radio Frequency Profile](#), on page 277.



Note For Cisco Embedded Wireless Controller on Catalyst Access Points, only Flex-based SSID creation is supported.

- Configure the DHCP server with Option #43 on the switch where the Cisco Embedded Wireless Controller on Catalyst Access Points is connected. This is IP address of the Catalyst Center Plug and Play server. Using this IP address, the APs contact the PnP server and download the configuration.
- Make sure that you have the Cisco Embedded Wireless Controller on Catalyst Access Points in the inventory. If not, discover them using the Discovery feature. For more information, see [Discover Your Network Using CDP, on page 53](#), [Discover Your Network Using an IP Address Range or CIDR, on page 55](#), and [About Inventory, on page 62](#).
- The APs should be in the factory reset state without any Cisco Wireless Controller configurations.

The Cisco Embedded Wireless Controller on Catalyst Access Points is available in multiple form factors:

- Cisco Embedded Wireless Controller on Catalyst 9115AX Access Points
- Cisco Embedded Wireless Controller on Catalyst 9117AX Access Points
- Cisco Embedded Wireless Controller on Catalyst 9120AX Access Points
- Cisco Embedded Wireless Controller on Catalyst 9130AX Access Points

Step 1

The Cisco Embedded Wireless Controller on Catalyst Access Points contacts the DHCP server.

In response, the DHCP server provides the IP address along with Option #43, which contains the IP address of the Cisco Plug and Play server.

Step 2

Based on Option #43, the Cisco Embedded Wireless Controller on Catalyst Access Points turns on the Plug and Play agent and contacts the Catalyst Center Plug and Play server.

Note If you have a set of Cisco Embedded Wireless Controller on Catalyst Access Points in the network, they go through an internal protocol. The protocol selects one Cisco Embedded Wireless Controller on Catalyst Access Points, which is configured on the Cisco Wireless Controller as the primary AP to reach the PnP server.

Step 3

Find the unclaimed Cisco Embedded Wireless Controller on Catalyst Access Points in the **Provision > Network Devices > Plug and Play** tab.

The table lists all the unclaimed devices. The **State** column shows as **Unclaimed**. Use the **Filter** or **Find option** to find specific devices.

You must wait for the onboarding status to become **Initialized** under the **Onboarding State** column.

Step 4

To claim the Cisco Embedded Wireless Controller on Catalyst Access Points, check the check box next to the AP device name.

Step 5

Choose **Actions > Claim** in the menu bar above the device table.

The **Claim Devices** window is displayed.

Step 6

In the **Site Assignment** window, choose a site from the **Site** drop-down list.

Claiming the selected AP to this particular site also applies the associated configurations.

Step 7

Click **Next**.

To configure a device, click the device name in the **Configuration** window.

Step 8

In the **Configuration for device name** window, assign the static IP details for the device.

Step 10 Click Save.

Step 11 Click Next.

The **Summary** window is displayed.

Step 12 Click **Claim** in the **Summary** window.

After the Cisco Embedded Wireless Controller on Catalyst Access Points is claimed, the IP address configured is assigned to the Cisco Embedded Wireless Controller.

The claimed device, which is a Cisco Embedded Wireless Controller with an internal AP, is now available under **Provision > Network Devices > Inventory**.

Step 13 To provision the additional controller, see [Provision a Cisco AireOS Controller, on page 478](#).

Step 14 To bulk import devices from a CSV file, see [Add Devices in Bulk, on page 456](#).

Step 15 To add devices manually, see [Add or Edit a Device](#).

Migrate Cisco AireOS Controller to Cisco Catalyst 9800 Series Wireless Controller Using Catalyst Center

Before you begin

- Design your network hierarchy by adding sites, buildings, and floors.
- Discover the Cisco Catalyst 9800 Series Wireless Controller by running the Discovery feature and add it to the Inventory. Make sure that the device status is reachable and in the Managed state.
You must enable NETCONF and set the port to 830 to discover the Catalyst 9800 Series Wireless Controller. NETCONF provides a mechanism to install, manipulate, and delete the configurations of network devices.
- Discover the Cisco AireOS Controllers and add it to the Inventory. Make sure that the device status is reachable and in the Managed state.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed, which lists the discovered devices.

Step 2 Check the check box next to the Cisco AireOS Controller.

Step 3 From the **Actions** drop-down list, choose **Provision > Assign Device to Site**.

Step 4 In the **Assign Device to Site** window, click **Choose a Site**.

Step 5 In the **Add Sites** window, check the check box next to the site name to associate a Cisco AireOS Controller.

Step 6 Click **Save**.

Step 7 From the **Actions** drop-down list, choose **More > Learn Device Config**.

The **Site Assignment** window opens and the **Learn Device Configuration** workflow begins.

- Note** You can also start this workflow by doing the following:
- From the **Inventory** window, click the device's link to open a dialog box that provides high-level information for that device.
 - Click **View Device Details** to open the device's details window.
 - Click **Learn WLC Config**.
- Step 8** In the **Assign Site** window, click **Next**.
- Step 9** The **Resolve Conflict** window shows any conflicting configurations in Catalyst Center that you need to resolve. Click **Next**.
- Step 10** In the **Design Object** window, click **Next**.
- Step 11** In the left pane, click **Network**.
The right pane displays network configurations that were learned as part of the device configuration learning process, and shows the following information:
 - AAA server details.
 - Systems settings, with details about the IP address and protocol of the AAA server. Enter the shared secret for the AAA server because the passwords are encrypted and Catalyst Center cannot learn passwords.
 - DHCP server, with details about all the DHCP servers available in the device.
 - NTP server, with details about all the NTP servers available in the device.
- Step 12** Click **Next**.
- Step 13** In the left pane, click **Wireless**.
The **Wireless** window displays the enterprise SSIDs, guest SSIDs, wireless interfaces, and RF profiles that are present on the device.
- Step 14** For an SSID with a preshared key (PSK), enter the passphrase key.
- Step 15** In the left pane, click **Discarded Config**.
This displays the conflicting and the existing configurations on Catalyst Center. The discarded configuration entries are available under the following categories:
 - Duplicate design entity
 - Unknown device configuration for radio policy
- Step 16** Click **Next**.
- Step 17** The **Network Profile** window lists the network profile or site profile that is created based on the AP and WLAN combination.
- Step 18** Click **Save**.
A success message is displayed.
- Step 19** Choose **Design > Network Settings > Wireless** to view the SSID and interface configurations that Catalyst Center has learned from the Cisco AireOS Controller.
- Step 20** Choose **Design > Network Profiles** to assign a site to the network profile.
- Step 21** In the **Network Profiles** window, click **Assign Site** to add sites to the selected profile.

- Step 22** In the **Add Sites to Profile** window, choose a site from the drop-down list, and click **Save**.
- Step 23** Click the **Provision** tab.
- Step 24** Check the check box next to the Cisco Catalyst 9800 Series Wireless Controller that you want to provision.
- Step 25** From the **Actions** drop-down list, choose **Provision**.
- Step 26** Click **Choose a site** to assign a site for the Cisco Catalyst 9800 Series Wireless Controller.
- Step 27** In the **Choose a site** window, check the check box next to the site name to associate a Catalyst 9800 Series Wireless Controller.
- Step 28** Click **Next**.
- The **Configuration** window is displayed.
- Step 29** Select a role for the Cisco Catalyst 9800 Series Wireless Controller as **Active Main WLC**.
- Step 30** Click **Select Primary Managed AP Locations** to configure a managed AP location for the primary controller.
- Step 31** In the **Managed AP Location** window, check the check box next to the site name. You can either select a parent site or the individual sites. If you select a parent site, the children under that parent site are automatically selected.
- Step 32** Click **Save**.
- Step 33** Click **Next**.
- Step 34** The **Summary** window shows the configurations that will be pushed to the Cisco Catalyst 9800 Series Wireless Controller from the Cisco AireOS Controller.
- Step 35** Click **Deploy** to provision the Cisco Catalyst 9800 Series Wireless Controller.
- Step 36** Click **Now** to deploy the device immediately. Click **Later** to schedule deployment for a later time and click **Apply**.
- Step 37** After the devices are deployed successfully, the **Provision Status** changes from **Configuring** to **Success**.
- Step 38** In the **Device Inventory** window, click **See Details** in the **Provision Status** column to get more information about the network intent or to view a list of actions that you need to take.
- Step 39** To manually resynchronize the Cisco Catalyst 9800 Series Wireless Controller, on the **Provision > Inventory** window, select the controller that you want to manually synchronize.
- Step 40** From the **Actions** drop-down list, choose **Resync**.
- Step 41** Provision the AP.

Configure and Provision a Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches

Supported Hardware Platforms

Device Role	Platforms
Embedded Wireless Controller	Cisco Catalyst 9300 Series Switches Cisco Catalyst 9400 Series Switches Cisco Catalyst 9500H Series Switches
Fabric Edge	Cisco Catalyst 9300 Series Switches

Device Role	Platforms
	Cisco Catalyst 9400 Series Switches Cisco Catalyst 9500H Series Switches Cisco Catalyst 3600 Series Switches Cisco Catalyst 3850 Series Switches
APs	Cisco 802.11ac Wave 2 APs: <ul style="list-style-type: none"> • Cisco Aironet 1810 Series OfficeExtend Access Points • Cisco Aironet 1810W Series Access Points • Cisco Aironet 1815i Access Point • Cisco Aironet 1815w Access Point • Cisco Aironet 1815m Access Point • Cisco 1830 Aironet Series Access Points • Cisco Aironet 1850 Series Access Points • Cisco Aironet 2800 Series Access Points • Cisco Aironet 3800 Series Access Points • Cisco Aironet 4800 Series Access Points Cisco 802.11ac Wave 1 APs <ul style="list-style-type: none"> • Cisco Aironet 1700 Series Access Points • Cisco Aironet 2700 Series Access Points • Cisco Aironet 3700 Series Access Points Cisco Catalyst 9105 Series Wi-Fi 6 Access Points Cisco Catalyst 9115 Series Wi-Fi 6 Access Points Cisco Catalyst 9117 Series Wi-Fi 6 Access Points Cisco Catalyst 9120 Series Wi-Fi 6 Access Points Cisco Catalyst 9124 Series Wi-Fi 6 Access Points Cisco Catalyst 9130 Series Wi-Fi 6 Access Points Cisco Catalyst 9136 Series Wi-Fi 6 Access Points

Preconfiguration

On Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9300 Series Switches, make sure that the following commands are present if the switch is already configured with **aaa new-model**:

```
aaa new-model
aaa authentication login default local
```

```
aaa authorization exec default local  
aaa session-id common
```

This is required for NETCONF configuration. These configurations are not required if you are using automated underlay for provisioning.

Configure Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Switches

1. Install Catalyst Center.

For more information, see the [Cisco Catalyst Center Installation Guide](#).

2. Log in to the Catalyst Center GUI and verify that the applications you need are in the **Running** state.

From the top-left corner, click the menu icon and choose **System > Software Updates > Installed Apps**.

3. Integrate Cisco Identity Services Engine with Catalyst Center. After Cisco ISE is registered with Catalyst Center, any device that Catalyst Center discovers, along with relevant configurations and other data, is pushed to Cisco ISE.

4. Discover Cisco Catalyst 9000 Series Switches and the edge switches.

You must enable NETCONF and set the port to 830 to discover Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches.

Do not enable NETCONF to discover the edge switches.

For more information, see [Discover Your Network Using CDP, on page 53](#) and [Discover Your Network Using an IP Address Range or CIDR, on page 55](#).

Change the **Preferred Management IP to Use Loopback**.

5. Make sure that the devices appear in the device inventory and are in **Managed** state.

For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).

Ensure that the devices are in the **Managed** state.

6. Design your network hierarchy, which represents your network's geographical location. You can create sites, buildings, and floors so that later you can easily identify where to apply the design settings or configurations.

You can either create a new network hierarchy, or if you have an existing network hierarchy on Cisco Prime Infrastructure, you can import it into Catalyst Center.

To import and upload an existing network hierarchy, see the [Import Your Site Hierarchy to Catalyst Center, on page 161](#).

To create a new network hierarchy, see the [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

7. For a nonfabric network, add and position APs on a floor map to get heatmap visualization during the design phase.

For a fabric network, you cannot place APs on a floor map during the design time. The APs are onboarded after adding devices to a fabric network.

For more information, see [Work with APs on a Floor Map, on page 180](#).

8. Define network settings, such as AAA (Cisco ISE is configured for Network and Client Endpoint), NetFlow Collector, NTP, DHCP, DNS, syslog, and SNMP traps. These network servers become the default for your entire network.

You can configure up to six AAA servers on the **Wireless** window during the SSID creation.

For more information, see [Network Settings Overview, on page 231](#), [Configure Global Network Servers, on page 234](#), and [Add Cisco ISE or Other AAA Servers](#).

9. Configure device credentials, such as CLI, SNMP, and HTTPS.

For more information, see [Configure Global Device Credentials, on page 235](#), [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).

10. Configure IP address pools at the global level.

To configure an IP address pool, see [Configure IP Address Pools, on page 247](#).

To reserve an IP address pool for the building that you are provisioning, see [Provision a Network Through LAN Automation](#).

11. Create enterprise and guest wireless networks. Define the global wireless settings once, and then Catalyst Center pushes the configurations to various devices across geographical locations.

Designing a wireless network is a two-step process. First, you must create SSIDs on the **Wireless** window. Then, associate the created SSID to a wireless network profile. This profile helps you to construct a topology, which is used to deploy devices on a site.

For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) and [Create SSIDs for a Guest Wireless Network, on page 264](#).

12. Configure the backhaul settings.

13. Configure the following on the **Policy** window:

- Create a virtual network. The virtual network segments your physical network into multiple logical networks.
- Create a group-based access control policy, and add a contract. For more information, see [Create Group-Based Access Control Policy, on page 695](#).

14. Provision Cisco Catalyst 9000 Series Switches and the edge node switches with the configurations added during the design phase.

- Create a fabric site.
- Add devices to the fabric network by creating a CP+Border+Edge or CP+Border.
- Enable embedded wireless capabilities on the Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Series Switches.
- Onboard APs in the fabric site.

For more information, see [Provision Fabric Networks, on page 561](#).

After the devices are deployed successfully, the deploy status changes from **Configuring to Success**.

Provision Embedded Wireless on Cisco Catalyst 9000 Series Switches

Before you begin

Before provisioning a Cisco Catalyst 9800 Embedded Wireless Controller on Catalyst 9000 Series Switches, ensure that you have completed the steps in [Configure Cisco Catalyst 9800 Embedded Wireless Controller for Catalyst 9000 Switches, on page 527](#).

This procedure explains how to provision embedded wireless on Cisco Catalyst 9300 Series Switches, Cisco Catalyst 9400 Series Switches, and Cisco Catalyst 9500H Series Switches.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

- Step 2** Check the check box next to the Catalyst 9000 Series Switch device and the edge switch that you want to associate to a site.

- Step 3** From the **Actions** drop-down list, choose **Provision > Assign Device to Site**. Assign the devices to a site. For more information, see [Add a Device to a Site, on page 108](#).

The next step is to provision the Catalyst 9000 Series Switch and the edge node with the configurations that were added during the design phase.

- Step 4** In the **Provision > Inventory** window, check the check box next to the device name that you want to provision.

- From the **Actions** drop-down list, choose **Provision > Provision Device**.
- Click **Next**.
- In the **Summary** window, review the configuration, and click **Next**.
- In the **Provision Device** depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Click **Apply**.
- On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
 - Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

- g) (Optional) After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).
- h) If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:
 1. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
 2. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
 3. Do one of the following:
 - When you're ready, click **Deploy or Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy or Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

4. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
5. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

- Step 5** To provision the edge switch, check the check box next to the edge switch that you want to provision.
- a) From the **Actions** drop-down list, choose **Provision**.
 - b) Click **Next**.
 - c) In the **Summary** window, verify the configurations, and click **Deploy**.
- After the devices are deployed successfully, the **Provision Status** changes from **Configuring** to **Success**.
- Step 6** To add devices to a fabric site, click the menu icon and choose **Provision > Fabric Sites**.
- Step 7** Create a fabric site. For more information, see [Add a Fabric Site, on page 575](#).
- Step 8** Add an IP transit network.
- Step 9** Add devices and associate virtual networks to a fabric site.
- Step 10** Add the Cisco Catalyst 9000 Series Switch as a control plane, a border node, and an edge node or a control plane and a border node.
- a) Click the device and choose **Add as CP+Border+Edge** or **Add as CP+Border**.
 - b) Click the edge node and choose **Add to Fabric**.
 - c) Click **Save**.
- Step 11** To enable embedded wireless on the device, click the device that is added as a **Edge**, **CP+Border+Edge** or **CP+Border**, and click the **Embedded Wireless LAN Controller** toggle button.

- a) If you haven't installed the wireless package on Cisco Catalyst 9000 Series Switches before enabling the wireless capability, Catalyst Center displays a warning message indicating that the embedded wireless controller software image is necessary for enabling the capability. In the warning dialog box, click **OK** to install the image manually.
- b) On the **Download Image** window, click **Choose File** to navigate to a software image stored locally, or **Enter image URL** to specify an HTTP or FTP source from which to import the software image.
- c) Click **Import**.

The progress of the image import is displayed. To exit the window, and view the progress of the import and schedule the installation later, click **Close**.

- d) After the image import is complete, under **Schedule Image Installation** on the **Download Image** window, choose one of the following options:
 - **Now:** Immediately install the image.
 - **Later:** Schedule the image installation for a later date or time.
- e) In the **Task Name** field, update the task name, if required.
- f) If you chose **Later**, do the following:
 - Under **Start Date/Time**, specify a start date and time for the image installation.
 - To use the default site time zone for the image installation, check the **Site Settings** check box. To select a time zone, uncheck the **Site Settings** check box and choose a time zone from the drop-down list.
- g) Click **Apply**.

To view the status of image installation, go to the **Activities > Tasks** window and open the relevant work item.

- h) After the embedded wireless controller software image is distributed and activated on the switch, resynchronize the device using the **Provision > Inventory > Resync** option.

Step 12 On the **Manage Scope** window, do the following:

- Under the **Primary** tab, check the check box next to the required site name.
- Under the **Secondary** tab, check the check box next to the required site name.

You can select either a parent site or individual sites. If you select a parent site, all the children under the parent site are also selected. You can uncheck the check box to deselect an individual site.

You can also use the **Search Hierarchy** search field or the filter icon to find a site.

Step 13 Click **Next**.

Step 14 On the **Advanced** window, to enable the Rolling AP Upgrade feature, check the **Enable** check box.

(Optional) If you check this check box, from the **AP Reboot Percentage** drop-down list, choose a percentage.

Step 15 Click **Next**.

On the **Summary** window, review the configuration settings, and click **Save**.

Step 17 On the **Modify Fabric** step, click **Now** to commit the changes, and click **Apply** to apply the configurations. The next step is to onboard APs in a fabric site.

Step 18 In the Catalyst Center GUI, click the menu icon and choose **Provision > Fabric Sites**.

A list of fabric sites is displayed.

Step 19 Select the fabric site that was created, and click the **Host Onboarding** tab to enable IP pool for APs.

Inter-Release Controller Mobility Introduction

- Step 20** Select the authentication template that is applied for devices in the fabric site. Then, click **Save**.
- Step 21** Under **Virtual Networks**, click **INFRA_VN** to associate one or more IP pools with the selected virtual network.
- Step 22** Under **Virtual Network**, click the guest virtual networks to associate IP pools for the selected guest virtual network.
- Step 23** Check the **IP Pool Name** check box that was created for APs during the design phase.
- Step 24** Click **Update** to save the setting.
- The AP gets the IP address from the specified pool, which is associated with the AP VLAN and registers with the wireless controller through one of the discovery methods.
- Step 25** Specify wireless SSIDs within the network that hosts can access. Under the **Wireless SSID** section, select the guest or enterprise SSIDs and assign address pools, and click **Save**.
- Step 26** Manually trigger resynchronization by choosing **Inventory > Resync** to see the APs on Catalyst Center for embedded wireless.
- The discovered APs are now displayed under **Inventory** in the **Provision** window and the **Status** is displayed as **Not Provisioned**.
- Step 27** Provision the AP.
- For more information, see [Provision a Cisco AP—Day 1 AP Provisioning](#), on page 486.
- Step 28** Configure and deploy application policies. For more information, see [Create an Application Policy](#), on page 732, [Deploy an Application Policy](#), on page 737, and [Edit an Application Policy](#), on page 736.
- Provision the Catalyst 9300 Series Switches and Cisco Catalyst 9500H Series Switches before deploying an application policy.
- Two different policies with different business relevance for two different SSIDs don't work. The last deployed policy takes precedence when you're setting up the relevance.
- Changing the default business relevance for an application doesn't work in FlexConnect mode.
- You can apply an application policy only on a nonfabric SSID.

Inter-Release Controller Mobility Introduction

Inter-Release Controller Mobility (IRCM) supports seamless mobility and wireless services across different Cisco Wireless Controllers with different software versions.

Catalyst Center supports the guest anchor feature for the following device combinations:

- Configuration of a Cisco AireOS controller as a foreign controller with a Cisco AireOS controller as an anchor controller.
- Configuration of a Cisco AireOS controller as a guest anchor controller with a Cisco Catalyst 9800 Series Wireless Controller as a foreign controller.
- Configuration of a Cisco Catalyst 9800 Series Wireless Controller as a foreign controller with a Cisco Catalyst 9800 Series Wireless Controller as an anchor controller.

Configuring IRCM on controller devices has the following limitations:

- Configuration of a Cisco AireOS controller as a foreign controller and Cisco Catalyst 9800 Series Wireless Controller as an anchor controller is not supported.

- Configuration of a fabric guest anchor is not supported.
- Only guest SSID is supported.
- Broadcast of a nonguest anchor SSID in guest anchor mode is not supported.

Guest Anchor Configuration and Provisioning Process

Follow these steps to configure a guest anchor Cisco Wireless Controller.

Step 1 Design a network hierarchy, with sites, buildings, floors, and so on. For more information, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

Step 2 Configure network servers, such as AAA, DHCP, and DNS servers. For more information, see [Configure Global Network Servers, on page 234](#) and [Add Cisco ISE or Other AAA Servers, on page 233](#).

Step 3 Create SSIDs for a guest wireless network with external web authentication and central web authentication along with configuring Cisco Identity Services Engine. For more information, see [Create SSIDs for a Guest Wireless Network, on page 264](#).

Step 4 Discover the wireless controller using the Cisco Discovery Protocol (CDP) or an IP address range, and make sure that the devices are in the **Devices > Inventory** window and in the **Managed** state. For more information, see [Discovery Overview, on page 43](#).

Step 5 Provision a foreign wireless controller as the active main wireless controller. See [Provision a Cisco AireOS Controller, on page 478](#).

Note If you choose a site with multiple network profiles while provisioning a foreign wireless controller, ensure that the total number of anchor groups for the network profiles is three or less.

Step 6 Choose the role for the wireless controller as guest anchor and provision the guest anchor controllers. For more information, see [Provision a Cisco AireOS Controller, on page 478](#).

Note

- You must choose the same site as the managed AP location for the anchor wireless controller as specified for the SSID.
- If you modify the interface configuration for the anchor wireless controller, you must reprovision it.

Step 7 Configure device credentials, such as CLI, SNMP, HTTP, and HTTPS. For more information, see [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).

Prerequisites for Configuring IRCM on Cisco Controller Device

- Discover the Cisco Catalyst 9800 Series Wireless Controller and Cisco AireOS Controllers.

You must enable NETCONF and set the port to 830 to discover the Catalyst 9800 Series Wireless Controller. NETCONF provides a mechanism to install, manipulate, and delete the configurations of network devices.

For more information, see [Discover Your Network Using CDP, on page 53](#) or [Discover Your Network Using an IP Address Range or CIDR, on page 55](#).

- Design your network hierarchy by adding sites, buildings, and floors so that later you can easily identify where to apply design settings or configurations.

To create a new network hierarchy, see [Create, Edit and Delete a Site, on page 167](#) and [Add, Edit, and Delete a Building, on page 168](#).

- Add the location information of APs, and position them on the floor map to visualize the heatmap coverage.

For more information, see [Work with APs on a Floor Map, on page 180](#).

- Define network settings, such as AAA (Cisco ISE is configured for Network and Client Endpoint), NetFlow Collector, NTP, DHCP, DNS, syslog, and SNMP traps. These network servers become the default for your entire network. You can add a TACACS server while adding a AAA server.

For more information, see [Network Settings Overview, on page 231](#), [Configure Global Network Servers, on page 234](#), and [Add Cisco ISE or Other AAA Servers](#).

- Create SSIDs for a guest wireless network.

For more information, see [Create SSIDs for a Guest Wireless Network, on page 264](#).

- The WLAN profile name of the foreign controller and anchor controller should be the same for mobility.

IRCM: Cisco AireOS Controller and Cisco Catalyst 9800 Series Wireless Controller

Before you begin

Ensure the prerequisite for configuring IRCM is met. For more information, see [Prerequisites for Configuring IRCM on Cisco Controller Device, on page 533](#).

-
- | | |
|----------------|--|
| Step 1 | From the top-left corner, click the menu icon and choose Provision > Network Devices > Inventory .

The Inventory window is displayed with the discovered devices listed. |
| Step 2 | Check the check box next to the Catalyst 9800 Series Wireless Controller that you want to provision as a foreign controller. |
| Step 3 | From the Actions drop-down list, choose Provision > Provision . |
| Step 4 | In the Assign Site window, click Choose a Site to assign a site for the Catalyst 9800 Series Wireless Controller device. |
| Step 5 | In the Add Sites window, check the check box next to the site name to associate a Catalyst 9800 Series Wireless Controller. |
| Step 6 | Click Save . |
| Step 7 | Click Apply . |
| Step 8 | Click Next . |
| Step 9 | Select a role for the Catalyst 9800 Series Wireless Controller as Active Main WLC . |
| Step 10 | For an active main wireless controller, you need to configure interface and VLAN details. |
| Step 11 | Under the Assign Interface area, do the following: <ul style="list-style-type: none"> a) VLAN ID: Enter a value for the VLAN ID. b) IP Address: Enter the interface IP address. |

- c) **Gateway IP Address:** Enter the gateway IP address.
- d) **Subnet Mask (in bits):** Enter the interface net mask details.

Note Assigning an IP address, gateway IP address, and subnet mask is not required for the Catalyst 9800 Series Wireless Controller.

Step 12 Click Next.

Step 13 In the **Summary** window, review the configuration settings.

Step 14 Click **Deploy** to provision the Catalyst 9800 Series Wireless Controller as a foreign controller.

Step 15 On the **Devices > Inventory** window, check the check box next to the Cisco AireOS Controller that you want to provision as a guest anchor controller.

Step 16 Repeat Step 3 through Step 8.

Step 17 Select a role for the Cisco AireOS Controller as **Guest Anchor**.

Step 18 For a guest anchor wireless controller, you need to configure the interface and VLAN details.

Step 19 Repeat Step 11 through Step 14.

Prerequisites for Provisioning a Meraki Device

- Integrate the Meraki dashboard with Catalyst Center. See [Integrate the Meraki Dashboard](#), on page 100.
- Create the SSID. See [Create SSIDs for an Enterprise Wireless Network](#), on page 253.



Note The Meraki dashboard supports the following types of SSIDs:

- Open: This SSID corresponds to Open in the Meraki dashboard.
- WPA2 Personal: This SSID corresponds to the preshared key with WAP2 in the Meraki dashboard.
- WPA2 Enterprise: This SSID corresponds to WAP-2 Encryption with Meraki authentication or My Radius server in the Meraki dashboard. If you have defined AAA or Cisco ISE servers for client and endpoint authentication at the building level in Catalyst Center, the configuration is provisioned to **my Radius server** in the Meraki dashboard. Otherwise, **Meraki Radius** is used for authentication by the Meraki devices.

For every SSID, you can choose an interface name. If you choose the **Management** interface in Catalyst Center and the VLAN ID is 0, the configuration is not supported in the Meraki dashboard and VLAN tagging is disabled in the Meraki dashboard. If you create a custom interface for the SSID in Catalyst Center, an AP tag is created with the custom interface name and VLAN ID in the Meraki dashboard.

- Create the network profile and assign it to the sites for which the SSID is provisioned.



Note The Network Hierarchy **Sites > Buildings** in Catalyst Center corresponds to **Organization > Network** in the Meraki dashboard. We recommend that you choose **Buildings** in the **Add Sites to Profile** window in the workflow.



Note Catalyst Center creates the Meraki network and provisions the SSIDs to the network. The Meraki dashboard provisions the Meraki network configuration to the Meraki devices.

Provision a Meraki Device

This procedure explains how to provision SSIDs for Cisco Meraki devices managed by a Meraki dashboard.

Before you begin

Ensure the prerequisite is met. For more information, see [Prerequisites for Provisioning a Meraki Device, on page 535](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
The **Inventory** window is displayed with the discovered devices listed.
- Step 2** To view the Meraki dashboard, expand the **Global** site in the left pane, and select a building.
All Meraki dashboards available in the selected building are displayed.
- Step 3** Check the check box next to the Meraki dashboard name that you want to provision.
- Step 4** From the **Actions** drop-down list, choose **Provision > Provision Device**.
The **Assign Site** window is displayed, which is where you can view the Meraki dashboard and the associated building.
- Step 5** To change the associated building, click **Choose a site**.
- Step 6** In the **Choose a site** window, select a building and click **Save**.
- Step 7** Click **Next**.
The **Configuration** window is displayed. You can view the managed building in the primary location.
- Step 8** Click **Select Secondary Managed AP Locations** to select the secondary managed location for the Meraki dashboard.
- Step 9** In the **Managed AP Location** window, check the check box next to the building name.
- Step 10** Click **Save**.
- Step 11** Click **Next**.
In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
- Note** Meraki deployment supports a maximum of 15 SSIDs in each network.
- Step 12** Click **Deploy**.
- Step 13** In the **Provision Devices** window, do the following to preview the CLI configuration:

- a) Click the **Generate Configuration Preview** radio button.
- b) In the **Task Name** field, enter a name for the CLI preview task, and click **Apply**.
- c) In the **Task Submitted** dialog box, click the **Work Items** link.

Note This dialog box displays for a few seconds and then disappears. To navigate to the **Tasks** window, click the menu icon and choose **Activities > Tasks**.

- d) In the **Tasks** window, click the CLI preview task for which you submitted the configuration preview request.
- e) View the CLI configuration details, and click **Deploy**.
- f) To immediately deploy the device, click the **Now** radio button, and click **Apply**.
- g) To schedule the device deployment for a later date and time, click the **Later** radio button and define the date and time of the deployment.
- h) In the **Information** dialog box, do the following:
 1. Click **Yes** if you want to delete the CLI preview task from the **Tasks** window.
 2. Click **No** if you want to retain the task in the **Tasks** window.

Note The CLI task will be marked as completed in the **Tasks** window. You can view the CLI configuration for this task, but you cannot deploy it again.

Note After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

The **Provision Status** column in the **Device Inventory** window shows **SUCCESS** after a successful deployment.

Provision Remote Teleworker Devices

The following topics explain the components of remote teleworker sites and the procedure for provisioning remote teleworker devices.

Remote Teleworker Deployment Overview

Deployment Components

The Cisco remote teleworker deployment is built around three main components: Cisco wireless controllers, Cisco OfficeExtend access points (APs) and a Corporate firewall. The following models are supported in this deployment:

- **Wireless Controllers:** Cisco 5520 Wireless Controller, Cisco 8540 Wireless Controller, Cisco 3504 Wireless Controller⁴, Cisco Catalyst 9800-40 Wireless Controller, Cisco Catalyst 9800-80 Wireless Controller, and Cisco Catalyst 9800-L Wireless Controller.
- **Access Points:** Cisco Aironet 1815T (Teleworker) Access Point, Cisco Aironet 1815I Access Point, Cisco Aironet 1815W Access Point, Cisco Aironet 1840I Access Point, Cisco Aironet 2800 Series Access Points, Cisco Aironet 3800 Series Access Points, Cisco Aironet 4800 Series Access Points, Cisco Catalyst 9115 Access Point, Cisco Catalyst 9120 Access Point, and Cisco Catalyst 9130 Access Point.

⁴ Supported with Cisco Aironet 1815 Teleworker Access Point only.

Cisco Wireless Controllers

Cisco controllers are responsible for system-wide WLAN functions, such as security policies, intrusion prevention, RF management, quality of service (QoS), and mobility. They work in conjunction with Cisco APs to support business-critical wireless applications for teleworkers. Controllers provide the control, scalability, security, and reliability that network managers need to build a secure, scalable teleworker environment.

To allow users to connect their corporate devices to the organization's on-site wireless network, the remote teleworking solution offers the same wireless Secure Set Identifiers (SSIDs) at a teleworker's home as those that support data and voice inside the organization.

Cisco OfficeExtend Access Points

APs cannot act independently of controllers. As an AP communicates with the controller resources, it downloads its configuration and synchronizes its software or firmware image, if required. The AP establishes a secure Datagram Transport Layer Security (DTLS) connection to the controller, which offers remote WLAN connectivity using the same profile as at the corporate office. Secure tunneling allows all traffic to be validated against centralized security policies and minimizes the management overhead associated with home-based firewalls.

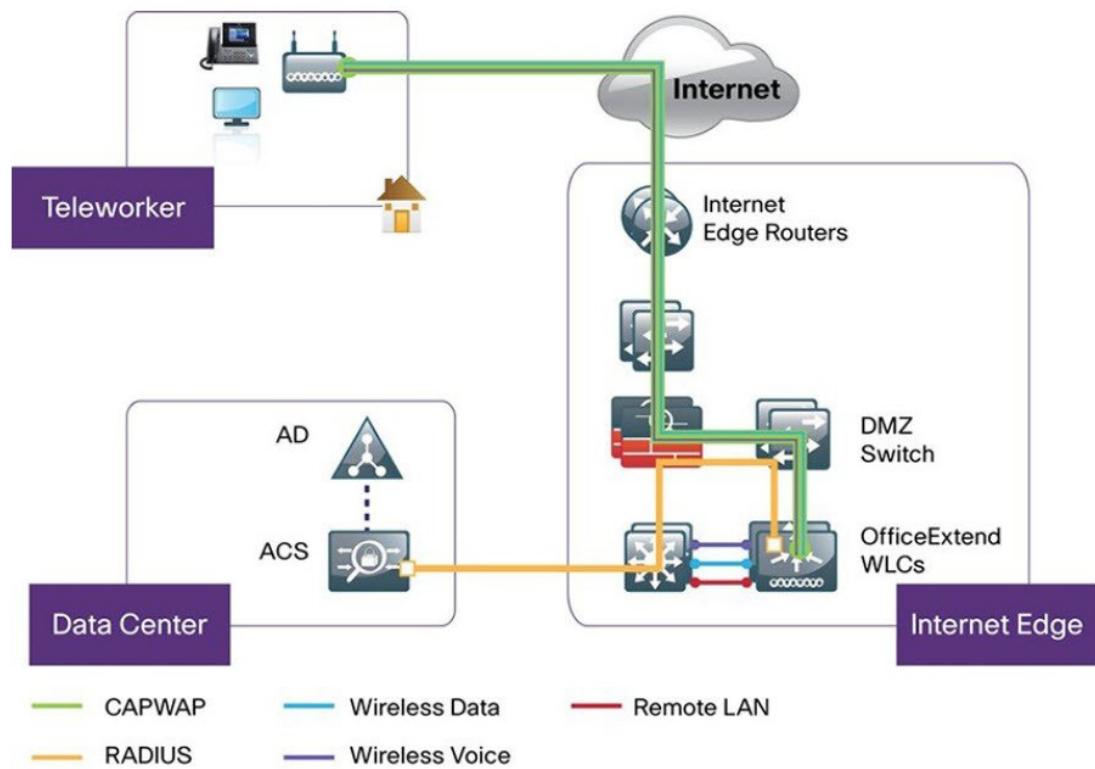
Corporate Firewall

The controller should be placed in a demilitarized zone (DMZ) and the corporate firewall must allow CAPWAP control and data traffic through the firewall to the controller. The general configuration on the firewall is to allow CAPWAP control and CAPWAP management port numbers through the firewall. The UDP 5246 and 5247 ports need to be opened on the firewall for communication between the controller and the AP.

Deployment Configuration

For the most flexible and secure remote teleworker configuration, deploy a dedicated controller pair in a dedicated to the Internet edge DMZ. Traffic from the Internet terminates in the DMZ versus in the internal network, while the remote AP is still directly connected to the internal network.

Figure 22: Sample Remote Teleworker Deployment Scenario



Create a Remote Teleworker Site

A remote teleworker site is a dedicated site that is used only to manage wireless controllers and remote teleworker access points (APs). To create a remote teleworker site, you need to enable the remote teleworker function on the site. Once enabled, the remote teleworker function cannot be independently disabled for a site, building, or floor within the site's hierarchy. The site can only manage remote teleworker functions.

In a teleworker site, switching is performed centrally from the controller. You cannot configure the network profile for Flex Connect with local switching.

Before you begin

- Understand the supported devices that are used in a teleworker deployment.
- Make sure that you have a Cisco Wireless Controller and Cisco APs in your inventory. If not, discover the devices or add them manually. For information, see [Discover Your Network, on page 43](#) or [Add a Network Device, on page 87](#).
- Configure global wireless network settings appropriate for your network. For information, see [Configure Global Wireless Settings, on page 252](#).
- For remote teleworker APs, we recommend that you create an AP profile with remote teleworker enabled and configure custom site tags. For more information, see [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices, on page 315](#) and [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).

Create a Remote Teleworker Site

- For Cisco AireOS devices, you must map the AP profile to the custom AP group of the site that will be used for the remote teleworker AP. For more information, see [Create Network Profiles for Wireless, on page 339](#) and [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile, on page 353](#).

Step 1 Create a site to manage remote teleworker APs. See [Create, Edit and Delete a Site, on page 167](#).

Step 2 Add buildings and floors. See [Add, Edit, and Delete a Building, on page 168](#).

Step 3 Configure the wireless network settings for the remote teleworker site.

- From the top-left corner, click the menu icon and choose **Design > Network Settings > Wireless**.
- From the left hierarchy tree, choose the remote teleworker site.
- Click **Remote Teleworker**.
- Check the **Enable Remote Teleworker** check box.
- Click **Save**.

Step 4 Assign the controller to the site. See [Add a Device to a Site, on page 108](#).

Step 5 Assign the APs to the site. See [Add a Device to a Site, on page 108](#).

You can use serial numbers or MAC addresses but not a mixture of both, or you can upload a CSV file.

Step 6 In the wireless network settings, add the APs to the authorized APs list.

- From the left hierarchy tree, choose Global.
- From the top-left corner, click the menu icon and choose **Design > Network Settings > Wireless**.
- Click **Security Settings**.
- Click the **AP Authorization List** tab and add the APs that are allowed to join the controller. For more information, see [Create an AP Authorization List, on page 305](#).

The controller responds only to CAPWAP requests from APs that are in its authorization list.

Step 7 Provision the controller.

- From the top-left corner, click the menu icon and choose **Provision > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

- Locate the controller that you want to provision.
- Check the check box next to the device name.
- From the **Actions** drop-down list, choose **Provision > Provision Device**.
- In the **Assign Site** window, verify the assigned site, and click **Save**.
- Click **Next**.
- (Optional) On the **Configuration** window, under **NAT Address for Remote Teleworker**, click the **Enable NAT Address** check box and enter the NAT IP address.
- Click **Next**.
- In the **Model Configuration** window, click **Next**.
- In the **Advanced Configuration** window, click **Next**.
- In the **Summary** window, review the configuration settings, and click **Deploy**.
- In the **Provision Device** slide-in pane, choose **Now**, and click **Apply**.

Note After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Step 8 After the Cisco Wireless Controller is provisioned, you can provision the APs.

- a) From the top-left corner, click the menu icon and choose **Provision > Inventory**.
The **Inventory** window is displayed with the discovered devices listed.
 - b) Locate the APs that you want to provision.
 - c) Check the check box next to the device names.
 - d) From the **Actions** drop-down list, choose **Provision > Provision Device**.
 - e) In the **Assign Site** window, click **Choose a floor**, and assign the APs to a floor.
 - f) Click **Save**.
 - g) Click **Next**.
 - h) In the **Configuration** window, click **Next**.
 - i) In the **Summary** window, review the configuration settings, and click **Deploy**.
 - j) In the **Provision Device** slide-in pane, choose **Now**, and click **Apply**.
-



CHAPTER 18

Provision a Routing Profile

- Provision a Router, on page 543
- VPC Inventory Collection, on page 545

Provision a Router

Before you begin

Make sure that you have defined the following global network settings before provisioning a routing profile:

- Network servers, such as AAA, DHCP, and DNS. For more information, see [Configure Global Network Servers, on page 234](#).
- Device credentials, such as CLI, SNMP, HTTP, and HTTPS. For more information, see [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).
- IP address pools. For more information, see [Configure IP Address Pools, on page 247](#).
- Service provider profiles. For more information, see [Configure Service Provider Profiles, on page 252](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The **Inventory** window is displayed with the discovered devices listed.

Step 2 To view devices available in a particular site, click **Global** and choose the desired site, building, or floor.

All the devices available in the selected site are displayed in the **Inventory** window.

Step 3 At the top of the **Inventory** window, click **Routers**.

Step 4 Check the check box next to the device that you want to provision.

Step 5 Click **Assign** under the site and then, in the **Assign Device to Site** window, click **Choose a site**.

Step 6 From the **Actions** drop-down list, choose **Provision > Provision Device**.

Step 7 To provision a router, do the following:

- Review the details in the **Confirm Profile** page and click **Next**.
- Review the details in the **Router WAN Configuration** page.

Provision a Router

If you are provisioning a virtual router, this page is not displayed.

1. If you chose gigabit Ethernet as the line interface, click **O**. If you choose a static IP address, enter the WAN IP address. If you choose DHCP, enter the IP address from the DHCP server. If the primary WAN is already configured using PnP, you can choose **Do not Change**. From the **Interface Name** drop-down list, choose the interface that is configured as the primary WAN.
2. If you chose cellular as the line interface, click **O**, choose **IP Negotiated**, choose the **Interface Name** from the drop-down list, and enter the **Access Point Name (APN)**. Depending on your service provider, check the **PAP** or **CHAP** check box.
3. Enter the **IP SLA Address** for the backup WAN interface if you have multiple service providers.
4. Click **Next**.
- c. Review the details in the **Router LAN Configuration** page.
 1. Choose the **Interface** from the drop-down list.
 2. Choose the **IP-Pool/IP** from the drop-down list.
 3. Choose the **IP Address Pool** from the drop-down list.
 4. Click **Next**.
- d. Review the details in the **Integrated Switch Configuration** page.
Depending on your configuration, this page may not be displayed.
- e. Review the details in the **Summary** page by expanding the drop-down menus for the various specifications, settings, and configurations.

Step 8

Click **Deploy**.

Step 9

In the **Provision Router device(s)** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations, on page 132](#).

Step 10

Click **Apply**.

Step 11

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 12 After deploying the configuration on the devices, the **Task Progress** bar displays the progress of the ongoing provisioning task under **Activities > Tasks** (which you can view by clicking the task name).

Step 13 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Device Configurations, on page 132](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

The **Provision Status** column in the **Device Inventory** window shows **SUCCESS** after a successful deployment.

Click **SUCCESS** to see a detailed provisional log status.

VPC Inventory Collection

After successful cloud inventory collection, the **Cloud** tab in the **Provision** section provides a view of the collected AWS VPC Inventory. The navigation on the left can be expanded to show the cloud regions for a cloud profile or access key. You can filter the left navigation items by keyword and click to see the VPCs just for the selected region or access key.

In the VPC Inventory view you can also click on a VPC to see more details about it, like the subnets and virtual instances in that VPC and some more details about them. AWS VPC inventory collection is scheduled to occur at the default interval for all inventory collection and can also be triggered on demand by using the **Sync** action from the gear menu for a cloud access key. The status of the inventory collection can be viewed by clicking on **Show Sync Status** in the **VPC Inventory** view.



CHAPTER 19

Provision Firewall Profiles

- Provision a Firewall Threat Defense Device, on page 547

Provision a Firewall Threat Defense Device

This procedure explains how to provision a Firepower Threat Defense (FTD) device managed by Firepower Management Center (FMC).

Before you begin

- Integrate FMC with Catalyst Center. See [Integrate Firepower Management Center, on page 101](#).
- Create a site in a network hierarchy. See [Create, Edit and Delete a Site, on page 167](#).
- Create a network profile for firewall and assign it to a site for which the FTD device is provisioned. See [Create Network Profiles for Firewall, on page 335](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.

The Inventory page displays the device information that is gathered during the discovery process.

Step 2 Check the check box next to the FTD device that you want to provision and click **Assign** under the **Site** column.

Step 3 In the **Assign Device to Site** window, click **Choose a Site**.

Step 4 In the **Choose a Site** window, select a site from the hierarchy and click **Save**.

Step 5 Click **Next**.

Step 6 Click **Now** to assign the device to site immediately or click **Later** to schedule at a specific time.

Step 7 Click **Assign**.

Note You can view the status of assigning device to site in **Activities > Tasks**.

Step 8 From the **Actions** drop-down list, choose **Provision > Provision Device**.

The **Provision Firewall Profile** window appears.

Step 9 Review the details in the **Confirm Profile** page and click **Next**.

Step 10 Review the details in the **Firewall Type** page and click **Next**.

Provision a Firewall Threat Defense Device

The **FTD Configuration** page appears.

Step 11

If you have associated a routed mode firewall with the site, do the following:

- a) Expand the **Outside Interface** area, choose an outside interface from the **Select Physical Interface** drop-down list, and choose **Static IP** or **DHCP** radio button.
 - **Static IP**: Enter the IP address and a subnet mask.
 - **DHCP**: The IP address is obtained from DHCP.
- b) Expand the **Inside Interface** area, choose an inside interface from the **Select Physical Interface** drop-down list, and choose **Static IP** or **DHCP** radio button.
 - **Static IP**: Enter the IP address and a subnet mask.
 - **DHCP**: The IP address is obtained from DHCP.

Step 12

If you have associated a transparent mode firewall with the site, do the following:

- a) Expand the **Outside Interface** area and choose an outside interface from the **Select Physical Interface** drop-down list.
- b) Expand the **Inside Interface** area and choose an inside interface from the **Select Physical Interface** drop-down list.
- c) Expand the **Bridge Virtual Interface** area, and do the following:
 - **Bridge Group Number**: Enter a bridge group number. The valid number is from 1 to 250.
 - **IP**: Enter the IP address of the FTD device.
 - **Subnet Mask**: Enter a subnet mask.

Step 13

Click **Next**.

Step 14

In the **Summary** window, review the device specifications.

Step 15

To proceed, click **Deploy**.

The **Provision Firewall device(s)** dialog box appears.

Step 16

Click **Now**, **Later**, or **Generate configuration preview** radio button.

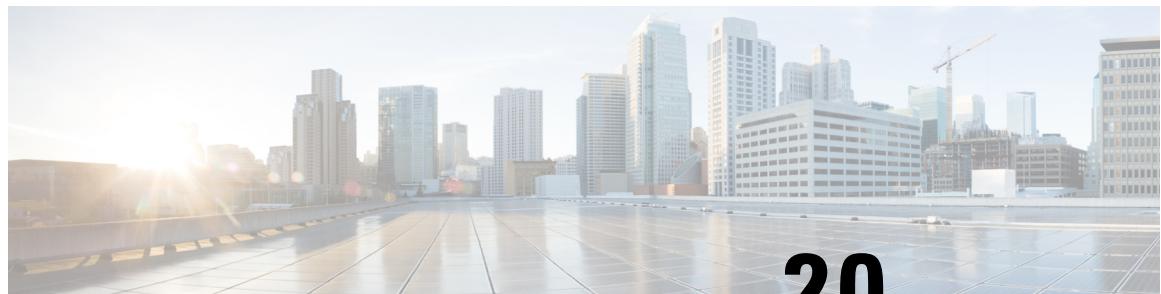
- **Now**: Starts the provisioning immediately.
- **Later**: Schedules the provisioning at a specific time.
- **Generate configuration preview**: Generates preview which can be later used to deploy on selected devices.

Step 17

Click **Apply**.

Note

You can view the status of provisioning firewall device in **Activities > Tasks**. If you have chosen **Generate configuration preview** in the **Provision Firewall device(s)** dialog box, you can view the work item status in **Activities > Tasks**.



CHAPTER 20

Provision a LAN Underlay

- [LAN Automation, on page 549](#)
- [Prerequisites for Provisioning a Network Through LAN Automation, on page 550](#)
- [Provision a Network Through LAN Automation, on page 551](#)
- [Peer Device in LAN Automation Use Case, on page 555](#)
- [Check the LAN Automation Status, on page 556](#)
- [Create a Link Between Interfaces, on page 557](#)
- [Delete a Link Between Interfaces, on page 557](#)
- [Edit Hostname and Loopback IP Address of LAN Automated Devices, on page 558](#)

LAN Automation

Catalyst Center provides LAN automation as an alternative for manual deployment of new networks. This automation allows you to simplify network operations and create a standard error-free network. LAN automation uses the IS-IS routing protocol to deploy a Layer 3 routed access design.

LAN Automation provides the following capabilities:

- Provision your network through LAN automation
- View the history of LAN automation sessions
- View the summary of LAN automated devices

From the top-left corner, click the menu icon and choose **Provision > LAN Automation** to view this window.

- **Start LAN Automation:** Use this option to initiate LAN automation sessions on your network.
- **Overview:** Expand this section to view the prerequisites and more information about provisioning your network through LAN automation.
- **Sessions:** This section consists of the **History** of LAN automation sessions, and the list of **LAN Automated Devices**.

Day-Zero Operation

On day zero, click **Start LAN Automation** to start provisioning your network through LAN automation. For more information, see [Provision a Network Through LAN Automation, on page 551](#).

For day zero, Catalyst Center doesn't display any data in the **Sessions** section.

Day-*n* Operation

On day *n*, you can click **Start LAN Automation** to initiate more LAN automation sessions. You can run up to five LAN automation sessions simultaneously across sites. For more information, see [Provision a Network Through LAN Automation, on page 551](#).

When a LAN automation session is in progress, Catalyst Center displays a tile for the session on the **LAN Automation** window. To view the details of the session, click **See Session Details** in the tile. To stop LAN automation for the session, click **Stop LAN Automation** in the tile.

The **History** tab displays the history of LAN automation sessions in your network. You can use the **Search** field to search for specific text. To view the session details, click the hyperlinked date. To view the logs for a session, in the session details window, click **View Session Logs**.

The **LAN Automated Devices** tab displays the details of the LAN automated devices. You can use the search field to filter the data based on specific text. Click one of the following toggle buttons to filter the data:

- **Seed Devices**: Displays the data for seed devices
- **Discovered**: Displays the data for discovered devices
- **Provisioned**: Displays the data for provisioned devices
- **Error**: Displays the data for devices with errors

In the **LAN Automated Devices** tab, you can also do the following:

- Click the device name hyperlink to view the device details.
- Provision interfaces between two devices by clicking **Add Link**. For more information, see [Create a Link Between Interfaces, on page 557](#).
- Delete the interface between two devices by clicking **Delete Link**. For more information, see [Delete a Link Between Interfaces, on page 557](#).
- Customize the hostname and loopback IP address of a device by clicking **Edit Device**.



Note

- To edit the hostname and loopback IP address of a device on Day-*n*, the device must be in the **Managed** state in the Inventory.
- You can edit the loopback IP addresses of a maximum of 25 devices in a single Day-*n* workflow.

For more information, see [Edit Hostname and Loopback IP Address of LAN Automated Devices](#).

Prerequisites for Provisioning a Network Through LAN Automation

Before provisioning a network through LAN automation, ensure the following:

- Configure your network hierarchy. (See [Add a Device to a Site, on page 108](#).)

- Define the following global network settings:

- Network servers, such as the AAA, DHCP, and DNS servers. (See [Configure Global Network Servers, on page 234](#).)
- Device credentials, such as the CLI, SNMP, HTTP, and HTTPS credentials. (See [Add Global CLI Credentials, on page 236](#), [Add Global SNMPv2c Credentials, on page 236](#), [Add Global SNMPv3 Credentials, on page 237](#), and [Add Global HTTPS Credentials, on page 240](#).)



Note SNMPv2 write credentials are not required and if configured, it won't be pushed to the device during LAN automation.

- IP address pools. (See [Configure IP Address Pools, on page 247](#).)
- Ensure you have at least one device in your inventory. If not, discover devices using the Discovery feature.



Note LAN automation is blocked if the discovered site is configured with "cisco" in the username of your CLI credentials.

- If you have a Cisco Catalyst 9400 Switch configured in the network, the following operations must be completed on the switch for LAN automation to automatically enable the 40G port:

- The day-zero configuration is performed on the switch.

For more information, see “Initial Configuration for the Switch” in the [Cisco Catalyst 9400 Series Switches Hardware Installation Guide](#).

- A 40G Quad Small Form-Factor Pluggable (QSFP) transceiver is inserted in either port 9 or port 10 of the Supervisor, and the ports numbered 1 to 8 on the Supervisor do not have a 10G or 1G Small Form-Factor Pluggable (SFP) transceiver inserted in them. If there are dual supervisor engines, ensure that the 40G QSFP is inserted in port 9.

For more information on the Catalyst 9400 Series Supervisor, see the “Uplink Ports” topic in the [Cisco Catalyst 9400 Series Supervisor Module Installation Note](#).

Provision a Network Through LAN Automation

Before you begin

Make sure that the prerequisites have been met. For more information, see [Prerequisites for Provisioning a Network Through LAN Automation, on page 550](#).

Step 1 Reserve an IP address pool for the site that you are provisioning.

Note The size of the LAN automation IP address pool must be at least 25 bits of netmask or larger.

Provision a Network Through LAN Automation

- a) From the top-left corner, click the menu icon and choose **Design > Network Settings > IP Address Pools**.
- b) From the left hierarchy tree, choose a site.
- c) Click **Reserve**. In the **Reserve IP Pool** slide-in pane, enter the following information to reserve all or a part of an available global IP address pool for your chosen site:
 - **IP Address Pool Name:** Unique name for the reserved IP address pool.
 - **Type:** Type of IP address pool. For LAN automation, choose **LAN**.
 - **IP Address Space:** Check either the **IPv4** or the **IPv6** check box to create an address pool. To create a dual-stack pool, check both the **IPv4** and **IPv6** check boxes.
 - **Global IP Pool:** IPv4 address pool from which you want to reserve all or some of the IP addresses.

Note LAN automation uses only the IPv4 subnet.

 - **Prefix length / Number of IP Addresses:** IP subnet and mask address that is used to reserve all or a part of the global IP address pool or the number of IP addresses that you want to reserve.
 - **Gateway:** Gateway IP address.
 - **DHCP Server(s):** DHCP server IP address.
 - **DNS Server(s):** DNS server IP address.

- d) Click **Reserve**.

Step 2

To initiate the discovery and provisioning of the devices, do the following:

- a) From the top-left corner, click the menu icon and choose **Provision > LAN Automation**.
- b) In the **LAN Automation** window, click **Start LAN Automation**.

The workflow guides you through the configuration process.

- c) In the **Seed Devices** window, do the following:
 1. Select the Primary Seed Device and its interface.
 2. (Optional) Select the Secondary Seed Device and its interface.
- d) In the **Sessions Attributes** window, do the following:
 1. Choose the site to which all the newly discovered devices are assigned. This site can be different from the primary and peer sites.
 2. From the **Principal IP Address Pool** drop-down, choose the IP address pool.
 3. (Optional) Click the **Advance Attributes** toggle button to set the IS-IS password and also to enable multicast.
 4. In the **HOSTNAME MAPPING** section, in the **Discovered Devices Hostname Prefix** field, define a prefix name for the devices.

You can either select a hostname map file from the **Choose a File** drop-down, or upload the CSV file from a storage device.

The CSV file contains a serial number and hostname for each device. Optionally, it can also have a customized loopback IP address for each device. The LAN automation process assigns the specified loopback IP address for the corresponding device. If the CSV file does not contain the loopback IP address information, a random IP address from the IP pool is assigned to the device.

Note The loopback IP address for a device can be an address from any IP address pool in the same site as the device.

5. Click Review.

- e) In the **Review** window, look through all the LAN automation session settings. To make any changes, click **Edit**. Click **Start**.

Step 3 The following table describes each field that you see in the workflow window:

Primary Seed Device	Select the primary device that Catalyst Center uses as the starting point to discover and provision new devices.
Secondary Seed Device	Select the secondary seed device.
Discovered Device Site	All the newly discovered devices are assigned to this site. This site can be different from the primary and peer sites.
Principal IP Pool	The IP address pool that is reserved for LAN automation.
Link Overlapping IP Pool	<p>The IP address pool that is shared with other sites and is used to configure the /31 IP addresses on point-to-point links in the underlay.</p> <ul style="list-style-type: none"> • A link that overlaps IP pool can be a subpool that is inherited from a parent site or a subpool that is defined in any other site. • A link that overlaps IP pool allows you to overlap /31 IP addresses in a multisite deployment. Hosts in different sites will be able to reuse the IP addresses on the /31 links. • If you choose to define a link that overlaps IP pool, the addresses that are defined in the Principal IP Pool field are used for management IPs, such as loopback address, VLAN address, and so on.
IS-IS Domain Password	A user-provided IS-IS password when LAN automation starts. If the password exists on the seed device, it is reused and is not overwritten. If no user-provided password is entered and there is no existing IS-IS password on the device, the default domain password is used. If both the primary and the secondary seeds have domain passwords, ensure that they match.
Advertise LAN Automation Summary Route into BGP	<p>Check this check box if you want LAN automation to advertise the principal IP pool into BGP on the primary and peer seed device. LAN automation advertises the summary route on the seed devices only if BGP is configured on them.</p> <p>This check box is disabled by default. It is enabled only if the primary or the peer seed device has an autonomous system (AS) number configured.</p>
Enable Multicast	Check this check box to enable underlay native multicast. LAN automation creates a multicast tree with seed devices as RPs and discovered devices as subscribers.

Provision a Network Through LAN Automation

Choose a File	<p>Click Browse to choose a hostname map file. User-provided names are configured for discovered devices using the chosen CSV file that contains a mapping between serial numbers and hostnames. If the discovered device is a stack, all the serial numbers of the stack are provided in the CSV file.</p> <p>Optionally, in the third field, you can specify a loopback IP address for the device.</p> <p>A sample CSV file is as follows:</p> <pre>standalone-switch,FCW2212L0NF,10.1.1.4 stack-switch,"FCW2212E00Y,FCW2212L0GV"</pre>
Device Name Prefix	Name prefix for the devices being provisioned. When Catalyst Center provisions each device, it prefixes the device with the text that you provide and adds a unique number at the end. For example, if you input "Access" as the name prefix, each consecutive device that is provisioned is named Access-1, Access-2, Access-3, and so on.

Step 4 In the **Review** window, click **Start**.

Catalyst Center begins to discover and provision the new devices.

LAN automation configures an IP address on the seed device of VLAN 1. If this VLAN 1 IP address of the seed device is not reachable from Catalyst Center, an error message is displayed on the **LAN Automation Status** window. Hover your cursor over the **See Details** link on this window to see the error details and possible remedial actions.

Step 5 Monitor and review the progress of the devices being provisioned.

In the **LAN Automation** window, click **See Session Details** on the status pane.

You can filter the status display and see the details of the discovered devices, or the provisioned devices, or error messages.

Note The provisioning of new devices may take several minutes.

Step 6 Stop the LAN automation session after all the devices have been discovered and added to the inventory.a) In the **LAN Automation Status** window, click **Stop LAN Automation**.

When you stop LAN automation, a **Review LAN Automation Session** workflow is triggered. This workflow allows you to review the devices that are discovered during the LAN automation session and make changes before deployment.

- b) In the **Review Discovered Devices** window, you can edit the loopback IP address (Management IP address) of a device.
- c) Click **Validate** to verify the edited IP address.
- d) If the validation is a success, click **Apply** to deploy the LAN automation configurations.

Step 7 (Optional) You can have multiple LAN automation sessions (up to five sessions) running in parallel. The details of each session are displayed on the respective tiles in the **LAN Automation** window.

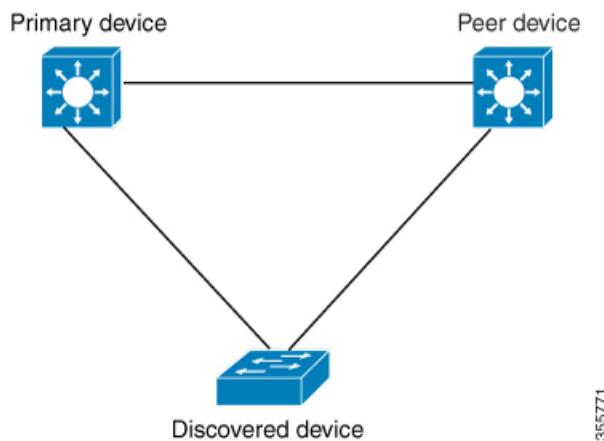
Consider the following aspects before you start simultaneous LAN automation sessions:

- You can't use the same seed device for more than one session.
- You can't use the same site for parallel sessions.
- You can't use the same IP pool for parallel sessions.

Peer Device in LAN Automation Use Case

Provision a Dual-Homed Switch

You must always select a peer device to provision the dual-homed switch.



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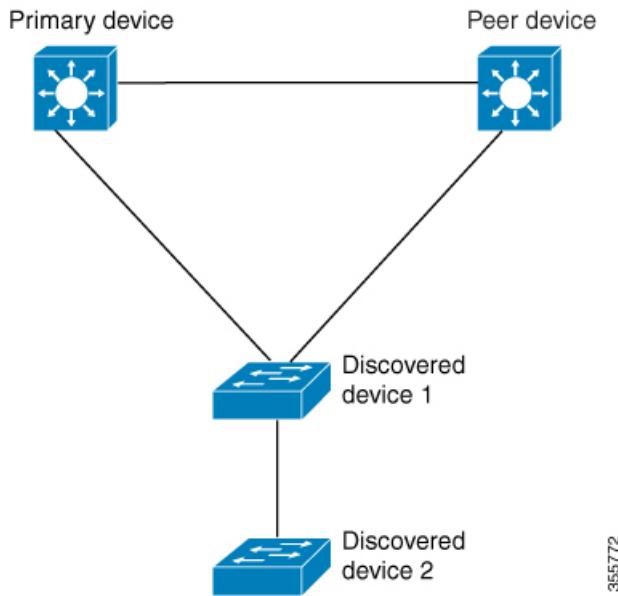
Catalyst Center configures the DHCP server on the primary device. Because Catalyst Center understands that the discovered device is connected to both the primary and peer devices, it configures two Layer 3 point-to-point connections when the LAN automation task is stopped. One connection is established between the discovered device and the primary device; the other connection is established between the discovered device and the peer device.



Note If the link between the primary and the peer device is not configured before the LAN automation job is executed, you must select the interface of the primary device that connects to the peer device as part of the LAN automation configuration in Catalyst Center.

Check the LAN Automation Status

LAN Automation's Two-Hop Limitation



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For the preceding topology, Catalyst Center configures the following links:

- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Primary device*
- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Peer device*
- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Discovered device 2*

Consider the scenario where a device—named *Discovered device 3*—is directly connected below *Discovered device 2*. The connection between *Discovered device 2* and *Discovered device 3* is not configured as part of the LAN automation job because it is more than two hops away from *Primary device*.

Check the LAN Automation Status

You can view the status of in-progress LAN automation jobs.

Before you begin

You must have created and started a LAN automation job.

Step 1

From the top-left corner, click the menu icon and choose **Provision > LAN Automation**.

A status pane displays the current status of LAN automation.

Step 2

In the status pane, click **See Session Details**.

You can view the overall status of LAN Automation (In Progress or Completed), and also filter the view based on the discovered or provisioned devices.

- Step 3** In the **LAN Automation** window, click **LAN Automated Devices** tab to view the configuration logs and session logs.

Create a Link Between Interfaces

To add a link between interfaces through LAN Automation, follow these steps:

- Step 1** From the top-left corner, click the menu icon and choose **Provision > LAN Automation**.

- Step 2** On the **LAN Automation** window, in the **LAN Automation Devices** tab, click **Add Link**.

Alternatively, you can create a link from **Workflows > Add Link**.

- Step 3** Follow these steps in the **Add Link** workflow:

- Select the two devices to establish the link.
- Select an IP address pool within the LAN.

Ensure that the IP address pool is reachable from Catalyst Center.

- Select the interfaces on both the devices between which you want to establish a connection.
- Click **Now or Later** to indicate when you want to provision the link.
- Enter a name for the task in the field provided.
- In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
- Click **Start Add Link**.

The **Link Configuration Started Successfully** window is displayed.

- Step 4** (Optional) To view the status of the configuration, click **View Status in Activities**.

Delete a Link Between Interfaces

Use this procedure to delete the interface links that were created during LAN Automation or by performing an Add Link operation.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > LAN Automation**.

- Step 2** On the **LAN Automation** window, in the **LAN Automation Devices** tab, click **Delete Link**.

Alternatively, you can delete a link from **Workflows > Delete Link**.

- Step 3** Follow the steps in the **Delete Link** workflow:

- Select the two devices to delete the interface link.
- Select the interfaces on both these devices between which you want to delete the link.
- Click **Now or Later** to indicate when you want to start the delete process.
- Enter a name for the task in the field provided.
- In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
- Click **Start Delete Link**.

Edit Hostname and Loopback IP Address of LAN Automated Devices

The **LAN Automation configuration has been removed from the selected interfaces** window is displayed.

- Step 4** (Optional) To view the status of the delete link task, click **View Status in Activities**.
-

Edit Hostname and Loopback IP Address of LAN Automated Devices

You can customize the hostname and loopback IP address of devices that are discovered through LAN automation using the reserved IP address pools of the type **LAN**.



Note

- To edit the hostname and loopback IP address of a device on Day-*n*, the device must be in the **Managed** state in the Inventory.
 - You can edit the loopback IP addresses of a maximum of 25 devices in a single Day-*n* workflow.
-

Before you begin

- Discover the devices through LAN automation. For more information, see [Provision a Network Through LAN Automation, on page 551](#).
 - Reserve the required IP address pools of the type **LAN**. For more information, see [Reserve an IP Address Pool, on page 248](#).
-

- Step 1** From the top-left corner, click the menu icon and choose **Provision > LAN Automation**.

- Step 2** In the **LAN Automated Devices** tab of the **LAN Automation** window, check the check box next to the devices that you want to edit.

- Step 3** Click **Edit Device**.

- Step 4** In the **Edit Devices** window, do the following:

- In the **Device Name** field, enter the hostname for the device.
- From the **IP Address Pool** drop-down list, choose an IP address pool.
- In the **IP Address** field, enter an IPv4 address without a subnet mask.

Note The IP address must be within the range of the selected IP address pool.

- Repeat Step 4.a, on page 558, Step 4.b, on page 558, and Step 4.c, on page 558 for each device.
- Click **Validate**.

If the specified IP address isn't available for allocation, Catalyst Center displays an error message. Enter a valid IPv4 address in the corresponding **IP Address** field.

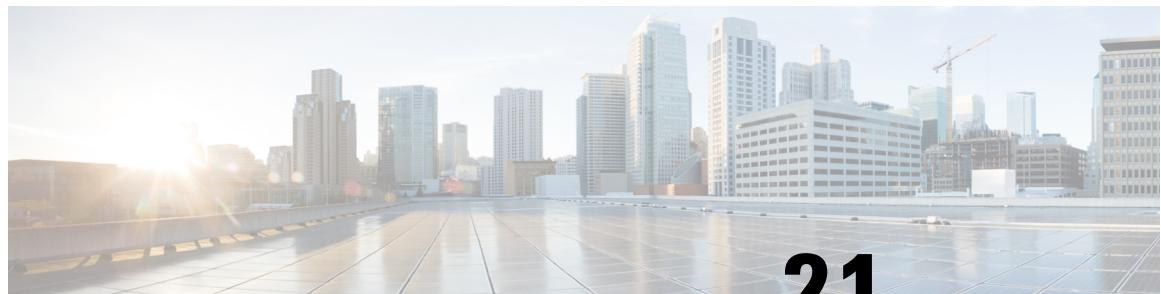
- Click **Next**.

- Step 5** In the **Schedule Edit Device Deployment** window, do one of the following:

- Click the **Now** radio button, name the task, and click **Apply**.

- Click the **Later** radio button; name the task; specify the start date, start time, and time zone; and click **Apply**.
-

Edit Hostname and Loopback IP Address of LAN Automated Devices



CHAPTER 21

Provision Fabric Networks

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- [About Fabric Networks, on page 568](#)
- [Visibility and Control of Fabric Configurations, on page 571](#)
- [Add a Fabric Site, on page 575](#)
- [Configure a Fabric Site, on page 578](#)
- [Add a Device to a Fabric, on page 578](#)
- [Add a Device as a Border Node, on page 582](#)
- [Configure LISP Pub/Sub, on page 586](#)
- [Reconfigure a Fabric, on page 588](#)
- [Create an IP Transit, on page 589](#)
- [Create an SD-Access Transit, on page 590](#)
- [Select an Authentication Template, on page 592](#)
- [Configure Ports Within the Fabric Site, on page 595](#)
- [Configure Wireless SSIDs for Fabric Networks, on page 597](#)
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- [Virtual Networks, on page 599](#)
- [Configure a Fabric Zone, on page 611](#)
- [Configure an Extended Node Device, on page 618](#)
- [Configure Supplicant-Based Extended Nodes, on page 625](#)
- [Configure a Port Channel, on page 631](#)
- [Multicast, on page 635](#)

Cisco SD-Access Zero-Trust Security Solution

Networks need protection against external and internal threats. Cisco SD-Access provides a zero-trust security solution for your workplace. The Cisco SD-Access zero-trust security solution provides secure access to users and devices from all locations across the network.

The Cisco SD-Access zero-trust security solution includes the following capabilities:

- Identify and verify all endpoints: SD-Access establishes an initial level of trust with each connecting endpoint.
- Establish policy and segmentation: SD-Access ensures least-privilege access based on the endpoint and user type.

- Continuously monitor endpoints: SD-Access continuously monitors the endpoints to ensure compliance.
- Threat mitigation: SD-Access allows you to quarantine the endpoints that are noncompliant or exhibit malicious behavior.

The Cisco SD-Access zero-trust security solution provides the flexibility to adopt a path to a zero-trust workplace based on your network settings and services. You can configure how users connect to the network using dynamic rules and automated segmentation.

The Cisco SD-Access zero-trust security solution provides the capability to automate network access policies using the following features:

- Endpoint visibility: You can identify and group endpoints. You can map their interactions through traffic flow analysis and define access policies.
- Trust monitoring: You can continuously monitor the endpoint behavior, scan for vulnerabilities, verify trustworthiness for continued access, and isolate rogue or compromised endpoints.
- Network Segmentation: You can enforce group-based access policies and secure network through multilevel segmentation.

The Cisco SD-Access zero-trust security solution enables you to explore various paths to zero-trust workplace based on your network settings and services. You can discover your optimal path based on your current network status, and explore the benefits of each added step on the zero-trust journey.

Zero-Trust Overview Dashboard

The SD-Access **Zero-Trust Overview** dashboard provides an overview of your zero-trust workplace journey. From the top-left corner, click the menu icon and choose **Provision > Zero-Trust Overview** to view this dashboard.

The zero-trust workplace journey has the following phases:

- Day zero: For starting your zero-trust workplace journey. For more information, see [Day-Zero View of Zero-Trust Overview Dashboard, on page 562](#).
- Day *n*: For ongoing monitoring and configuration changes of your zero-trust workplace journey. For more information, see [Day-n View of Zero-Trust Overview Dashboard, on page 565](#).

Day-Zero View of Zero-Trust Overview Dashboard

Before you start your SD-Access zero-trust workplace journey, the day-zero view of the **Zero-Trust Overview** dashboard consists of the following sections:

Welcome to Cisco SD-Access!

SD-Access offers a turnkey, zero-trust security solution to automate network access policies. Security is deeply embedded within the network, and a software-defined approach allows rapid iteration and innovation.

[Take a Tour](#)

Endpoint Visibility
Identify and group endpoints. Map their interactions through traffic flow analysis and define access policies.

Trust Monitoring

Network Segmentation

Zero-Trust Workplace

Explore and start your journey to SD-Access Zero-Trust Workplace

Explore different paths to Zero-Trust Workplace based on your network settings and services. Flexible adoption pathways to reach complete SD-Access mean there is no one-size-fits-all approach. Discover your optimal path based on where your network is currently, and explore the benefits of each added step on your Zero-Trust journey.

NETWORK CONNECTIVITY

- With Wireless
- With CAT9K
- With Traffic Telemetry Appliance

SERVICES

- With ISE
- With Talos
- With CBAR Enabled

I'm Done Exploring and Ready to Start My Journey

Once you are done exploring your options and have selected your preferred path settings above, click on Start My Journey to start your Cisco SD-Access to Zero-Trust Workplace.

Start my journey with creation of network fabric
 I already have connectivity and want to start with Endpoint Visibility

[Start My Journey](#)

- **Welcome to Cisco SD-Access!**: This section consists of an overview video that provides a short overview of the multiple paths towards a full SD-Access zero-trust workplace. It also consists of a circle containing sections for each pillar of the SD-Access zero-trust workplace:

- **Endpoint Visibility**

Get Started with SD-Access Zero-Trust Workplace Journey

- Trust Monitoring
- Network Segmentation

Hover your cursor over each section to view more information.

- **Explore and start your journey to SD-Access Zero-Trust Workplace:** This section allows you to explore the different paths to a zero-trust workplace based on your network settings and services, and discover the optimal path for your network. This section consists of the **Network Connectivity** and **Services** options, and a circular journey map with details about the paths. Based on the options that you choose for network connectivity and services, the journey map displays the available paths to your zero-trust workplace journey.

To view details about each recommended step in the journey map, hover your cursor over the corresponding step around the journey map.

- **I'm Done Exploring and Ready to Start My Journey:** After exploring the paths and selecting your preferred settings, use this section to start your journey to a zero-trust workplace.

Get Started with SD-Access Zero-Trust Workplace Journey

Step 1 From the top-left corner, click the menu icon and choose **Provision > Zero-Trust Overview**.

Step 2 Under **Explore and start your journey to SD-Access Zero-Trust Workplace**, do the following:

- a) For **Network Connectivity** settings, choose the required options:
 - Enable **With Wireless** to use wireless devices in your zero-trust workplace journey.
 - Enable **With CAT9K** to use Cisco Catalyst 9000 Series devices or enable **With Traffic Telemetry Appliance** to use the Catalyst Center Traffic Telemetry Appliance in your zero-trust workplace journey.
- b) For **Services** settings, choose the required options:
 - Enable **With ISE** to use Cisco Identity Services Engine in your zero-trust workplace journey.
 - Enable **With Talos** to use Talos Intelligence in your zero-trust workplace journey.
 - Enable **With CBAR Enabled** to use Controller-Based Application Recognition (CBAR) in your zero-trust workplace journey.
- c) (Optional) To view details about each recommended step in the journey map, hover your cursor over the corresponding step around the journey map.

Step 3 Under **I'm Done Exploring and Ready to Start My Journey**, choose one of the following options:

- To create a fabric network and start your journey towards a zero-trust workplace, click **Start my journey with creation of network fabric**.
- If you already have fabric network connectivity and want to start your journey towards zero-trust workplace with endpoint visibility, click **I already have connectivity and want to start with Endpoint Visibility**.

Step 4 Click **Start My Journey**.

Step 5 In the **Modify Journey Map** dialog box, do the following:

- a) Review your journey map settings.

Note

- Catalyst Center displays a message if it doesn't discover the selected services for your network.
- Catalyst Center displays a message if it discovers additional services that were not selected in the journey.

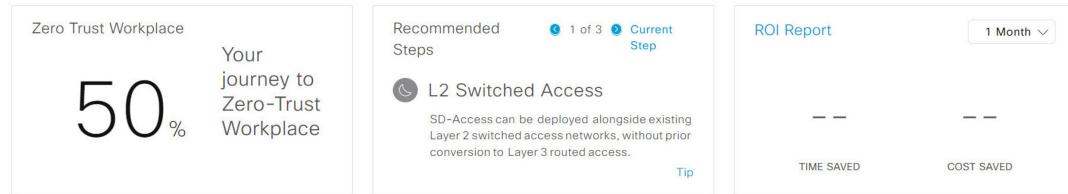
- b) (Optional) To remove a selected service from your journey map settings, uncheck the corresponding check box.
 - c) Click **Confirm**.
-

Day-*n* View of Zero-Trust Overview Dashboard

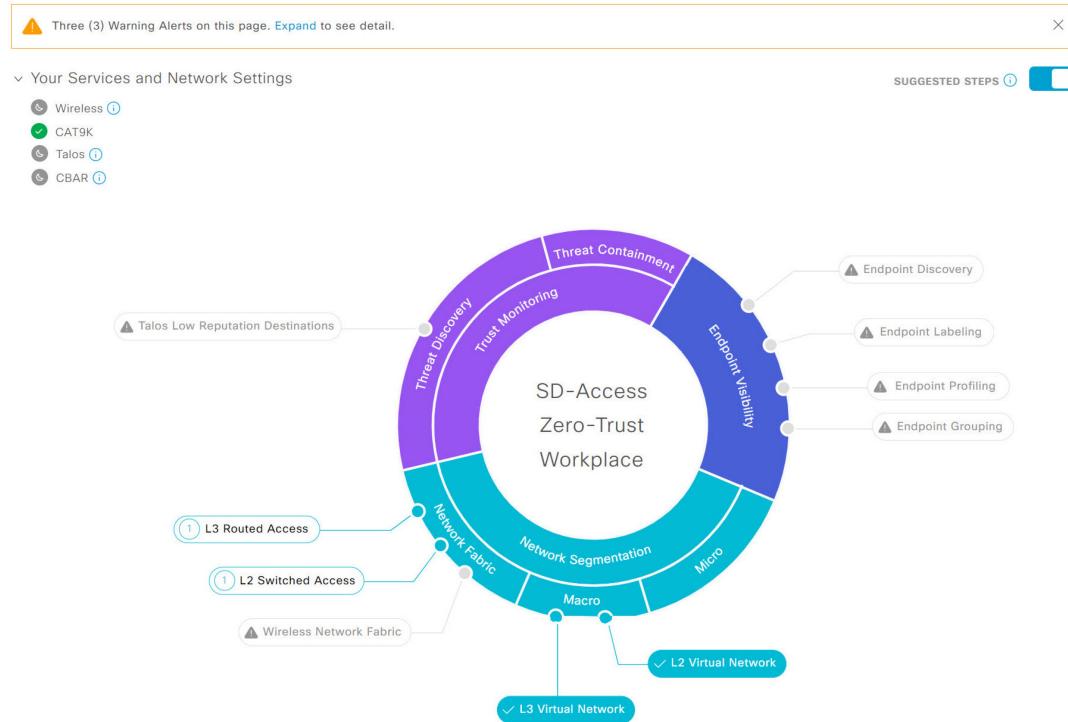
After starting your SD-Access zero-trust workplace journey, the day-*n* view of the **Zero-Trust Overview** dashboard consists of the following sections:

Day-n View of Zero-Trust Overview Dashboard

Your Journey to SD-Access Zero-Trust Workplace

[Take a Tour](#)

Your Journey Map

[Modify My Journey](#) [Hide Map](#)

Your SD-Access Overview



- **Your Journey to SD-Access Zero-Trust Workplace:** This section consists of the following dashlets:
 - The **Zero Trust Workplace** dashlet displays the percentage progress of your zero-trust workplace journey.
 - The **Recommended Steps** dashlet displays the next recommended steps for your zero-trust workplace journey. Use the arrow buttons (and) to scroll through all the steps. This dashlet also displays the tips for some steps. If available, click **Tip** to view the tips for the corresponding step.

- The **ROI Report** dashlet displays the time and cost savings based on the implemented steps as you progress through your zero-trust workplace journey. Use the drop-down in this dashlet to choose the time period for the report. Click **ROI Report** to view the report.

- **Your Journey Map:** This section displays the details of network connectivity and service settings for your zero-trust workplace journey. Click **Modify My Journey** to modify your zero-trust workplace journey. Click **Hide Map** to hide the journey map.

This section displays the warning alerts for your journey, if available. Click **Expand** to view the details of the alerts. If a selected service is currently unavailable in your network and you want to remove it from your journey, click the corresponding **Remove From Journey** option. If you want to get a selected service that is currently unavailable in your network, click the corresponding hyperlink to get the service.

Expand the **Your Services and Network Settings** drop-down to view the list of selected services for your journey. The  icon next to a service indicates that the service is currently available in your network. The  icon next to a service indicates that the service is currently unavailable in your network. Hover your cursor over the corresponding  icon to view the **Update Needed** dialog box with details about the unavailable service. In the **Update Needed** dialog box, do the following:

- To remove the service from your journey, click **Remove From Journey**.
- To get the unavailable service in your network, click the corresponding hyperlink.

Enable the **Suggested Steps** toggle button to view the suggested order of steps around your journey map.

To view details about each step in the journey map, hover your cursor over the corresponding step around the journey map.

The  icon next to a step indicates that the corresponding configurations are incomplete. A number next to a step (for example, ) indicates the suggested order of the recommended steps for your journey map. The  icon next to a step indicates that the corresponding configurations are complete.

- **Your SD-Access Overview:** This section consists of dashlets for each functional area of your zero-trust workplace journey. Click the corresponding **Go to Page** option to open the relevant window. Each dashlet indicates its corresponding pillar of the zero-trust workplace journey in its upper-right corner.

Modify SD-Access Zero-Trust Workplace Journey

Step 1 From the top-left corner, click the menu icon and choose **Provision > Zero-Trust Overview**.

Step 2 Under **Your Journey Map**, click **Modify My Journey**.

Step 3 Under **Explore and start your journey to SD-Access Zero-Trust Workplace**, do the following:

a) For **Network Connectivity** settings, choose the required options:

- Enable **With Wireless** to use wireless devices in your zero-trust workplace journey.
- Enable **With CAT9K** to use Cisco Catalyst 9000 Series devices or enable **With Traffic Telemetry Appliance** to use the Catalyst Center Traffic Telemetry Appliance in your zero-trust workplace journey.

b) For **Services** settings, choose the required options:

About Fabric Networks

- Enable **With ISE** to use Cisco Identity Services Engine in your zero-trust workplace journey.
 - Enable **With Talos** to use Talos Intelligence in your zero-trust workplace journey.
 - Enable **With CBAR Enabled** to use Controller-Based Application Recognition (CBAR) in your zero-trust workplace journey.
- c) (Optional) To view details about each recommended step in the journey map, hover your cursor over the corresponding step around the journey map.

Step 4 Under **I'm Done Exploring and Ready to Start My Journey**, choose one of the following options:

- To create a fabric network and start your journey towards a zero-trust workplace, click **Start my journey with creation of network fabric**.
- If you already have fabric network connectivity and want to start your journey towards zero-trust workplace with endpoint visibility, click **I already have connectivity and want to start with Endpoint Visibility**.

Step 5 Click **Modify My Journey**.

Step 6 In the **Modify Journey Map** dialog box, do the following:

- a) Review your journey map settings.

Note	<ul style="list-style-type: none"> • Catalyst Center displays a message if it doesn't discover the selected services for your network. • Catalyst Center displays a message if it discovers additional services that were not selected in the journey.
-------------	--
 - b) (Optional) To remove a selected service from your journey map settings, uncheck the corresponding check box.
 - c) Click **Confirm**.
-

About Fabric Networks

A fabric network is a logical group of devices that is managed as a single entity in one or multiple locations. Having a fabric network in place enables several capabilities, such as the creation of virtual networks and user and device groups, and advanced reporting. Other capabilities include intelligent services for application recognition, traffic analytics, traffic prioritization, and steering for optimum performance and operational effectiveness.

Catalyst Center allows you to add devices to a fabric network. These devices can be configured to act as control plane, border, or edge devices within the fabric network.

Fabric Sites

A fabric site is an independent fabric area with a unique set of network devices: control plane, border, edge, wireless controller, ISE PSN. Different levels of redundancy and scale can be designed per site by including local resources: DHCP, AAA, DNS, Internet, and so on.

A fabric site can cover a single physical location, multiple locations, or only a subset of a location:

- Single location: branch, campus, or metro campus

- Multiple locations: metro campus + multiple branches
- Subset of a location: building or area within a campus

A Software-Defined Access fabric network may comprise multiple sites. Each site has the benefits of scale, resiliency, survivability, and mobility. The overall aggregation of fabric sites accommodates a large number of endpoints and scales modularly or horizontally. Multiple fabric sites are interconnected using a transit.

Transits

A transit is a site that interconnects two or more fabric sites or connects the fabric site with external networks (Internet, data center, and so on). There are two types of transit networks:

- IP transit: Uses a regular IP network to connect to an external network or to connect two or more fabric sites. It leverages a traditional IP-based (VRF-LITE, MPLS) network, which requires remapping of VRFs and SGTs between sites.
- SD-Access transit: Uses LISP/VxLAN encapsulation to connect two fabric sites. The SD-Access transit area may be defined as a portion of the fabric that has its own control plane nodes, but does not have edge or border nodes. However, it can work with a fabric that has an external border. With an SD-Access transit, an end-to-end policy plane is maintained using SGT group tags.

Fabric Readiness, Image Compatibility, and Compliance Checks

Fabric Readiness Checks

Fabric readiness checks are a set of preprovisioning checks done on a device to ensure that the device is ready to be added to the fabric. Fabric readiness checks are now done automatically when the device is provisioned. Interface VLAN and Multi VRF configuration checks are not done as part of fabric readiness checks.

Fabric readiness checks include the following:

- Connectivity check: Checks for the necessary connectivity between devices; for example, connectivity from the edge node to map server, from edge node to border, and so on.
- Existing configuration check: Checks for any configuration on the device that conflicts with the configuration that is pushed through SD-Access and can result in a failure later.
- Hardware version: Checks if the hardware version of the device is supported.
- Image type: Checks if the device is running with a supported image type (IOS-XE, IOS, NXOS, Cisco Controller).
- Loopback interface: Checks for the loopback interface configuration on the device. A device must have a loopback interface numbered 0 with an IP address configured on it to work with the SDA application. Lack of a loopback interface numbered 0 may cause fabric provisioning errors because Loopback0 is used as the routing locator (RLOC) by default.
- Software license: Checks if the device is running with an appropriate software license.

If an error is detected during any of the fabric readiness checks, an error notification is displayed on the topology area. You can correct the problem and continue with the provisioning workflow for the device.

Image Compatibility Check

To ensure the network devices (before and after a fabric deployment) are compatible with the recommended or supported software image versions based on the Catalyst Center package version, Catalyst Center performs Image Compatibility check to evaluate the network devices.

If a network device is running an incompatible software image, the  icon is displayed in the **Provision > Inventory > Image Compatibility** column. You can check the supported software image versions for your device from the [Cisco SD-Access Compatibility Matrix](#) and continue with the provisioning workflow for the device.

Fabric Compliance Checks

Fabric compliance is a state of a device to operate according to the user intent configured during the fabric provisioning. Fabric compliance checks are triggered based on the following:

- Every 24 hours for wired devices and every six hours for wireless devices.
- When there is a configuration change on the wired device.

A configuration change on the wired device triggers an SNMP trap, which in turn triggers the compliance check. Ensure that you have configured the Catalyst Center server as an SNMP server.

The following compliance checks are done to ensure that the device is fabric compliant:

- Virtual Network: Checks whether the necessary VRFs are configured on the device to comply with the current state of the user intent for the VN on Catalyst Center.
- Fabric Role: Checks whether the configuration on the device is compliant with the user intent for a fabric role on Catalyst Center.
- Segment: Checks the VLAN and SVI configuration for segments.
- Port Assignment: Checks the interface configuration for the VLAN and authentication profile.

Fabric Health Check

The health of SD-Access application is checked periodically to provide an indication of the application status. SD-Access health check also includes the check for stale database entries in the SD-Access application, which could potentially disrupt fabric provisioning.

You can check the status of SD-Access application on the **System > System 360 > System Health** page. For more information about how to check the health of an application, see “Use System 360” and “Monitor System Health” in the [Cisco Catalyst Center Administrator Guide](#).

You can also use the Validation Tool to run the same checks by subscribing to the SD-Access Application Health status. Validation Tool is available on the **System > System 360 > System Health** page. When you run a new validation, ensure that you check the **Application Health Status** check box under the **Validation Set(s) selection** field. For more information on how to access and run the Validation Tool, see “Use the Validation Tool” in the [Cisco Catalyst Center Administrator Guide](#).

SD-Access application status can have three values:

- **HEALTHY**—Indicates that the SD-Access application is working as expected and all provisioning activities are allowed.

- **UNHEALTHY**—Indicates that the SD-Access application is not working due to dependent services not being healthy. This condition may block all provisioning activities in the SD-Access fabric.

- **DEGRADED**—Indicates that all dependent services are working but there are database inconsistencies in the SD-Access application. This condition may affect the functioning or provisioning of one or more fabric sites.

If your SD-Access application is in the DEGRADED state, contact Cisco TAC to resolve the issue.

Visibility and Control of Fabric Configurations

The Visibility and Control of Configurations feature provides a solution to further secure your planned network configurations before deploying them on to your devices. With enhanced visibility, you can enforce the previewing of device configurations (CLI and NETCONF commands) before deploying them. With enhanced control, you can ensure only authentic and authorized configurations are provisioned onto your network devices through an IT Service Management (ITSM) check. These two options also offer you the flexibility to preview configurations at your own pace. You can preview the configurations immediately in a visibility-and control-supported workflow or later in the **Activities > Tasks** window.

By default, the Visibility and Control of Configurations settings are configured as follows:

- Visibility of Configurations (**Configuration Preview**) is enabled.
- Control of Configurations (**ITSM Approval**) is disabled.

To enable or disable these settings, see "Enable Visibility and Control of Configurations" in the [Cisco Catalyst Center Administrator Guide](#).



Note If a provisioning workflow supports Visibility and Control of Configurations, the following banner message is displayed when you schedule the deployment of your task:

This workflow supports enforcing network administrators and other users to preview configurations before deploying them on the network devices. To configure this setting, go to **System > Settings > Visibility and Control of Configurations**.

Visibility and Control of Configurations Workflow

When it's time to schedule your task during a provisioning workflow, depending on the Visibility and Control of Configurations settings, you can do the following:

- If **Configuration Preview** is enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because you must preview the device configurations before deploying them.
- If **Configuration Preview** and **ITSM Approval** are enabled, **Generate configuration preview** is selected by default. This means that the **Now** and **Later** scheduling options are dimmed (unavailable) because you must preview the device configurations and submit them to an IT administrator for approval before deploying them.
- If **Configuration Preview** and **ITSM Approval** are disabled, you can choose any available option (**Now**, **Later**, or **Generate configuration preview**).

If you choose **Generate configuration preview**, Catalyst Center performs the following the high-level steps:

Step		Description
1	A set of network provisioning prechecks to ensure a seamless provisioning operation.	<p>On the Performing Initial Checks window, Catalyst Center checks for and notifies you of any Pending Operations and Device Compliance issues.</p> <p>You must address all the identified issues and perform a recheck to ensure all the validations are successful. For more information, see Network Provisioning Prechecks, on page 137.</p>
2	Prepare the chosen devices to generate the configurations.	<p>On the Preparing Devices and Configuration Models window, if the provisioning workflow supports the workflow progression view, the steps the system takes to prepare a listed device are displayed. Otherwise, an in-progress message is displayed.</p> <p>Because this preparation step can take some time, you can exit the workflow and return to it later while the system continues the process in the background.</p>
3	Display the device configurations for the first listed device.	<p>On the Preview Configuration window, Catalyst Center displays a side-by-side comparison of the running configuration and the planned configuration for the first listed device.</p> <p>You can review the device configurations and then, when you're ready, deploy them or submit them for ITSM approval.</p>

While reviewing the configurations on the **Preview Configuration** window, you can do the following:

To...	Do this...
Preview the configuration of a device.	Choose a device in the left pane.
Filter the data in the configuration preview pane.	From the View by Configuration Source drop-down list, choose an available option.
View a side-by-side comparison of the planned configuration and the running configuration, or view only the planned configuration.	<p>Click the view switcher ().</p> <p>Note Viewing YANG configurations in the side-by-side comparison view isn't supported.</p>

To...	Do this...
Highlight corresponding commands between the running and planned configurations.	<p>Click one command in one configuration to highlight the corresponding command in the other configuration.</p> <p>Note Keep the following limitations in mind:</p> <ul style="list-style-type: none"> The system supports only side-by-side highlighting for first-level commands, not sublevel commands. All commands must be a complete match for the system to display the side-by-side highlighting between configurations. If you click any commands starting with <code>no</code> in one configuration, the system will ignore the <code>no</code> portion when checking for a match in the other configuration.
Search for a value in the displayed configuration.	Use the Search configuration field.
Display the workflow progression view.	<p>Choose a device in the left pane, and then click Back to workflow progress in the top-right corner of the right pane. To return to the configuration preview pane, click Go to generated config.</p> <p>Note Back to workflow progress and Go to generated config are only available if the workflow supports the workflow progression view.</p>
Exit the workflow and review the device configurations later.	<p>Click Exit and Preview Later. When you're ready to continue reviewing the configurations, go to the Activities > Tasks window and open the relevant work item.</p>

After reviewing the configurations, depending on the Visibility and Control of Configuration settings, you can do the following:

To...	Do this...
Discard the work item permanently.	Click Discard and, in the Warning dialog box, click Yes . If you discard it, you can't recover it later.

To...	Do this...
Retain any generated configurations and discard all other resources.	<p>Click Discard and, in the Discard dialog box, check the Retain generated configs (if any) check box and click Accept.</p> <p>Tip If a configuration preview fails, consider retaining any generated configurations and discarding all other resources so that you or your IT administrator can inspect the issue.</p> <p>If you retain any generated configurations and discard all other resources, Exit displays instead of Exit and Preview Later because you've previewed all the configurations and discarded the nongenerated ones.</p>

To...	Do this...
Deploy the configurations or submit them for ITSM approval.	<p>Click Deploy or Submit for ITSM Approval.</p> <p>Note</p> <ul style="list-style-type: none"> If Save Intent displays instead of Deploy, the parameters that you chose during the workflow are already present on the device. To save those parameters to the database, click Save Intent. No configuration is pushed to the device because the device already has the required configuration. If there are multiple devices, you must click each device to preview its configuration. However, when you click Deploy, the configurations are pushed to all the devices even if the configurations have not been previewed on all devices. <p>In the slide-in pane, schedule the time and date of the deployment and, if you're submitting the configurations for ITSM approval, add notes for the IT administrator. Then click Submit.</p> <p>You can check the work item's approval status or the task's deployment status on the Tasks window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it is deployed at the scheduled time.</p> <p>Note</p> <p>When you preview the configurations, Catalyst Center creates a snapshot of the configuration previews. If there are any changes in the network settings or network profiles after this operation is scheduled for deployment, the changes are not included during the device provisioning.</p>

Add a Fabric Site

Before you begin

You can create a fabric site only if IP Device Tracking (IPDT) is already configured for the site.

Add a Fabric Site

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
- Step 2** Under **SUMMARY**, click the number that indicates the count of the fabric sites.
- The resulting window displays every fabric site that has already been created and its information (such as Health Score, Fabric Zones, Fabric Devices, Fabric Roles, and Connected Transits) in a tabular format.
- You can customize the table view to display only selected columns. Use the gear icon at the top right corner of the window to edit the **Table Settings** and **Apply** the changes.
- Step 3** Click **Create Fabric Sites**.
- Alternatively, instead of the first three steps, click the menu icon and choose **Workflow > Create Fabric Sites and Fabric Zones**.
- Step 4** In the **Create Fabric Sites** window, click **Let's Do it** to go directly to the workflow.
- Step 5** In the **Fabric Site Location** window, choose an area, building, or floor to add as a fabric site.
- Step 6** In the **Wired Endpoint Data Collection** window, ensure that the **Wired Endpoint Data Collection** check box is checked.
- Step 7** In the **Authentication Template** window, do the following:
- Choose an authentication template for the fabric site:
 - Closed Authentication**: Any traffic before authentication is dropped, including DHCP, DNS, and ARP.
 - Open Authentication**: A host is allowed network access without having to go through 802.1X authentication.
 - Low Impact**: Security is added by applying an ACL to the switch port, to allow very limited network access before authentication. After a host has been successfully authenticated, additional network access is granted.
 - None**
 - (Optional) If you choose **Closed Authentication**, **Open Authentication**, or **Low Impact**, click **Edit** to edit the authentication settings:
 - First Authentication Method**: Choose **802.1x** or **MAC Authentication Bypass (MAB)**.
 - 802.1x Timeout (in seconds)**: Use the slider to specify the 802.1x timeout, in seconds.
 - Wake on LAN**: Choose **Yes** or **No**.
 - Number of Hosts**: Choose **Unlimited** or **Single**.
 - BPDU Guard**: Use this check box to enable or disable the Bridge Protocol Data Unit (BPDU) guard on all the **Closed Authentication** ports.
 - Pre-Authentication Access Control List**: Enable the toggle button to configure preauthentication control for **Low Impact** authentication. From the **Implicit Action** drop-down list, choose an implicit action and enter a description for the rule. To add an access contract, click **Add Contract Action**, choose the rules, and click **Apply Table**.
- Step 8** (Optional) In the **Fabric Zones** window, choose one of the following options:
- To designate fabric zones later, click **Setup Fabric Zones Later**.
 - To designate fabric zones and create scoped subnets, click **Setup Fabric Zones Now** and choose a fabric site from the network hierarchy displayed.

Step 9 In the **Summary** window, review the fabric site settings.

You can edit any of the fabric site or zone settings here.

Step 10 In the **Fabric Site Creation Scheduler** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations](#).

Step 11 Click **Deploy**.

Step 12 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 13 If you chose **Generate configuration preview** in the **Fabric Site Creation Scheduler** window, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations](#).

- c. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

When the configurations are successfully submitted, a success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will be deployed at the scheduled time, which you can view on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time.

- Step 14** It takes a few seconds for the site and zones to be provisioned. Upon successful creation of the site, a Fabric Site Creation Completed message is displayed.

Next, you are provided with options to either create a new fabric site or view the activities on the **Tasks** window.

Configure a Fabric Site

After you create a fabric site, you can configure the devices, virtual networks, and authentication methods for the hosts to connect to a fabric site.

Select a fabric site under the **Provision > SD-Access > Fabric Sites** menu and use the following tabs:

- **Fabric Infrastructure:** Assign devices to fabric roles.
- **Layer 3 Virtual Networks:** Create a Layer 3 virtual network for the fabric site or assign an existing Layer 3 virtual network to the fabric site.
- **Layer 2 Virtual Networks:** Create a Layer 2 virtual network for the fabric site or assign an existing Layer 2 virtual network to the fabric site.
- **Anycast Gateways:** Create an Anycast Gateway for a Layer 3 virtual network in the fabric site.
- **Authentication Template:** Select an authentication template for the fabric.
- **Wireless SSIDs:** Specify wireless SSIDs within the network that hosts can access. You can select the guest or enterprise SSIDs and assign address pools.
- **Port Assignment:** Apply specific configurations to each port, depending on the type of device that connects to the fabric site.

Each of these operations is explained in the later sections.

Note the following constraints:

- Cisco SD-Access deployments support only APs, extended nodes, user devices (such as a single computer or a single computer plus phone), and devices that need trunk ports, such as single servers.
- Servers with internal switches or virtual switches aren't supported.
- Other networking equipment (such as hubs, routers, or switches) isn't supported.

Add a Device to a Fabric

After you have created a fabric site, you can add devices to the fabric site. You can also specify whether the device should act as a control plane node, an edge node, or a border node.

You can add a new device to the fabric site only if IP Device Tracking (IPDT) is configured for the fabric site.

A device that is assigned the Access role and has been provisioned before enabling IPDT on the site can't be added to the fabric. Reprovision such devices before adding them to the fabric site. Check the Provision workflow to confirm the status of **Deployment of IPDT** on the device.



Note

- It's optional to designate the devices in a fabric site as control plane nodes or border nodes. You might have devices that don't occupy these roles. However, every fabric site must have at least one control plane node device and one border node device. In the current release for wired fabric, you can add up to six control plane nodes for redundancy.
- Currently, the Cisco Wireless Controller communicates only with two control plane nodes.

Before you begin

Provision the device if you haven't already provisioned it:

- The **Provision > Network Devices > Inventory** window displays the discovered devices.
- The topology view shows a device in gray if it has passed the fabric readiness checks and is ready to be provisioned.
- If an error is detected during any of the fabric readiness checks, an error notification is displayed on the topology area. Click **See more details** to check the problem area listed in the resulting window. Correct the problem and click **Re-check** to ensure that the problem is resolved.
- If you update the device configuration as a part of problem resolution, ensure that you resynchronize the device information by performing an **Inventory > Resync** for the device.



Note

You can continue to provision a device that has failed the fabric readiness checks.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2

Under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3

Select the fabric site to add a device.

The resulting topology view displays all devices in the network that have been inventoried. In the topology view, any device that is added to the fabric is shown in blue.

Step 4

From the **List** view under the **Fabric Infrastructure** tab, click a device. A slide-in pane displays the following **Fabric** options:

Option	Description
Edge Node	Toggle the button next to this option to enable the selected device as an edge node.
Border Node	Toggle the button next to this option to enable the selected device as a border node.
Control Plane Node	Toggle the button next to this option to enable the selected device as a control plane node.

Add a Device to a Fabric

To configure a device as a fabric-in-a-box, select the **Control Plane Node**, **Border Node**, and **Edge Node** options.

To configure the device as a control plane and a border node, select both **Control Plane Node** and **Border Node**.

Step 5

(Optional) To enable the wireless capability for the device, under **Capability**, click the **Embedded Wireless LAN Controller** toggle button and do the following:

Alternatively, if the toggle button is already enabled, you can click **Configure** to configure the wireless settings.

- If you have not installed the wireless package on the device yet, Catalyst Center displays a warning message indicating that the embedded wireless controller software image is necessary for enabling the capability. In the warning dialog box, click **OK** to install the image manually.
- Under **Download Image**, click **Choose File** to navigate to a software image stored locally, or **Enter image URL** to specify an HTTP or FTP source from which to import the software image.
- Click **Import**.

The progress of the image import is displayed. To exit the window, and view the progress of the import and schedule the installation later, click **Close**.

- After the image import is complete, under **Schedule Image Installation** on **Download Image**, choose one of the following options:

- **Now**: Immediately install the image.
- **Later**: Schedule the image installation for a later date or time.

- In the **Task Name** field, update the task name, if required.

- If you chose **Later**, do the following:

- Under **Start Date/Time**, specify a start date and time for the image installation.
- To use the default site time zone for the image installation, check the **Site Settings** check box. To select a time zone, uncheck the **Site Settings** check box and choose a time zone from the drop-down list.

- Click **Apply**.

To view the status of image installation, go to the **Activities > Tasks** window and open the relevant work item. After the software image is distributed and activated on the switch, you must resynchronize the device using the **Provision > Inventory > Resync** option.

- Under **Manage Scope**, do the following:

- Under the **Primary** tab, check the check box next to the required site name.
- Under the **Secondary** tab, check the check box next to the required site name.

You can select either a parent site or individual sites. If you select a parent site, all the children under the parent site are also selected. You can uncheck the check box to deselect an individual site.

You can also use the **Search Hierarchy** search field or the filter icon to find a site.

- Click **Next**.

- Under **Advanced**, to enable the Rolling AP Upgrade feature, check the **Enable** check box.

(Optional) If you check this check box, from the **AP Reboot Percentage** drop-down list, choose a percentage.

- Click **Next**.

- Under **Summary**, review the configuration settings.

- Click **Save**.

If the wireless capability is enabled for a device and there are changes in the wireless network settings, to push the changes to the device, you must click **Configure** and save the configuration.

Step 6 Click **Add** to save the configurations.

Step 7 Click **Deploy** under the **Fabric Infrastructure** tab to configure the device.

Depending on the Visibility and Control of Configurations settings, choose an available option for deployment:

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations](#).

Note A device is added to the fabric only if the device runs a software release that is compatible with the Catalyst Center release. For information about fabric device compatibility, see [Cisco SD-Access Compatibility Matrix](#).

For a given fabric role, if the software image on the device isn't compatible with the Catalyst Center release, the device isn't added to the fabric and an error message is displayed.

Step 8 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9 If you chose **Generate configuration preview** in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:

- a. Review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- b. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- c. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- d. Click **Submit**.

Add a Device as a Border Node

When the configurations are successfully submitted, a success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time, which you can view on the **Tasks** window.

What to do next

After a device is added to the fabric, fabric compliance checks are automatically performed to ensure that the device is fabric-compliant. The topology displays a device that has failed the fabric compliance check in blue color with a cross-mark beside it. Click **See more details** on the error notification to identify the problem area and correct it.

Add a Device as a Border Node

When you add a device to a fabric, you can add it in various combinations to act as a control plane node, border node, or edge node, as described in [Add a Device to a Fabric, on page 578](#).

This section describes how to add a device as a border node and configure the following:

- Border node type: Internal, External, or Internal and External ([Step 9, on page 583](#))
- Border node Priority ([Step 10, on page 583](#))
- Border node Affinity-ID ([Step 10, on page 583](#))
- TCP MSS Adjustment value on the border node switched virtual interfaces (SVIs) ([Step 10, on page 583](#))
- AS Path Prepend ([Step 10, on page 583](#))
- Associated transit: SD-Access transit or IP-based transit ([Step 11, on page 584](#))
- IP address pool allocation for Layer 3 handoff ([Step 11, on page 584](#))

Before you begin

To use the Border Node Affinity-ID feature, ensure that you create an SD-Access LISP Pub/Sub transit. For more information, see [Create an SD-Access Transit, on page 590](#). When adding the first control plane node in the local fabric site, ensure that you select the LISP Pub/Sub control plane protocol. For more information, see [Configure LISP Pub/Sub, on page 586](#). The border node must be running Cisco IOS XE Release 17.8.1 or later.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
- Step 2** In the **Fabric Sites** tab, under **SUMMARY**, click the number that indicates the count of fabric sites.
- Step 3** In the **Fabric Sites** window, select the fabric site to configure a border node.
The resulting topology view displays all the devices in the network inventory. In the topology view, any device that is operating in a fabric role is shown in blue.
- Step 4** Under the **Fabric Infrastructure** tab, click a device.

- Step 5** In the slide-in pane, click the **Border Node** toggle button.
- Step 6** In the resulting slide-in pane, click the **Layer 3 Handoff** tab.
- Step 7** Check the **Enable Layer 3 Handoff** check box.
- Step 8** Enter the **Local Autonomous Number** for the device.
If the local autonomous number is already configured on the device, this field displays the configured number and is disabled. You cannot change the local autonomous number if it's already configured on the device.
- Step 9** Configure the type of border node. By default, a border node is designated as an external border node, wherein it acts as the default gateway to the fabric site, without importing any external routes.
A border node can be configured to be an internal border node, wherein it isn't the default gateway and only imports external routes. A border node can also have a combined role of internal and external borders.
- Check both the **Default to all virtual networks** and **Do not import external routes** check boxes to designate the border as an external border node.
 - Uncheck both the **Default to all virtual networks** and **Do not import external routes** check boxes to designate the border as an internal border node.
 - Check the **Default to all virtual networks** check box to designate the border node as an external and internal border. It acts as the fabric default gateway and also imports BGP-learned routes into the fabric site. (Don't check the **Do not import external routes** check box.)

For information about border node types, see the [Cisco SD-Access Solution Design Guide](#).

- Step 10** To configure the border node priority, affinity-ID, AS Path Prepend, TCP MSS adjustment and native multicast across SD-Access transit, click **Advanced** and configure the following:
- a) To change the border node priority, check the **Modify Border Priority** check box and enter a new priority value.
 - Priority value ranges from 1 to 10.
 - 1 indicates the highest priority.
 - 10 indicates the lowest priority.
 - The default priority value is 10.

If two or more border nodes are configured in a fabric site, traffic is routed through the border node that has a higher priority. If the priority values are the same, traffic is load balanced across the border nodes.

- b) (Optional) To configure the border node affinity-ID, check the **Modify Border Node Affinity-ID** check box and enter values for the following fields:
 - **Affinity-ID Prime**: A lower relative prime value indicates a higher preference.
 - **Affinity-ID Decider**: When the prime value is the same for two border nodes, the decider value is used as a tie-breaker to determine the border node preference.

Affinity-ID is a relative value, considering the value of this border node among the received values from all the other available border nodes. The lower the relative value of affinity-ID, the higher the preference for a destination border node. By default, the affinity-ID value isn't provisioned.

When the received affinity-ID values are equal, priority is used to determine the border node preference.

- Note** For proper functionality of the Affinity-ID feature, ensure that you configure an affinity-ID on all border nodes connected to the same SD-Access transit.

Add a Device as a Border Node

- c) To define the number of AS Path prepends to the BGP AS_PATH list, check the **AS Path Prepending** check box and enter a value between 1 to 10.

AS Path prepending helps you to choose the ingress border.

- d) To customize the TCP maximum segment size (MSS) value for the Layer 3 handoff SVIs, check the **TCP MSS Adjustment** check box and input the required value.

The TCP MSS Adjustment value can range from 500 to 1440. **TCP MSS Adjustment** value is applicable for the TCP sessions over both IPv4 and IPv6.

Note You can customize the TCP MSS value only if the border device is configured for Layer 3 handoff.

- e) (Optional) To configure native multicast over multiple sites that are connected to an SD-Access transit, check the **Enable Multicast over SD-Access Transit** check box.

Note Ensure that you enable a similar check box for the SD-Access transit too.

You can view the border node priority and affinity-ID deployment logs in **Activities > Audit Logs**.

Step 11

Hover your cursor over **Add Transit Site** and select a transit that will be connected to this border node.

In an **IP:BGP IP TRANSIT**, you can choose to either automate the IP address allocation for a virtual network or manually assign the Local and Peer IP addresses for a virtual network. You cannot do both.

- a) (Optional) To enable Catalyst Center to allocate IP address for the connection between the border node and peer, choose an IP address pool from the **Select IP Address Pool** drop-down list.

Note **Select IP Address Pool** is disabled if you have manually assigned the Local and Peer IP addresses.

- b) To configure the handoff interface, click **Add External Interface**.

Do the following steps in the resulting window:

1. Select an interface from the **External Interface** drop-down.
2. The **Remote AS Number** is automatically derived from the selected Transit or Peer network.
3. (Optional) Enter the a description for the interface in the **Interface Description** field.
4. (Optional) From the **Actions** drop-down list, choose **Enable All** or **Disable All**.
5. Click the **Enable Layer 3 Handoff** toggle button for the virtual network. This virtual network is advertised by the border node to the peer through BGP. You can select one, multiple, or all virtual networks.
6. In the **VLAN ID** field, enter an ID for the selected virtual network.
7. (Optional) To manually assign the IPv4 and IPv6 **Local IP Address** and **Peer IP Address** for the selected virtual network, enter the IP addresses and subnet mask in the CIDR notation (IP address/prefix-length).

Note The **Local IP Address** and **Peer IP Address** fields are disabled if you have already selected an IP Pool.

8. Click **Save**.

- c) Click **Add**.

Step 12

(Optional) Perform this step only if you are connecting a traditional network to the fabric site or you are migrating from a traditional network to an SD-Access network. Click the **Layer 2 Handoff** tab.

A list of virtual networks and the count of IP address pools in each virtual network is displayed.

- a) Click a virtual network that is to be handed off.

A list of IP address pools that are present in the virtual network and a list of interfaces through which you can connect to the traditional network are displayed.

- b) From the **External Interface** drop-down, choose an interface.
- c) Under **Interface Description**, enter an optional description for the interface.
- d) In the **External VLAN** field, enter the VLAN number into which the fabric must be extended.

A virtual network can be handed off on a single interface or on multiple interfaces. Layer 2 handoff for a segment can also be done on two different devices. In both cases, ensure that no loops are formed in the network.

Because a border node is connected to the traditional network, it is subject to broadcast storms, Layer 2 loops, and spanning-tree problems that can occur in Layer 2 switched access networks. To prevent disruption of control plane node services or border node services connecting to other external networks, a border node should be dedicated to the Layer 2 handoff feature and not colocated with other fabric roles or services.

- e) Click **Save**.

Step 13 Click **Add** to save the configurations.

Step 14 Click **Deploy** under the **Fabric Infrastructure** tab to configure the border node.

Depending on the Visibility and Control of Configurations settings, choose an available option for deployment:

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations](#).

Note A device is configured as a border node only if the device runs a software release that is compatible with the Catalyst Center release. If the device runs an incompatible software, an error message is displayed and the device is not configured as a fabric border node. For information about software compatibility, see the [Cisco SD-Access Compatibility Matrix](#).

Step 15 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 16 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure LISP Pub/Sub

You can configure LISP Pub/Sub on a fabric site only when you add the first control plane to your fabric.

Before you begin

Ensure that the fabric devices operate on Cisco IOS XE Release 17.6.1 or later.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 Under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3 Select the fabric site to add a device.

The resulting topology view displays all devices in the network that have been inventoried. In the topology view, any device that is added to the fabric is shown in blue.

Step 4 From the **List** view under the **Fabric Infrastructure** tab, click a device that is to be configured as a control plane.

Step 5 In the slide-in pane, enable the **Control Plane Node** toggle button to configure this plane.

Step 6 In the **Configure Control Plane** slide-in pane, choose **LISP Pub/Sub** route distribution protocol and click **Add**.

Step 7 Click **Deploy** under the **Fabric Infrastructure** tab to configure the LISP Pub/Sub Control Plane.

Depending on the Visibility and Control of Configurations settings, choose an available option for deployment:

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations](#).

Step 8 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9 If you chose **Generate configuration preview**, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:

- a. Review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- b. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- c. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- d. Click **Submit**.

When the configurations are successfully submitted, a success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time, which you can view on the **Tasks** window.

Step 10 To verify the configuration of LISP Pub/Sub in the fabric site, see the LISP Pub/Sub status on the **SITE SUMMARY** window.

Reconfigure a Fabric

If you modify an IP address pool that is used in a fabric, the fabric becomes outdated. You must update the fabric to configure the IP address pool changes to the devices in the fabric site. The time taken to the reconfigure the fabric depends on the number of devices.



Note You can't perform other operations on the fabric devices until the fabric is reconfigured to update the devices with the IP address pool changes.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2

In the **Fabric Sites** tab, under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3

In the **Fabric Sites** window, select the fabric site that uses the modified IP address pools.

Step 4

In the **Fabric Infrastructure** tab, under the warning alert, click **Reconfigure Fabric**.

Depending on the Visibility and Control of Configurations settings, choose an available option for reconfiguring the fabric:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Step 5

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 6

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:
 - When you're ready, click **Deploy or Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy or Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Create an IP Transit

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Transits**.
- Step 2** Click **Create Transit**.
- Step 3** In the **Transit** slide-in pane, enter a name for the transit network.
- Step 4** Choose **IP-Based**.
The routing protocol is set to BGP by default.
- Step 5** Enter the Autonomous System Number (ASN) for the transit network.
- Step 6** Click **Save**.
- Step 7** In the **Transit** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.
 - **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Step 8** Click **Apply** to create the IP transit.
- Step 9** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
 - Pending Operations: Wait for all pending operations to deploy or discard them.

Create an SD-Access Transit

- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 10 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Create an SD-Access Transit

To add an SD-Access transit:

Step 1 From the top-left corner, click the menu icon and choose **Provision > Transits**.

Step 2 Click **Create Transit**.

Step 3 In the **Transit** slide-in pane, enter a name for the transit.

Step 4 Choose an SD-Access **Transit Type**.

To configure a transit for the fabric sites that don't have a LISP Pub/Sub control plane, choose **SD-Access (LISP/BGP)**.

To configure a transit for the fabric sites that have a LISP Pub/Sub control plane, choose **SD-Access (LISP Pub/Sub)**.

To share the **SD-Access (LISP Pub/Sub)** Transit with other Catalyst Center clusters, choose **Yes, Share**. Otherwise, choose **No, keep it local**.

Note The **Yes, Share** option is visible only if the **Multiple Catalyst Center** package is installed on all the Catalyst Center clusters.

Step 5 Choose a **Transit Control Plane Node Site** from the drop-down list. Choose at least one transit map server.

Step 6 Choose a **Transit Control Plane Node** for the transit network from the drop-down list.

Step 7 (Optional) To configure an additional map server, click the plus icon (+) and repeat [Step 5, on page 591](#) and [Step 6, on page 591](#).

Step 8 (Optional) To configure native multicast over the LISP Pub/Sub-based SD-Access transit, click **Advanced Attributes**.

In the **Advanced Attributes** slide-in pane, check the **Multicast Over SD-Access Transit** check box.

In the **Advanced Attributes** slide-in pane, click **Save**.

Note To complete the native multicast configuration over multiple sites that are connected to the SD-Access transit, ensure that you enable multicast over SD-Access transit on the border nodes.

Step 9 Click **Save** to save the configurations.

After a transit is created, the **Transits** window displays the newly created transit and its attributes.

Note You can't add an **SD-Access (LISP Pub/Sub)** transit to a fabric site that uses LISP/BGP control plane. You can't add **SD-Access (LISP/BGP)** transit to a fabric site that uses LISP Pub/Sub control plane.

Step 10 In the **Transit** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Step 11 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

Select an Authentication Template

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 12 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

What to do next

To interconnect the fabric sites with an SD-Access Transit, add the transit to the fabric border node.

Select an Authentication Template

You can configure an authentication template that applies to all devices in the fabric site.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 Under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3 Click a fabric site.

Step 4 Click the **Authentication Template** tab.

Step 5 Under **Select Authentication Template**, choose an authentication template for the site:

- **Open Authentication:** A host is allowed network access without having to go through 802.1X authentication.
- **Closed Authentication:** Any traffic prior to authentication is dropped, including DHCP, DNS, and ARP.

- **Low Impact:** Security is added by applying an ACL to the switch port, to allow limited network access prior to authentication. After a host has been successfully authenticated, additional network access is granted.
- **None**

You can edit the settings of the selected authentication template to address site-specific authentication requirements.

Before you change the site-level authentication, you must resynchronize any fabric device whose Access Points were onboarded through macros or autoconf and haven't yet undergone the periodic resync.

Step 6 (Optional) To edit the settings of the chosen authentication method, click **Edit**.

- In the slide-in pane, complete the following:

- **First Authentication Method:** Choose **802.1x** or **MAC Authentication Bypass (MAB)**
- **802.1x Timeout (in seconds):** Use the slider to specify the 802.1x timeout, in seconds.
- **Wake on LAN:** Choose **Yes** or **No**.

Wake on LAN (WoL) is supported only in the following scenarios:

- The source (WoL initiator) and destination (sleeping host) are both in the same subnet and Layer 2 Flooding is enabled.
- The source is outside the SD-Access fabric but located in the network that is connected to the fabric through Layer 3 handoff and the destination is in an SD-Access subnet with IP-Directed Broadcast enabled.

Note The following topologies do not support Wake on LAN:

- The WoL initiator and the sleeping host are on different subnets within the same Layer 3 Virtual Network.
- The WoL initiator routes to the sleeping host over an SD-Access Transit.

- **Number of Hosts:** Choose **Unlimited** or **Single**.

Note **Number of Hosts** specifies the number of data hosts that can be connected to a port. With **Single**, you can have only one data client on the port. With **Unlimited**, you can have multiple data clients and one voice client on the port.

- **Pre-Authentication Access Control List:** Enable the toggle button to configure preauthentication control for **Low Impact** authentication. From the **Implicit Action** drop-down list, choose an implicit action. Enter a description for the rule. To add an access contract, click **Add Contract Action**, choose the rules, and click **Apply Table**.

- Click **Save**.

The saved modifications apply only to the site for which the authentication template is edited.

Step 7 Click **Deploy** under the **Select Authentication Template** tab to configure the authentication template for all the nodes.

Depending on the Visibility and Control of Configurations settings, choose an available option for deployment:

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

Select an Authentication Template

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations](#).

The Hitless Authentication Change feature lets you switch from one authentication method to another without removing the devices from the fabric.

Step 8

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure Ports Within the Fabric Site

The **Port Assignment** tab enables you to configure each access device in the fabric site. You can specify network behavior settings for each port on a device.

If you don't configure the authentication template for an individual port, the port inherits these settings from the global authentication template configuration. An inherit icon is displayed next to the authentication template name for the corresponding port in the **Ports** table.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 In the **Fabric Sites** tab, under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3 In the **Fabric Sites** window, click a fabric site to configure the port assignments.

Step 4 Click the **Port Assignment** tab.

Step 5 From the list of fabric devices, select a device and click **Configure**.

Step 6 In the **Configure Port Assignments** slide-in pane, click a type of connected device:

Option	Description
User Devices and Endpoints	Configures the port to connect to a host device.
Access Point (AP)	Configures the port to connect to an access point.
Trunk	Configure the port as a trunk port.
Supplicant-Based Extended Node	Configures the port to receive a supplicant-based extended node.

- To connect host devices, click **User Devices and Endpoints** and do the following:
 - a. Choose the VLAN name for data from the **VLAN Name (Data)** drop-down list.
 - b. Choose a security group from the **Security Group** drop-down list.
Security groups are supported only with the **None** authentication template.
 - c. Choose the VLAN name for voice from the **VLAN Name (Voice)** drop-down list.
 - d. Choose the authentication type from the **Authentication Template** drop-down list.
 - e. Enter a **Description** for the connected device.
- To connect an access point, click **Access Point** and do the following:
 - a. Choose the VLAN name from the **VLAN Name (Data)** drop-down list.
 - b. Choose the authentication type from the **Authentication Template** drop-down list.
 - c. Enter a **Description** for the connected device.
- To connect a supplicant-based extended node device, click **Supplicant-Based Extended Node**.
- To connect a trunk port, click **Trunk** and enter a **Description** for the port.

Step 7 Click **Update** in the **Configure Port Assignment** slide-in pane to save the configurations.

Configure Ports Within the Fabric Site

- Step 8** Click **Deploy All** under the **Port Assignment** tab to update the port assignments.
- Step 9** In the **Update Port Assignment** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- Step 10** Click **Apply** to configure the port assignments.

- Step 11** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
- If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

- Step 12** If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure Wireless SSIDs for Fabric Networks

Before you begin

Ensure to add the wireless device to the fabric site.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 Under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3 Click a fabric site.

Step 4 Click the **Wireless SSIDs** tab and specify the wireless SSIDs within the network that the hosts can access.

Step 5 From the **Choose Pool** drop-down list, choose an IP address pool reserved for the SSID.

The wireless IP address pools that are configured for Layer 3 and Layer 2 segments are available in this drop-down list.

Step 6 From the **Assign SGT** drop-down list, choose a security group for the SSID.

Step 7 Check the **Enable Wireless Multicast** check box to enable wireless multicast on the SSIDs.

Step 8 Click **Deploy**.

Step 9 In the **Modify SSID Table** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Step 10 (Optional) In the **Task Name** field, update the task name.

Step 11 Click **Apply**.

Step 12 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

Configure Wireless Mesh Access Point in a Fabric

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

- Step 13** If you chose **Generate configuration preview** in the **Modify SSID Table** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure Wireless Mesh Access Point in a Fabric

Starting with Catalyst Center Release 2.3.7, you can onboard a wireless Mesh AP in an SD-Access fabric. You can provision a mesh AP either as a Mesh Access Point (MAP) or a Root Access Point (RAP), depending on the network requirement. For more information, see [About Wireless Mesh Networks](#).

Before you begin

- Define a list of authorized Access Points (APs). You can choose the AP authorization list while provisioning the Cisco Wireless Controller. Cisco Wireless Controllers respond only to requests from those APs that are present in the AP authorization list. For information on how to create a list of authorized APs, refer to [Create an AP Authorization List](#).
- Define an AP Profile to manage and provision the mesh AP. See [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices](#).

Step 1 If you have existing APs that you want to use in the mesh network mode, you must first change the AP Mode to Bridge using the **Configure Access Point** workflow. For information, see [Configure APs](#).

Step 2 Provision the fabric-enabled wireless controller with the AP Authorization List to onboard the Mesh APs. See [Provision a Cisco Catalyst 9800 Series Wireless Controller](#).

What to do next

Onboard an AP and provision it in the role of a MAP or a RAP.

Virtual Networks

Virtual networks are overlays that are used to segment traffic within a common physical network infrastructure; this is also known as macrosegmentation. Layer 2 virtual networks segment switched traffic, and Layer 3 virtual networks segment routed traffic. Each endpoint that is connected to a Cisco SD-Access fabric is assigned to a specific virtual network based on the static edge port configurations or the dynamic policy from the Cisco Identity Service Engine. Within a virtual network, endpoints can communicate with each other unless explicitly blocked by microsegmentation policy. Endpoints across different virtual networks cannot communicate with each other by default. Intervirtual network traffic requires connectivity policy to be implemented outside of the Cisco SD-Access fabric, such as on a fusion device.

A typical use case for virtual networks is an office building containing both corporate endpoints and building-management systems. The corporate endpoints must be segmented from building systems, such as lighting, heating, ventilation, and air conditioning. In such a scenario, a network administrator can use macrosegmentation to segment the corporate endpoints and the building systems using two or more virtual networks to block unauthorized access between the building systems and corporate endpoints.

A Layer 3 virtual network may span multiple fabric sites and across network domains (wireless LAN, campus LAN, and WAN). A Layer 2 virtual network resides within a single fabric site.

Create a Layer 3 Virtual Network

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Create Layer 3 Virtual Networks**.

Alternatively, you can navigate to the **Layer 3** tab in **Provision > Virtual Networks** and click **Create Layer 3 Virtual Networks**.

Step 2 If the task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 3 In the **Layer 3 Virtual Networks** window, do the following:

- In the **Layer 3 Virtual Network name** field, enter a name for the Layer 3 virtual network.
- (Optional) To create another Layer 3 virtual network, click the plus icon (+) and enter a name for the Layer 3 virtual network.

Step 4 In the **Fabric Sites and Fabric Zones (Optional)** window, configure the following:

- Click **Select Fabric Sites** and choose the fabric sites.

You can assign a virtual network to multiple fabric sites. To choose the fabric sites, do one of the following:

Create a Layer 3 Virtual Network

- Click the plus icon (+) next to the required fabric sites.
- Click the fabric site name and click **Add Selected**.

Note To choose multiple fabric sites, press **Shift**, click the fabric site names, and click **Add Selected**.

- To choose all the fabric sites, click **Add All**.

Repeat this association for all the Layer 3 virtual networks that you created.

b) Click **Assign**.

c) Click **Select Fabric Zones** and do one of the following:

- Click the plus icon (+) next to the required fabric zones.
- Click the fabric zone name and click **Add Selected**.

Note To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.

- To choose all the fabric zones, click **Add All**.

d) Click **Assign**.

Step 5

Review the Layer 3 virtual network settings in the **Summary** window.

Step 6

In the **Deploy Layer 3 Virtual Networks** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to create the Layer 3 virtual network.

Step 7

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 8

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Create a Layer 2 Virtual Network

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Create Layer 2 Virtual Networks**.

Alternatively, you can navigate to the **Layer 2** tab under **Provision > Virtual Networks** and click **Create Layer 2 Virtual Networks**.

Step 2 If the task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 3 In the **Configuration Attributes** window, configure the following:

- a) In the **VLAN Name** field, enter the VLAN name.
- b) In the **VLAN ID** field, enter the VLAN ID. The valid range for VLAN ID is from 2 through 4093.

Note The VLAN IDs from 1002 through 1005 and 2046 are reserved VLAN IDs.

- c) From the **Traffic Type** area, choose **Data** or **Voice**.
- d) Check the **Fabric-Enabled Wireless** check box to enable wireless.
The **Layer 2 Flooding** check box is enabled by default for a Layer 2 virtual network.

e) To add another Layer 2 virtual network, click the plus icon (+) and repeat 3.a, on page 601 to 3.d, on page 601.

Step 4 In the **Fabric Sites and Advanced Attributes** window, choose a fabric site for the Layer 2 virtual network from the **Fabric Sites** drop-down. Optionally, to choose the fabric zone to associate with this Layer 2 virtual network, do the following:

- a) Click **Select Fabric Zones** and do one of the following:

Create a Layer 2 Virtual Network

- Click the plus icon (+) next to the required fabric zones.
- Click the fabric zone name and click **Add Selected**.

Note To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.

- To choose all the fabric zones, click **Add All**.

b) Click **Assign**.

Repeat this association for all the Layer 2 virtual networks that you created.

Step 5

(Optional) In the **Fabric Sites and Advanced Attributes** window, click the **Advanced Attributes** toggle button on to associate a Layer 3 virtual network to this Layer 2 virtual network.

Step 6

In the **Summary** window, review your Layer 2 virtual network settings.

Step 7

In the **Create Layer2 Virtual Networks** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to create the Layer 2 virtual network.

Step 8

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Do one of the following:

- When you're ready, click **Deploy or Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy or Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Step 10 To verify the gateway creation after you see a success message, click **View Anycast Gateway**.

In the **Virtual Networks** window, the **Anycast Gateway** tab displays the details of all the anycast gateways in the fabric.

Associate Layer 3 Virtual Networks to Fabric Sites

Step 1 From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.

Step 2 Under **SUMMARY**, click the number that indicates the count of **Layer 3 Virtual Networks**.

The resulting window displays all the Layer 3 virtual networks that are created at the global level.

Step 3 In the **Layer 3** tab, check the check box next to the Layer 3 virtual networks for which you want to edit the fabric site association.

Note You can edit up to five Layer 3 virtual networks.

Step 4 Hover your cursor over **More actions**, and choose **Edit Fabric Site and Fabric Zone Associations**.

Step 5 In the **Fabric Sites and Fabric Zones (Optional)** window, configure the following:

- Click **Select Fabric Sites** and choose the fabric sites.

You can assign a virtual network to multiple fabric sites. To choose the fabric sites, do one of the following:

- Click the plus icon (+) next to the required fabric sites.
- Click the fabric site name and click **Add Selected**.

Note To choose multiple fabric sites, press **Shift**, click the fabric site names, and click **Add Selected**.

- To choose all the fabric sites, click **Add All**.

Repeat this association for all the Layer 3 virtual networks.

Associate Layer 3 Virtual Networks to Fabric Sites

- b) Click **Assign**.
- c) Click **Select Fabric Zones** and do one of the following:
 - Click the plus icon (+) next to the required fabric zones.
 - Click the fabric zone name and click **Add Selected**.

Note To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.

 - To choose all the fabric zones, click **Add All**.

- d) Click **Assign**.

Step 6

Review the Layer 3 virtual network sites on the **Summary** window.

Step 7

In the **Update Layer 3 Virtual Networks** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
- If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Update** to assign the Layer 3 virtual networks to the selected sites.

Step 8

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
- If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.

- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Create Anycast Gateways

Before you begin

Ensure that you have created a Layer 3 virtual network. For more information, see [Create a Layer 3 Virtual Network, on page 599](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.

Step 2 Under **SUMMARY**, click the number that indicates the count of **Anycast Gateways**.

Step 3 In the **Anycast Gateway** tab, click **Create Anycast Gateways**.

Alternatively, click the menu icon and choose **Workflows > Create Anycast Gateways**.

Step 4 If the task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 5 In the **Layer 3 Virtual Networks** window, select one or more virtual networks to add a gateway.

- Click the plus icon (+) next to the required fabric sites.
- Click the fabric site name and click **Add Selected**.

Note To choose multiple fabric sites, press **Shift**, click the fabric site names, and click **Add Selected**.

- To choose all the fabric sites, click **Add All**.

Step 6 In the left pane of the **Configuration Attributes** window, choose the Layer 3 virtual network for which you want to create the anycast gateway and do the following:

- From the **IP Address Pool** drop-down list, choose an IP address pool.
- For INFRA_VN, do the following:
 - Choose **AP** or **Extended Node** from the **Pool Type** drop-down list.
 - Enter a valid **VLAN Name** or check the **Auto generate VLAN name** check box.
 - Enter a custom **VLAN ID** for the virtual network.

Create Anycast Gateways

- To onboard a supplicant-based extended node, check the **Supplicant-Based Extended Node Onboarding** check box.

Note This check box is active only when you choose the **Extended Node** pool type.

- To enable the IP-Directed Broadcast feature, check the **IP-Directed Broadcast** check box.

Note

- When you enable Directed Broadcast, Catalyst Center automatically enables Layer 2 flooding.
- Routers and Cisco Nexus 7000 Series Switches don't support Directed Broadcast.
- Before enabling Directed Broadcast, ensure that you have enabled underlay multicast.

- To enable the intrasubnet routing, check the **Intra-Subnet Routing** check box.

Note When you enable intrasubnet routing, Catalyst Center automatically disables the **Fabric-Enabled Wireless** and **Layer 2 Flooding** check boxes.

- To customize the TCP maximum segment size (MSS) value for the anycast gateway, check the **TCP MSS Adjustment** check box and input the required value.

TCP MSS Adjustment value can range from 500 to 1440. **TCP MSS Adjustment** value is applicable for the TCP sessions over both IPv4 and IPv6.

TCP MSS Adjustment value is applied to all the anycast gateway switched virtual interfaces (SVIs).

- Enter a valid **VLAN Name** or check the **Auto generate VLAN name** check box.
- Enter a custom **VLAN ID** for the virtual network.

Note

- VLAN IDs 1, 1002–1005, 2046, and 4095 are reserved and can't be used.
- If you don't provide a custom VLAN ID, Catalyst Center generates a VLAN ID in the range of 1021–2020.

- Choose **Data** or **Voice** from the **Traffic Type** area.

- From the **Security Group** drop-down list, choose a security group.
- To include this IP pool in the critical IP address pool, check the **Critical VLAN** check box.

A critical pool is used for closed authentication profile when an authentication server isn't available. A critical VLAN is assigned to the critical pool and all unauthenticated hosts are placed in the critical VLAN in the absence of an authentication server.

Note When you enable critical VLAN, Catalyst Center automatically generates the VLAN name.

- To enable this IP pool as a wireless IP address pool, check the **Fabric-Enabled Wireless** check box.
- To enable Layer 2 flooding, check the **Layer 2 Flooding** check box.

Note Layer 2 flooding requires underlay multicast, which is configured during LAN automation. If you don't provision the underlay through LAN automation, configure the underlay multicast manually.

- To enable onboarding of bridge-mode virtual machines that are connected to the fabric-enabled wireless network, check both the **Fabric Enabled Wireless** and the **Multiple IP-to-MAC Addresses** check boxes.
- To enable a wired host to have multiple IPv4 addresses (IP aliasing), check only the **Multiple IP-to-MAC Addresses** check box.

You can have a maximum of 1000 IPv4 addresses for a single MAC address.

- o) To associate more IP pools, click the plus icon (+) and repeat the steps.

Step 7

In the **Fabric Zones (Optional)** window, do the following:

- a) Click **Select Fabric Zones** and do one of the following:

- Click the plus icon (+) next to the required fabric zones.
- Click the fabric zone name and click **Add Selected**.

Note To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.

- To choose all the fabric zones, click **Add All**.

- b) Click **Assign**.

Step 8

Review the anycast gateway settings in the **Summary** window.

Step 9

In the **Create Anycast Gateway** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to create an anycast gateway.

Step 10

On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 11

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Extranet Policy

Configure an extranet policy to allow route leaks between Layer 3 virtual networks (VNs), without using a fusion device. Use an extranet policy to provide the endpoints (hosts or users) with access to shared services like DHCP, DNS, Internet, and so on, through Catalyst Center automation. The shared services connect to a Provider VN. The endpoints that use the shared services reside in a Subscriber VN. An extranet policy establishes communication between the Provider VN and the Subscriber VNs.

You can create an extranet policy, edit an extranet policy, and delete an extranet policy for the following deployments:

- Single site fabric with IP Transit
- Multi-site fabric with SDA Transit

Guidelines for Configuring an Extranet Policy

Consider the following guidelines before you configure an extranet policy:

- To configure an extranet policy, a device should operate Cisco IOS XE 17.9.1 or a later release.
- Extranet Policy is supported only on the fabric sites that have a LISP Pub/Sub control plane.
- To configure an extranet policy on a multisite fabric with SD-Access transit, ensure that all the sites have the provider VN.
- If you configure multiple VN policies in your network, the same VN cannot be the Provider VN in more than one policy.
- Extranet Policy does not support overlapping IP pools.
- Provider VN in a policy cannot be configured as a Subscriber VN in another VN Policy and conversely.

- Add the Provider VN to all the fabric sites where an extranet policy is applicable.
- Ensure that the Provider VNs do not leak into each other outside the fabric. Else, it might result in route leaks between the Subscriber VNs.
- Extranet policy is not supported on router devices.
- Inter-VN multicast through an extranet policy is not supported. You cannot route multicast between the Layer 3 virtual networks that are interconnected through an extranet policy.

Create an Extranet Policy

To create an Extranet policy, follow these steps:

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Create Extranet Policy**. Alternatively, navigate to **Extranet Policies** tab under **Provision > Virtual Networks**. In the **Extranet Policies** window, click **Create Extranet Policy**.
- Step 2** Follow the on-screen guidance to provide a name for the policy, to select a Provider VN and the Subscriber VNs. You can assign this Extranet policy to one or more fabric sites. In a multisite deployment where an SD-Access transit connects the fabric sites, ensure that you select all the fabric sites that are connected by the SD-Access transit.
- Step 3** On the **Summary** page, review the Extranet Policy configuration. To make changes, click **Edit** next to the group of settings that you want to change.
- Step 4** In the **Deploy Extranet Policy** window, depending on the Visibility and Control of Configurations settings, choose an available option.
- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- Step 5** Click **Deploy** to create the Extranet policy.
- Step 6** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
 - After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

Edit an Extranet Policy

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 7 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Edit an Extranet Policy

You can edit an Extranet Policy to add or delete Subscriber VNs and to assign or remove the policy from a fabric site.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.

Step 2 In the **Extranet Policies** tab, select the policy to be edited, and click **More Actions > Edit Extranet Policy**.

Step 3 Follow the on-screen guidance to edit the policy.

Delete an Extranet Policy

To delete an Extranet Policy, follow these steps:

Step 1 From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.

Step 2 In the **Extranet Policies** tab, select the policy to be deleted, and click **More Actions > Delete Extranet Policy**.

Step 3 In the **Delete Extranet Policy** slide-in pane, depending on the Visibility and Control of Configurations settings, choose an available option::

- To immediately delete the Extranet Policy, click **Now**.
- To schedule the delete operation for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Apply** to perform the operation.

Configure a Fabric Zone

A fabric site (parent site) can be divided into fabric zones with smaller subnets to help you manage the network easily. A fabric zone can have its own edge nodes and extended nodes, but it connects to the parent site for a control plane and border. If you migrated from an earlier Catalyst Center release to the current release, you can create a fabric zone on the existing fabric site. This fabric zone inherits all the properties of its parent site.

Before you begin

- Ensure that you have created a network hierarchy under the Global site.
- Select a parent site that is not at the lowest level in the hierarchy.

The following is the broad workflow to configure a fabric zone.

1. Create a fabric zone in one of the following ways:
 - Create a fabric site and its zones using the **Create Fabric Site** workflow. For more information, see [Create a Fabric Site and Its Fabric Zones, on page 612](#).
 - Edit an existing fabric site to add fabric zones to it. For more information, see [Create a Fabric Zone Within a Fabric Site, on page 614](#).
2. Add edge nodes and extended nodes to the fabric zone. For more information, see [Add a Device to a Fabric, on page 578](#).
3. Assign Layer 3 virtual networks and segments to the fabric zone. For more information, see [Associate Layer 3 Virtual Networks to Fabric Zones, on page 615](#).



Note Only the virtual networks and segments of the parent site are available to the fabric zone.

**Note**

After a segment is added to a fabric zone, it can't be updated in the parent site.

You can't edit edge nodes and extended nodes of a fabric zone in its parent site.

You can configure the edge node of a fabric zone as a control plane or a border of the parent site.

Create a Fabric Site and Its Fabric Zones

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
- Step 2** Click **Create Fabric Site**.
Alternatively, click the menu icon and choose **Workflows > Create Fabric Site**.
- Step 3** If a task overview window appears, click **Let's Do It** to go directly to the workflow.
- Step 4** In the **Fabric Site Location** window, choose an area, building, or floor to add as a fabric site.
- Step 5** In the **Wired Endpoint Data Collection** window, ensure that the **Wired Endpoint Data Collection** check box is checked.
- Step 6** In the **Authentication Template** window, do the following:
- Choose an authentication template for the fabric site:
 - Closed Authentication**: Any traffic before authentication is dropped, including DHCP, DNS, and ARP.
 - Open Authentication**: A host is allowed network access without having to go through 802.1X authentication.
 - Low Impact**: Security is added by applying an ACL to the switch port, to allow limited network access before authentication. After a host has been successfully authenticated, additional network access is granted.
 - None**
 - (Optional) If you choose **Closed Authentication**, **Open Authentication**, or **Low Impact**, click **Edit** to edit the authentication settings:
 - First Authentication Method**: Choose **802.1x** or **MAC Authentication Bypass (MAB)**.
 - 802.1x Timeout (in seconds)**: Use the slider to specify the 802.1x timeout, in seconds.
 - Wake on LAN**: Choose **Yes** or **No**.
 - Number of Hosts**: Choose **Unlimited** or **Single**.
 - BPDU Guard**: Use this check box to enable or disable the Bridge Protocol Data Unit (BPDU) guard on all the **Closed Authentication** ports.
 - Pre-Authentication Access Control List**: Enable the toggle button to configure preauthentication control for **Low Impact** authentication. From the **Implicit Action** drop-down list, choose an implicit action. Enter a description for the rule. To add an access contract, click **Add Contract Action**, choose the rules, and click **Apply Table**.
- Step 7** In the **Fabric Zones** window, to designate fabric zones and create scoped subnets, click **Setup Fabric Zones Now**.
To enable a fabric zone, choose a fabric site in the network hierarchy.

Step 8 In the **Summary** window, review the fabric site settings.

You can edit any of the fabric site or zone settings here.

Step 9 In the **Fabric Site Creation Scheduler** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy**.

Step 10 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 11 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

Create a Fabric Zone Within a Fabric Site

e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

- Step 12** It takes a few seconds for the site and zones to be provisioned. Upon successful creation of the site, a success message is displayed.

The newly created fabric zone is tagged with an "FZ" in the site hierarchy pane.

Create a Fabric Zone Within a Fabric Site

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 Under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3 For the fabric site where you want to designate fabric zone, under the **Actions** column, hover your cursor over the ellipsis icon (...) and choose **Edit Fabric Zone**.

Step 4 In the **Edit Fabric Zones** window, choose an area, building, or floor.

Step 5 Review the fabric site settings in the **Summary** window.

You can edit any of the fabric site or zone settings here.

Step 6 In the **Fabric Site Update Scheduler** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- To immediately deploy the configuration, click **Now**.
- To schedule the deployment for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy**.

Step 7 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 8 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Fabric Configurations](#), on page 571.
- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Step 9 It takes several seconds for the fabric site and fabric zones to be provisioned. After the provisioning, a success message is displayed.

The newly created fabric zone is tagged with an “FZ” in the site hierarchy pane.

What to do next

- Add only edge node and extended node devices to the newly created fabric zone.
Devices assigned to a fabric zone can't be assigned to the parent site. However, an edge node device assigned to a fabric zone can still be configured as a control plane or a border node for the parent site.
- Assign IP pools and virtual networks to the fabric zone.

Associate Layer 3 Virtual Networks to Fabric Zones

Before you begin

Ensure that you have created the fabric zone.

Associate Layer 2 Virtual Networks to Fabric Zones

Note You can add only the Layer 3 virtual networks of a parent site to a fabric zone.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.

Step 2 Under **SUMMARY**, click the number that indicates the count of **Layer 3 Virtual Networks**.

The resulting window displays all the Layer 3 virtual networks at a global level.

Step 3 In the **Layer 3** tab, check the check box next to the Layer 3 virtual networks for which you want to edit the fabric zone associations.

Note You can edit up to five Layer 3 virtual networks.

Step 4 Hover your cursor over **More actions**, and choose **Edit Fabric Site and Fabric Zone Associations**.

Step 5 In the **Fabric Sites and Fabric Zones (Optional)** window, configure the following:

- Click **Select Fabric Zones** and choose the fabric zones.

You can assign a virtual network to multiple fabric zones in a fabric site. To choose the fabric zones, do one of the following:

- Click the plus icon (+) next to the required fabric zones.
- Click the fabric zone name and click **Add Selected**.

Note To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.

- To choose all the fabric zones, click **Add All**.

- Click **Assign**.
- Repeat this association for all the Layer 3 virtual networks.

Step 6 Review the Layer 3 virtual network zones on the **Summary** window.

Step 7 In the **Created and Deploy (Step 1 of 2)** window, click **Update**.

Step 8 In the **Created and Deploy (Step 2 of 2)** window, click **Deploy** to deploy the Layer 3 virtual networks.

Step 9 To verify the virtual networks, click **View Layer 3 Virtual Networks**.

In the **Virtual Networks** window, the **Layer 3** tab displays the details of all the Layer 3 virtual networks.

Associate Layer 2 Virtual Networks to Fabric Zones**Before you begin**

Note After you add the gateways to a fabric zone, you can't edit them at the parent site.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.
- Step 2** Under **SUMMARY**, click the number that indicates the count of **Layer 2 Virtual Networks**.
The resulting window displays all the Layer 2 virtual networks at a global level.
- Step 3** Click Fabric Site: **Global**.
- Step 4** In the **Select Fabric Site** slide-in pane, choose a fabric site and click **Select**.
- Step 5** In the **Layer 2** tab, check the check box next to the Layer 2 virtual networks for which you want to edit the fabric zone associations.
- Note** You can edit up to five Layer 2 virtual networks.
- Step 6** Hover your cursor over **More actions**, and choose **Edit Layer 2 Fabric Zone Associations**.
- Step 7** In the **Associated Fabric Sites and Fabric Zones** window, configure the following:
- Click **Select Fabric Zones** and choose the fabric zones.
You can assign a virtual network to multiple fabric zones in a fabric site. To choose the fabric zones, do one of the following:
 - Click the plus icon (+) next to the required fabric zones.
 - Click the fabric zone name and click **Add Selected**.**Note** To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.
 - To choose all the fabric zones, click **Add All**.
 - Click **Assign**.
 - Repeat this association for all the Layer 2 virtual networks.
- Step 8** In the **Summary** window, review your Layer 2 virtual network settings and click **Create**.
- Step 9** In the **Create** window, click **Deploy** to deploy the Layer 2 virtual network.
After the Layer 2 virtual network is provisioned, a success message is displayed.
- Step 10** To verify the virtual network creation, click **View Layer 2 Virtual Networks**. In the **Virtual Networks** window, the **Layer 2** tab displays the details of all the Layer 2 virtual networks.
-

Associate Anycast Gateways to Fabric Zones

Before you begin

Ensure that you have created the fabric zone.



Note You can add only the anycast gateways of a parent site to a fabric zone.

After you add an anycast gateway to a fabric zone, you can't update it at the parent site.

Configure an Extended Node Device

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Virtual Networks**.
- Step 2** Under **SUMMARY**, click the number that indicates the count of **Anycast Gateways**.
The resulting window displays all the anycast gateways at a global level.
- Step 3** Click **Fabric Site: Global**.
- Step 4** In the **Select Fabric Site** slide-in pane, choose a fabric site and click **Select**.
- Step 5** In the **Anycast Gateway** tab, check the check box next to the anycast gateways for which you want to edit the fabric zone associations.
- Note** You can edit up to five anycast gateways.
- Step 6** Hover your cursor over **More actions**, and choose **Edit Fabric Zone Associations**.
- Step 7** In the **Fabric Zones (Optional)** window, do the following:
- Click **Select Fabric Zones** and do one of the following:
 - Click the plus icon (+) next to the required fabric zones.
 - Click the fabric zone name and click **Add Selected**.**Note** To choose multiple fabric zones, press **Shift**, click the fabric zone names, and click **Add Selected**.
 - To choose all the fabric zones, click **Add All**.
 - Click **Assign**.
- Step 8** Review the anycast gateway settings in the **Summary** window.
- Step 9** In the **Create** window, click **Deploy**.
- Step 10** To verify the gateway creation after you see a success message, click **View Anycast Gateway**.
In the **Virtual Networks** window, the **Anycast Gateway** tab displays the details of all the anycast gateways.
-

Configure an Extended Node Device

An extended node is configured by automated workflow. After configuration, the extended node device is displayed in the fabric topology view. You can assign ports for the extended nodes using the **Port Assignment** tab.



Note You can't onboard the extended nodes through the GUI-based provisioning workflows. An Extended node is onboarded only through the SD-Access automated workflow after resetting the device configuration to the factory default and powering on the device.

A device is onboarded according to the license of its Extended Node neighbor and its own license:

- If the neighbor is operating with an Essentials license, the device is onboarded as a standard Extended Node, regardless of its license.

- If the neighbor is operating with an Advantage license, the device is onboarded as a standard Extended Node if it has an Essentials license.
- If the neighbor is operating with an Advantage license, the device is onboarded as a Policy Extended Node if it has an Advantage license.
- If the device has more than one neighbor, and those neighbors have different license levels, the device is onboarded as a standard Extended Node, regardless of its license.

Extended node devices support multicast traffic.

Policy Extended Nodes are extended nodes that support security policy within the virtual network. You can select a **Group** during port assignment for a Policy Extended Node.

Policy Extended Node devices include Cisco Catalyst Industrial Ethernet (IE) 3400, IE 3400 Heavy Duty series switches, and Cisco Catalyst 9000 series switches that run Cisco IOS XE Release 17.1.1s or later.

Cisco Digital Building series switches, Cisco Catalyst 3560-CX switches, and Cisco Industrial Ethernet 4000, 4010, and 5000 series switches can't be configured as Policy Extended Nodes.

Steps to Configure an Extended Node

When configured as a fabric edge, Cisco Catalyst 9300, Cisco Catalyst 9400, and Cisco Catalyst 9500 series switches support extended nodes.



Note Cisco Catalyst 9200 series switches that are configured as fabric edge nodes don't support extended node devices.

The following are the minimum supported software versions on the extended nodes:

- Cisco Industrial Ethernet 4000, 4010, 5000 series switches: 15.2(7)E0s with LAN base license enabled.
If you have an IP services license, you must change the Switch Database Management (SDM) template to `dual-ipv4-and-ipv6 default` manually.
- Cisco Catalyst IE 3400, 3400 Heavy Duty (X-coded and D-coded) series switches: Cisco IOS XE Release 17.1.1s.
- Cisco Catalyst IE 3300 series switches: Cisco IOS XE Release 16.12.1s.
- Cisco Digital Building series switches, Cisco Catalyst 3560-CX switches: Release 15.2(7)E0s.

The minimum software version that is required on a policy extended node device and on the edge node device supporting the policy extended node is Cisco IOS XE Release 17.1.1s.

The following configuration steps are applicable to both a standard Extended Node and Policy Extended Node.

Before you begin

To configure a device as a Policy Extended Node, both the device and the edge node supporting it must have the Network Advantage and Advantage license levels enabled.

Steps to Configure an Extended Node

- Step 1** Configure a network range for the extended node. See [Configure IP Address Pools, on page 247](#). This step comprises adding an IP address pool and reserving the IP pool at the site level. Ensure that the CLI and SNMP credentials are configured.
- Step 2** Assign the extended IP address pool to INFRA_VN. See [Create Anycast Gateways, on page 605](#). Choose **Extended Node** as the **Pool Type**.
- Catalyst Center configures the extended IP address pool and VLAN on the supported fabric edge device. This enables the onboarding of extended nodes.
- Step 3** Configure the DHCP server with the extended IP address pool and Option 43. Ensure that the extended IP address pool is reachable from Catalyst Center.
- Note** For a detailed description of Option 43, see [DHCP Controller Discovery, on page 449](#).
- Step 4** Connect the extended node device to the fabric edge device. You can have multiple links from the extended node device to the fabric edge.
- Step 5** Create a port channel on the fabric edge node that is connected to the extended node. For a subsequent extended node in a ring or daisy chain, create the port channel on the previous extended node it connects to.
- Note** Complete this step only if the global authentication mode for the fabric is **Open Authentication, Low Impact**, or **Closed Authentication**. If the fabric site is set to **None** authentication mode, the port channel is automatically created during the onboarding of the extended nodes using Plug and Play provisioning.
- To create a port channel, complete the following steps:
- From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
 - In the **Fabric Sites** tab, click the number that indicates the count of fabric sites.
 - Click a fabric site.
 - In the **Fabric Infrastructure** tab, choose a fabric edge node (or an extended node, depending on the connection).
 - In the **Port Channel** tab of the slide-in pane, click **Create Port Channel**.
 - Complete the following:
 - Choose an **Extended Node** in the **Connected Device Type** drop-down list.
 - Enter a description.
 - Choose **Port Aggregation Protocol (PAgP Desirable)**.
- Starting with Cisco IOS XE Release 17.1.1s, IE 3300 and IE 3400 devices support PAgP.
- Select **On** for IE 3300 and IE 3400 devices if they are running versions earlier than Cisco IOS XE Release 17.1.1s.
- Note** Link Aggregation Control Protocol (LACP) doesn't work for extended node onboarding.
- Choose the ports to be bundled as a port channel.
- Click **Done**.
- This creates a port channel on the fabric edge node (or the extended node) to onboard an extended device.
- Step 6** Power up the extended node device if it has no previous configuration. If the extended node device has configurations, reset the device configuration to factory default and reload it.

Catalyst Center adds the extended node device to the inventory and assigns the same site as the fabric edge. The extended node device is then added to the fabric, onboarded, and ready to be managed.

Note An extended node device is added to the fabric only if the device runs a software release that is compatible with the Catalyst Center release. If the device runs an incompatible software release, it will not be onboarded. For information about fabric device compatibility, see [Cisco SD-Access Compatibility Matrix](#).

After the configuration is complete, the extended node appears in the fabric topology with a tag (X) to indicate that it is an extended node.

Upgrade an Extended Node to a Policy Extended Node

Cisco SD-Access automation onboards a policy extended node-capable device with a Catalyst Center Essentials license as an extended node. You can convert this extended node device to a policy-extended node by upgrading its license to Catalyst Center Advantage.

In a daisy chain, you cannot upgrade an extended node to a policy extended node if its upstream device is an extended node.

In a ring, you cannot upgrade an extended node to a policy extended node if both its neighbors are extended nodes.

After you upgrade the node to policy extended node, you cannot reconfigure it as an extended node.

To convert an extended node to a policy extended node, do the following.

Before you begin

- Ensure that the extended node is already onboarded.
- Update the Smart Licensing credentials on Catalyst Center.

Step 1 Change the license level on the device from Catalyst Center Essentials to Catalyst Center Advantage, using the Catalyst Center License Manager:

- From the top-left corner, click the menu icon and choose **Tools > License Manager**.
- In the **Devices** tab, select the device.
- Choose **Actions > Change License > Change DNA License**.
- In the **Change DNA License Level** window, click **Advantage**.
- Click **Confirm**.
- In the **Success** message window, click **OK**.

The device reloads.

Step 2 Wait for the node to become **Reachable** and get to the **Managed** state.

The **Provision > Network Devices > Inventory** window displays the reachability status of all the devices.

Step 3 If you see a **Netconf Connection Refused** error, resynchronize the device. Repeat the resynchronization process until the error is no longer displayed.

- In the **Provision > Network Devices > Inventory** window, select the device.

Delete an Extended Node

- b) Choose **Actions > Inventory > Resync Device**.

Step 4 Upgrade to policy extended node.

- In the **Provision > Fabric Sites** window, select the site in which the device is onboarded.
 - In the **Fabric Infrastructure** tab, click a device to edit its attributes.
 - In the **Fabric** tab, click the **Policy** toggle button under **Extended Node Attributes**.
 - In the **Policy Extended Node Upgrade** window that is displayed, click **Upgrade**.
-

Delete an Extended Node

This task describes the steps to delete an extended node, policy extended node, and authenticated extended node.

Step 1 Remove the extended node device from the fabric.

- From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
- In the **Fabric Sites** tab, click the number that indicates the count of fabric sites.
- Select the fabric site that contains the extended node device.
- In the **Fabric Infrastructure** tab, click the extended node device.
- In the slide-in pane, click **Remove From Fabric**.
- Click **Add**.

Step 2 Delete the device from **Inventory**.

For steps to delete the device from inventory, see [Delete a Network Device, on page 124](#).

Step 3 For a supplicant-based extended node device, delete the port assignment configuration in the fabric edge node or the FIAB.**Configure a REP Ring Topology for Extended Nodes and Policy Extended Nodes**

To enable redundancy with a recovery time of less than 50 ms for network failures with extended nodes, configure a Resilient Ethernet Protocol (REP) ring for the fabric site.

Unless explicitly stated, the term *extended node* also represents a policy extended node.

The following devices can be configured in a REP ring:

- Extended Node:

Cisco Industrial Ethernet (IE) 4000, 4010, 5000 series switches that operate Cisco IOS 15.2(7)E3 and later releases.

Cisco Catalyst IE3300 series switches that operate Cisco IOS XE 17.3.3 and later releases.

- Policy Extended Node:

Cisco Catalyst IE3400, IE3400H series switches that operate Cisco IOS XE 17.3.3 and later releases.

Limitations of a REP Ring

- To add an extended node into an existing REP ring, first delete the REP ring. Deleting the REP ring enables the Per VLAN Spanning Tree Protocol (PVSTP), which avoids Layer 2 loops. Then, add the new extended node to the fabric and recreate the REP ring to include the new extended node.
- Multiple rings within a given REP ring and a ring of rings aren't supported.
- A node in a REP ring can have other nodes connected to it in a daisy chain manner. However, a node in a daisy chain can't have a ring of nodes connected to it.
- A REP ring or a daisy chain can't be a mix of extended nodes and policy extended nodes. A REP ring or a daisy chain must consist entirely of either extended nodes or policy extended nodes.
- By default, a maximum of 18 devices can be onboarded in a single REP ring. To onboard more than 18 devices, increase the BPDU timer using **spanning-tree vlan infra VN VLAN max-age 40** command. Use the Catalyst Center templates to configure the command.

Note that in some rare instances, when the last two nodes of the ring try to onboard simultaneously, a port channel might not be created between these nodes. A port channel is established between the last two nodes of the ring when a REP ring is created.

Unless otherwise stated, the following steps are applicable to both extended node and policy extended node.

Before you begin

Ensure that you have onboarded the fabric edge nodes and extended nodes.

Identify the fabric edge node and its interfaces that terminate the REP ring.



Note

The REP ring configuration procedure may disrupt the network traffic for a brief period.

Step 1

From the top-left corner, click the menu icon and choose **Workflows > Configure REP Ring**.

Alternatively, you can navigate to the Fabric Site topology view, select the Fabric Edge node or the FIAB node on which you want to create the REP ring and click **Create REP Ring** under the **REP Rings** tab.

Step 2

If a task overview window appears, click **Let's Do It** to go directly to the workflow.

Step 3

In the **Select a fabric site** window, select a site that has both edge node and extended nodes.

Step 4

In the **Select a fabric edge node** window, choose a fabric edge node.

Step 5

In the **Select Extended Nodes connected to Fabric Edge** window, choose the extended nodes that connect to the fabric edge node.

You can choose two extended nodes to connect to the fabric edge node.

Step 6

Review and edit (if necessary) your fabric site, edge node, and extended node selections.

Step 7

To initiate the REP ring configuration, click **Provision**.

You can see a detailed status of the configuration progress on the **REP Ring Configuration Status** window.

Step 8

The **REP Ring Summary** window displays the details of the REP ring that is created along with the discovered devices.

Step 9

After the creation of the REP ring, a success message is displayed.

To verify the creation of the REP ring, go to the fabric site window and click the fabric edge node.

View REP Ring Status

In the slide-in window, under the **REP Ring** tab, you can see the list of all REP rings that exist on that edge node.

Click a REP ring name in the list to view its details, such as the devices present in the ring, ports of each device that connect to the ring, and so on.

View REP Ring Status

To view the status of the devices in an REP ring, do the following:

Step 1 In the Catalyst Center GUI, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 In the **Fabric Sites** tab, click the number that indicates the count of fabric sites.

Step 3 Click a fabric site.

Step 4 In the **Fabric Infrastructure** tab, click the fabric edge node or the fabric in a box (FIAB).

A slide-in pane displays the details of the fabric edge node or the FIAB that is selected.

Step 5 In the **REP Rings** tab, click **View** to see the **REP Ring Topology Status**.

The **REP Topology Status** section displays the current state of all the devices in the REP ring. The state, as displayed in the **Role** column, can be **Open**, **Fail**, or **Alt**.

Open indicates that the device link is up and that it is forwarding traffic.

Fail indicates that the device link is down.

Alt indicates that the device link is up, but the port cannot forward traffic.

Delete a REP Ring

Step 1 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2 In the **Fabric Infrastructure** tab, click the fabric edge node that terminates the REP Ring.

A slide-in window displays the details of the fabric edge node selected.

Step 3 In the **REP Rings** tab, for the desired REP Ring, click **Actions (...) > Delete**.

This deletes the REP Ring.

Delete a Node from a REP Ring

This task describes the steps to delete one extended node or multiple extended nodes from a REP ring.



Note After the extended nodes are removed, the downsized REP ring should use the existing interfaces to create a link to the neighboring devices.

Before you begin

Ensure that the REP ring to which the node belongs is not incomplete.

Step 1 Manually remove the extended node devices from the network.

Alternatively, if a device in a REP ring goes down, the **Fabric Infrastructure** window displays a notification.

Step 2 From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 3 In the **Fabric Infrastructure** tab, click the fabric edge node that terminates the REP ring.

A slide-in pane displays the details of the selected fabric edge node.

Step 4 In the **REP Rings** tab, for the desired REP ring, choose **Actions (...) > Rediscover**.

The extended node device is deleted from the REP ring and the REP ring display is updated.

Configure Supplicant-Based Extended Nodes

Supplicant-based extended nodes, also called Authenticated Extended Nodes (AENs), are extended node devices that receive an IEEE 802.1x (Dot1x) supplicant configuration and are onboarded into the SD-Access network only after a complete authentication and authorization. To onboard a supplicant-based extended node device, the authenticator port on the fabric edge must be configured with a Closed Authentication Template.

The following platforms support supplicant-based extended node onboarding:

Fabric Edge or FIAB:

Cisco Catalyst 9000 Series – C9300, C9400, C9500, and C9500H switches that operate Cisco IOS XE 17.7.1 or later.

Supplicant-based Extended Node:

Cisco Catalyst 9000 Series – C9200, C9300, C9400, C9500, and C9500H switches that operate Cisco IOS XE 17.7.1 or later.

Steps to Configure a Supplicant-Based Extended Node

Before you begin

- Configure Cisco ISE and ensure that it operates Release 3.1 or later. See [Configure Cisco Identity Services Engine to Onboard Supplicant-Based Extended Node, on page 628](#).
- Add the fabric edge node or FIAB device to the fabric and ensure that it operates Cisco IOS XE 17.7.1 or later.

Steps to Configure a Supplicant-Based Extended Node

- Set the Path MTU appropriately for the path between the fabric edge node and Cisco ISE. We recommend a value of 9100. Note that the Path MTU is set for all the devices in the fabric during LAN automation or when the underlay is configured.

Step 1 Configure AAA server settings in Catalyst Center.

- Define Cisco ISE as the AAA server for device authentication in the **System > Settings > External Services > Authentication and Policy Servers** window.

For the complete procedure, see "Configure Authentication and Policy Servers" in the *Cisco Catalyst Center Administrator Guide*.

- Add the Cisco ISE server to the global site. For information, see [Add Cisco ISE or Other AAA Servers, on page 233](#).

Step 2 (Optional) Configure Catalyst Center to authorize the device before onboarding.

- From the top-left corner, click the menu icon and choose **System > Settings > Device Settings > PnP Device Authorization**.
- Check the **Device Authorization** check box to enable authorization on the device.
- Click **Save**.

Step 3 Configure the Catalyst Center appliance to manage your PKI certificates.

- From the top-left corner, click the menu icon and choose **System > Settings > Certificates > Certificate Authority**.
- In the **Certificate Authority** window, click **Use Cisco DNA Center**.
- In the **CA Management** tab, click **Download** to download the CA Certificate.
- Add the certificate to the Cisco ISE Trusted Certificate Store. For more information, see the [Cisco Identity Services Engine Administrator Guide](#).

If you use an external certificate, add that certificate to the Cisco ISE Trusted Certificate Store.

Step 4 Configure the DHCP server with the extended IP address pool and Option 43. Ensure that the extended IP address pool is reachable from Catalyst Center.

For a detailed description of Option 43, see [DHCP Controller Discovery, on page 449](#).

Step 5 Enable **Closed Authentication** and disable Bridge Protocol Data Unit (BPDU) Guard on the fabric Site.

By default, selecting Closed Authentication pushes the BPDU Guard configuration on all the downlink access ports. When a remote switch like an extended node is connected, BPDU Guard pushes the port to error disabled mode. To disable BPDU Guard, uncheck the **Enable BPDU Guard** check box during the Closed Authentication configuration.

For more information, see [Select an Authentication Template](#).

Step 6 Assign an extended IP address pool to INFRA_VN, as described in [Create Anycast Gateways, on page 605](#).

In the **Create Anycast Gateways** workflow, choose **Extended Node** as the **Pool Type** and check the **Supplicant-Based Extended Node Onboarding** check box.

Catalyst Center configures the extended IP address pool and VLAN on the supported fabric edge device. This enables the onboarding of extended nodes.

Note Extended IP address pool is successfully assigned only if the fabric edge devices operate Cisco IOS XE 17.7.1 or later. If you upgraded from an earlier release of Catalyst Center, the supplicant-based extended node migration must be complete before configuring the extended IP address pool.

Step 7 Connect the extended node device to the fabric edge node or the FIAB.

After powering on, the extended node device is in **Pending Authorization** state if you chose to authorize the device before onboarding (Step 2). You can check the status of the device in the **Provision > Plug and Play** window.

Step 8

(Optional) Authorize the device.

Perform this step only if the device is in **Pending Authorization** state.

- a) From the top-left corner, click the menu icon and choose **Provision > Plug and Play**.
- b) In the **Plug and Play** window, select the supplicant-based extended node device and choose **Actions > Authorize**.

The authorization process provisions the supplicant-based extended node device for completing a certificate-based EAP-TLS authentication with Cisco ISE. After authentication, Cisco ISE authorizes the supplicant-based extended node device for complete access. The supplicant-based extended node device is then fully onboarded into the SD-Access fabric.

After a supplicant-based extended node device is onboarded into the fabric, access to the fabric edge-supplicant port is only based on authentication status. If the device or the port goes down, the authentication session is cleared, and traffic is not allowed on the port. When the port comes up again, it goes through the IEEE 802.1x (Dot1x) authentication process to regain access to the SD-Access network.

Replace a Faulty Port

If the link between the authenticator (fabric edge or FIAB) port and the supplicant port goes down, you can replace the faulty port and configure a new port through the **Port Assignment** menu.

Step 1

To replace the supplicant port, follow these steps:

- a) Clear the configuration on the new supplicant port.
- b) Copy the existing configuration from the current supplicant port to the new supplicant port to allow 802.1X authentication.

Step 2

To replace the authenticator port, follow these steps:

- a) Assign the supplicant port to the new interface of the authenticator. For information on port assignment, see [Configure Ports Within the Fabric Site, on page 595](#). Choose **Supplicant-Based Extended Node** as the **Connected Device Type**.
- b) Clear the existing port assignment on the old interface of the authenticator.

Step 3

Disconnect the physical connection between the old ports of the authenticator and the supplicant. Connect a cable between the new ports of the authenticator and the supplicant. Bring this link up.

Step 4

After the link between the new ports of the authenticator and supplicant is up, follow these steps:

- a) Resynchronize the device information in Catalyst Center by performing an **Inventory > Resync Device** for both the authenticator and the supplicant. See [Resynchronize Device Information, on page 124](#).
- b) Assign the new supplicant port to the authenticator. For information on port assignment, see [Configure Ports Within the Fabric Site, on page 595](#). Choose **Authenticator Switch** as the **Connected Device Type**.
- c) Clear the port assignment on the old supplicant port.

Configure Cisco Identity Services Engine to Onboard Supplicant-Based Extended Node

This task describes how to profile an Supplicant-Based Extended Node (SBEN) device in Cisco Identity Services Engine (ISE). The steps listed below are part of the Cisco ISE configuration procedure. For more information, refer the [Cisco Identity Services Engine Administrator Guide](#).

Before you begin

Download the CA certificate from Catalyst Center.

Step 1 Import the CA certificate into Cisco ISE:

From the Cisco ISE home page, choose **Administration > System > Certificates > System Certificates > Import**. In the **Import** window, ensure that you select the **Trust for client authentication** and **Syslog** check box. For more information, see the "Import the Root Certificates to the Trusted Certificate Store" section in the [Cisco Identity Services Engine Administrator Guide](#).

Step 2 Configure the following authorization profiles with their RADIUS attributes:

From the Cisco ISE main menu, choose **Policy > Policy Elements > Results > Authorization > Authorization Profiles**.

Configure the following profiles:

```
SBEN-DHCP:
Access Type = ACCESS_ACCEPT
Filter-ID = SBEN_DHCP_ACL.in

SBEN_LIMITED_ACCESS_AUTHZ:
Access Type = ACCESS_ACCEPT
Filter-ID = SBEN_MAB_ACL.in
cisco-av-pair = interface-template-name=SWITCH_SBEN_MAB_TEMPLATE

SBEN_FULL_ACCESS_AUTHZ :
Access Type = ACCESS_ACCEPT
cisco-av-pair = interface-template-name=SWITCH_SBEN_FULL_ACCESS_TEMPLATE
```

Step 3 Define the device profiling policy in the **Profiling Policies** window.

- From the Cisco ISE main menu, choose **Policy > Profiling > Profiling Policies**.
- In the **Profiling Policies** window, add a new **DHCP-v-i-vendor-class** condition for the **Cisco-Device: Cisco-Switch** policy.

* Name	Cisco-Switch	Description	Generic policy for all Cisco Switches																																										
Policy Enabled	<input checked="" type="checkbox"/>																																												
* Minimum Certainty Factor	20	(Valid Range 1 to 65535)																																											
* Exception Action	NONE	<input type="button" value="▼"/>																																											
* Network Scan (NMAP) Action	NONE	<input type="button" value="▼"/>																																											
Create an Identity Group for the policy	<input type="radio"/> Yes, create matching Identity Group <input checked="" type="radio"/> No, use existing Identity Group hierarchy																																												
Parent Policy	Cisco-Device																																												
* Associated CoA Type	Global Settings																																												
System Type	Administrator Modified																																												
Rules																																													
<table border="1"> <tr> <td>If Condition</td> <td>Cisco-IOS-NMAPOSCheck</td> <td>Then</td> <td>Certainty Factor Increases</td> <td>10</td> <td><input type="button" value="gear"/></td> </tr> <tr> <td>If Condition</td> <td>CDP_cdpCachePlatform_CONTAINS_9200...</td> <td>Then</td> <td>Certainty Factor Increases</td> <td>20</td> <td><input type="button" value="gear"/></td> </tr> <tr> <td>If Condition</td> <td>DHCP_v-i-vendor-class_CONTAINS_9200...</td> <td>Then</td> <td>Certainty Factor Increases</td> <td>20</td> <td><input type="button" value="gear"/></td> </tr> <tr> <td>If Condition</td> <td>Condition Name</td> <td>Expression</td> <td></td> <td>OR</td> <td><input type="button" value="gear"/></td> </tr> <tr> <td>If Condition</td> <td></td> <td>DHCP:v-i-ven...</td> <td>CONTAIN</td> <td>9200</td> <td><input type="button" value="gear"/></td> </tr> <tr> <td>If Condition</td> <td></td> <td>DHCP:v-i-ven...</td> <td>CONTAIN</td> <td>9300</td> <td>OR</td> </tr> <tr> <td>If Condition</td> <td></td> <td>DHCP:v-i-ven...</td> <td>CONTAIN</td> <td>9500</td> <td>OR</td> </tr> </table>				If Condition	Cisco-IOS-NMAPOSCheck	Then	Certainty Factor Increases	10	<input type="button" value="gear"/>	If Condition	CDP_cdpCachePlatform_CONTAINS_9200...	Then	Certainty Factor Increases	20	<input type="button" value="gear"/>	If Condition	DHCP_v-i-vendor-class_CONTAINS_9200...	Then	Certainty Factor Increases	20	<input type="button" value="gear"/>	If Condition	Condition Name	Expression		OR	<input type="button" value="gear"/>	If Condition		DHCP:v-i-ven...	CONTAIN	9200	<input type="button" value="gear"/>	If Condition		DHCP:v-i-ven...	CONTAIN	9300	OR	If Condition		DHCP:v-i-ven...	CONTAIN	9500	OR
If Condition	Cisco-IOS-NMAPOSCheck	Then	Certainty Factor Increases	10	<input type="button" value="gear"/>																																								
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If Condition	Condition Name	Expression		OR	<input type="button" value="gear"/>																																								
If Condition		DHCP:v-i-ven...	CONTAIN	9200	<input type="button" value="gear"/>																																								
If Condition		DHCP:v-i-ven...	CONTAIN	9300	OR																																								
If Condition		DHCP:v-i-ven...	CONTAIN	9500	OR																																								

- c) Create a new child policy for the supplicant device, under **Cisco-Switch** and apply the **CdpCachePlatform** and **V-I-Vendor-Class** conditions.

Ensure that the **Minimum Certainty Factor** value for the child policy is higher than that of the parent policy.

Configure Cisco Identity Services Engine to Onboard Suplicant-Based Extended Node

* Name: CAT9K_EN

Description:

Policy Enabled:

* Minimum Certainty Factor: 30 (Valid Range 1 to 65535)

* Exception Action: NONE

* Network Scan (NMAP) Action: NONE

Create an Identity Group for the policy: Yes, create matching Identity Group
 No, use existing Identity Group hierarchy

* Parent Policy: Cisco-Switch

* Associated CoA Type: Global Settings

System Type: Administrator Created

Rules

If Condition: CDP_cdpCachePlatform_CONTAINS_C920...	Then: Certainty Factor Increases	By: 30
If Condition: DHCP_v-i-vendor-class_CONTAINS_C920...	Then: Certainty Factor Increases	By: 30

Step 4 Set the global Change of Authorization (CoA) type to **Reauth**.

To configure the **CoA Type**, from the Cisco ISE home page, navigate to **Work Centers > Profiler > Settings**.

Choose **Reauth** from the **CoA Type** drop-down list.

Overview Ext Id Sources Network Devices Endpoint Classification Node Config Feeds Manual Scans Policy Elements Profiling Policies More

Profiler Settings NMAP Scan Subnet Exclusions

Profiling

Profiler Settings

CoA Type*: **Reauth**

Current custom SNMP community strings: *****

Show

Change custom SNMP community strings:

Confirm changed custom SNMP community strings:

EndPoint Attribute Filter

Anomalous Behaviour Detection

Anomalous Behaviour Enforcement

Custom Attribute for Profiling Enforcement

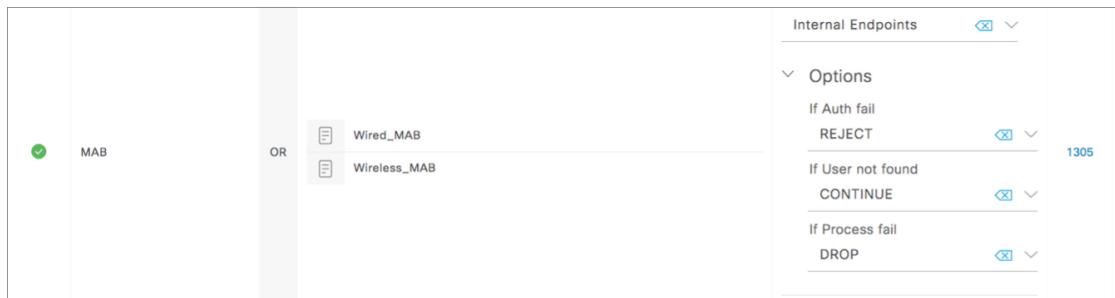
Profiling for MUD

Profiler Forwarder Persistence Queue

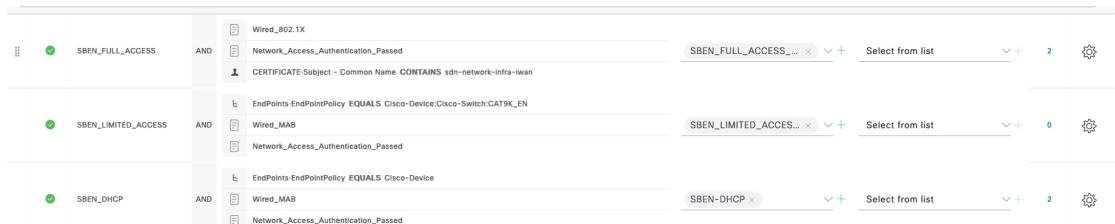
XSS Security Scan Enforcement for EndPoint Probe Data

Step 5 Define the authorization policy in the **Authorization Policy** window.

- From the Cisco ISE home page, choose **Policy > Policy Sets > Default > Authorization Policy**.
- Ensure that the default MAB policy is set to **CONTINUE** option for the **If User not found** field.



- c) In the **Authorization Policy** window, configure the authorization policies for the supplicant device and associate the policies with the authorization profiles that were created earlier (SBEN-DHCP, SBEN_LIMITED_ACCESS_AUTHZ, SBEN_FULL_ACCESS_AUTHZ).



Configure a Port Channel

A group of ports bundled together to act as a single entity is called a port channel. Port channels between a fabric edge and its remotely connected devices, such as extended nodes or servers, increase the connection resiliency and bandwidth.

Create a Port Channel

Before you begin

The authentication must be **Closed Authentication**.



Note

The following steps are automated for other authentication modes.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2

In the **Fabric Sites** tab, under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3

In the **Fabric Sites** window, click a fabric site to configure port channels.

Step 4

In the **Port Assignment** tab, hover your cursor over **More Actions**, and click **Create Port Channel**.

Step 5

In the **Select your fabric devices** window, select the fabric devices for which a port channel has to be created.

Create a Port Channel

Step 6 To specify the number of port channels and configure each port channel, perform the following actions in the **Determine number of port channels** window.

- a) From the **Connected Device Type** drop-down list, choose the type of connected device:
 - To create a port channel between a fabric edge node and an extended node or between two extended nodes, choose **Extended Node**.
 - To create a port channel with a fabric edge node or extended node on one side and a third-party device or a server port on the other side, choose **Trunk**.
- b) Enter a **Description** for the new port channel.
- c) Choose a protocol:
 - For the extended nodes that run Cisco IOS XE Release 16.12.1s and earlier releases, choose **On** as the protocol.
 - For the extended nodes that run Cisco IOS XE Release 17.1.1s and later releases, choose **Port Aggregation Protocol (PAgP)** as the protocol.
 - Don't select **Link Aggregation Control Protocol (LACP)** as the protocol for extended nodes. You can only connect the trunk ports or the server ports in the LACP mode.

Step 7 From the list of available interfaces, choose the interfaces to be bundled as a port channel.

Note You cannot have more than 16 members in a port channel that is connected in the LACP mode.

You cannot have more than eight members in a port channel that is connected in the PAgP mode.

Step 8 In the **Summary** window, review the port channels that are created.

Step 9 In the **Deploy Port Channel** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to configure the port channel.

Step 10 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 11

If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.

- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Update a Port Channel

Before you begin

Ensure that at least one member interface exists before you update a port channel.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.

Step 2

In the **Fabric Sites** tab, under **SUMMARY**, click the number that indicates the count of fabric sites.

Step 3

In the **Fabric Sites** window, click a fabric site to update the port channels.

Step 4

In the **Port Assignment** tab, click the port channel to be updated.

Step 5

Hover your cursor over **More Actions**, and click **Edit Port Channel**.

Step 6

Follow the onscreen guidelines to update the port channel configuration.

You can either add interfaces to the port channel or delete existing interfaces on the port channel.

Step 7

In the **Deploy Port Channel** window, depending on the Visibility and Control of Configurations settings, choose an available option:

Update a Port Channel

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to update the port channel.

Step 8 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 9 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.

- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Delete a Port Channel

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Fabric Sites**.
- Step 2** Under **SUMMARY**, click the number that indicates the count of fabric sites.
- Step 3** Click a fabric site.
- Step 4** In the **Fabric Infrastructure** tab, click a fabric edge node.
- Step 5** In the slide-in pane, click the **Port Channel** tab.
The **Port Channel** view lists all the existing port channels.
- Step 6** Check the check box for the port channel and click **Delete**.
- Step 7** At the prompt, click **Yes**.

Multicast

Multicast traffic is forwarded in different ways:

- Through shared trees by using a rendezvous point. PIM SM is used in this case.
- Through shortest path trees (SPT). PIM source-specific multicast (SSM) uses only SPT. PIM SM switches to SPT after the source is known on the edge router that the receiver is connected to.

See [IP Multicast Technology Overview](#).

Configure Multicast

Catalyst Center provides a workflow to enable group communication or multicast traffic in virtual networks. The workflow also allows you to choose multicast implementation in the network: native multicast or headend replication.



- Note** You can enable multicast on a virtual network whose border serves as a multisite remote border. Configuring multicast on such a virtual network configures multicast on the devices in the inherited virtual network too, provided the inherited virtual network already contains a segment. If the inherited virtual network doesn't have a segment, multicast is deployed only after the first segment is created. Ensure that a virtual network and its inherited networks deploy the same type of multicast implementation. The edge node devices of an inherited virtual network cannot be configured as a rendezvous point (RP).

Configure Multicast

-
- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Configure Multicast**.
- Step 2** If a task overview window appears, click **Let's Do It** to go directly to the workflow.
- Step 3** In the **Fabric Site** window, select a site in the site hierarchy pane.
- Step 4** In the **Replication Mode** window, choose the method of multicast implementation for the network from the following:
- **Native Multicast**
 - **Head-end replication**
- Step 5** In the **Virtual Networks** window, select the virtual network for which you want to set up multicast.
- Note** You can't select an inherited virtual network to set up multicast.
- Step 6** In the **Multicast pool mapping** window, select an IP address pool from the **IP Pools** drop-down list. The selected IP address pool is associated with the chosen virtual network.
- Step 7** In the **Multicast Mode** window, choose the type of multicast to implement:
- **SSM** (Source Specific Multicast)
 - **ASM** (Any Specific Multicast)
 - Select **SSM** and **ASM** to configure both together.
- Step 8** Do the following:
- a) On selecting **SSM**, configure the SSM list by adding an IP group range for each virtual network. You can add multiple IP group ranges for a virtual network.
 1. By default, 232.0.0.0/8 range of IPv4 address is selected. You can optionally modify the IPv4 address range. Choose an IP group range from 225.0.0.0 to 239.255.255.255.
 2. For IPv6 addresses, FF3x::/32 is reserved for SSM.
 - b) On selecting **ASM**, in the **Multicast Group to Rendezvous Point Mapping** window, configure the rendezvous point for each virtual network:
 1. Choose the type of rendezvous point: **External** or **Fabric**.
 2. Configure the rendezvous points in the respective tabs: **IPv4 RP** and **IPv6 RP**.
 3. You can define any number of external rendezvous points.
 4. Optionally, you can define a group-to-rendezvous point mapping. There could be one or multiple IPv4/IPv6 multicast groups that are associated with a rendezvous point.
 5. You can either have a rendezvous point with no mapping or with mapping. Both can't be configured together.
 6. The permitted multicast group ranges for IPv6 and IPv4 FF00:/8 and 225.0.0.0/8 - 239.0.0.0/8 respectively.
- Step 9** In the **Summary** window, review the multicast settings. To modify any of the settings, click **Edit**.
- Step 10** In the **Deploy Multicast** window, depending on the Visibility and Control of Configurations settings, choose an available option.
- **Now**: Immediately deploy the configurations.

- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

Click **Deploy** to complete the configuration.

Step 11 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 12 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

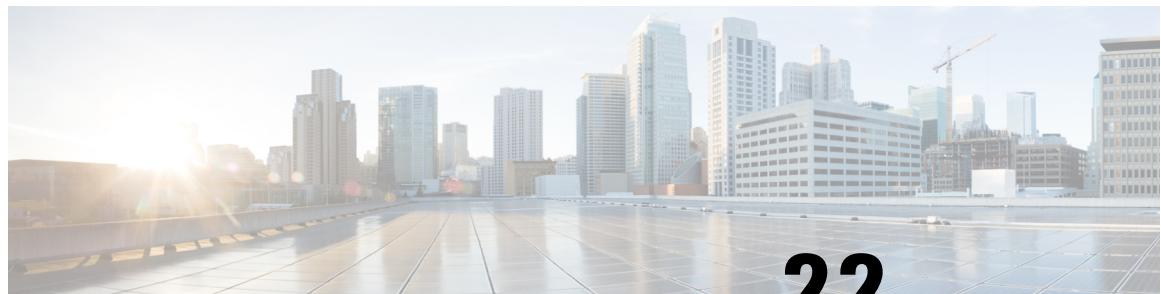
For more information, see [Visibility and Control of Fabric Configurations, on page 571](#).

- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.



CHAPTER 22

Provision Services

- [Applications, on page 639](#)
- [Application Hosting, on page 660](#)
- [Application Hosting on Cisco Catalyst 9100 Series Access Points, on page 667](#)
- [Configure a Site-to-Site VPN, on page 670](#)
- [Create a User-Defined Network Service, on page 672](#)
- [Configure Cisco Umbrella, on page 672](#)
- [Create Secure Tunnel, on page 679](#)

Applications

The following sections provide information about applications.

About Application Visibility

The Application Visibility service lets you manage your built-in and custom applications and application sets.

The Application Visibility service, hosted as an application stack within Catalyst Center, lets you enable the Controller-Based Application Recognition (CBAR) function on a specific device to classify thousands of network and home-grown applications and network traffic.

You can install the following packages:

- **Application Policy:** Lets you automate QOS policies across LAN, WAN, and wireless within your campus and branch.
- **Application Registry:** Lets you view, manage, and create applications and application sets.
- **Application Visibility Service:** Provides application classification using Network-Based Application Recognition (NBAR) and CBAR techniques.

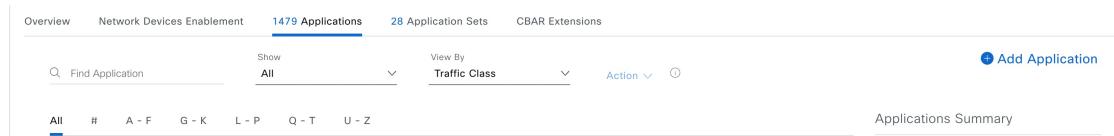
NBAR supports provisioning of up to 450 interfaces on Cisco Catalyst 9000 devices. Catalyst Center Application Visibility does not exceed this 450-interface limit.



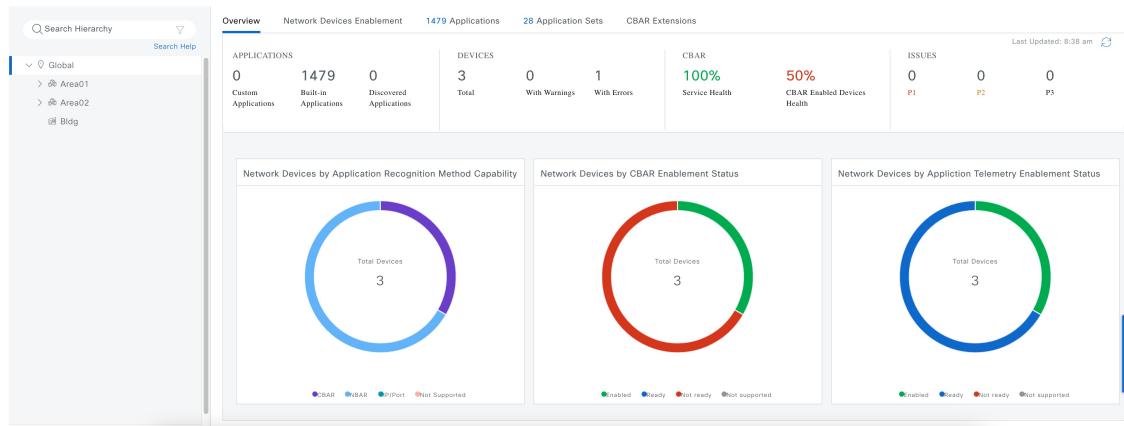
Note To ensure compatibility, the preceding packages must have the same package version.

Application Visibility View

If you install Application Registry or both Application Registry and Application Policy, you can see the **Applications** and **Application Sets** tabs when you click the menu icon and choose **Provision > Application Visibility**.



If you install Application Registry and Application Visibility Service or Application Registry, Application Policy, and Application Visibility Service, you can see the **Applications**, **Application Sets**, **Network Devices Enablement**, and **CBAR Extensions** tabs when you click the menu icon and choose **Provision > Application Visibility**.



Application Visibility View

The following table describes the dashlets and charts that are available in the **Overview** tab in **Provision > Services > Application Visibility**.

Item	Description
Applications	<p>This chart displays the number of applications available in the Catalyst Center application that can be used in Application Policy. The applications are classified as follows:</p> <ul style="list-style-type: none"> Custom: Applications added by a user Built-in: Preinstalled applications in Catalyst Center Discovered: Applications discovered by different recognition methods and imported into the application registry <p>Note The chart shows that the applications observed only on CBAR-enabled devices.</p>
Devices	Shows the total number of devices, devices with warning, and devices with error.

Item	Description
CBAR	<p>This widget displays the service health and the average health score for all CBAR-enabled devices. The device is healthy if there are no outstanding errors or warnings on that device.</p> <p>The CBAR health score is calculated across all CBAR-enabled devices.</p> <p>You can view the CBAR health of each CBAR-enabled device. A 0% CBAR health score indicates that the device has at least one error (P1). A 50% CBAR health score indicates that the device has no errors but has at least one warning (P2). A 100% CBAR health score indicates a healthy device.</p>
Issues	<p>All issues are classified by priority:</p> <ul style="list-style-type: none"> • Errors (P1) • Warnings (P2) • Others (P3) <p>Click the P1, P2, and P3 tabs to view the device issues and remedy details.</p>
Network Devices by Application Recognition Method	<p>This chart displays the number of devices classified by each of the application recognition methods:</p> <ul style="list-style-type: none"> • CBAR: CBAR-enabled devices such as routers and switches • NBAR: NBAR-based devices such as routers, switches, Cisco Wireless Controllers, and Cisco Catalyst 9800 Series Wireless Controller • IP/port: IP/port-based devices such as switches • Not supported: Devices that aren't supported by any of the preceding methods
Network Devices by CBAR Enablement Status	<p>This chart displays the device count in each CBAR readiness status.</p> <ul style="list-style-type: none"> • Enabled: Devices that are CBAR-enabled • Ready: Devices that are ready for enabling CBAR <p>Note The info icon next to Ready status shows that the respective device is wireless enabled.</p> <ul style="list-style-type: none"> • Not Ready: Devices that support CBAR but aren't ready for enabling CBAR due to some issues • Not Supported: Devices that don't support CBAR

Item	Description
Network Devices by Application Telemetry Enablement Status	<p>This chart displays the device application telemetry enablement status.</p> <ul style="list-style-type: none"> Enabled: Devices that are application telemetry-enabled Ready: Devices that are ready for enabling application telemetry Not Ready: Devices that support application telemetry but aren't ready for enabling application telemetry due to some issues Not Supported: Devices that don't support application telemetry

The following table describes the device information and statuses that are available in **Site Devices** table, under **Network Devices Enablement** tab:

Column	Description
Device Name	Name of the device. Click the device name to view the CBAR Service Status.
Management IP	IP address of the device.
Device Type	Group of related devices, such as routers, switches and hubs, or wireless controllers.
Site	The site to which the device is assigned.
Fabric	The fabric domain to which the device is assigned.
Role	Role assigned to each discovered device during the scan process. The device role is used to identify and group devices according to their responsibilities and placement within the network. If Catalyst Center cannot determine a device role, it sets the device role to Unknown.
Active Recognition Method	Shows the device recognition method (CBAR, NBAR, IP/Port, or Not Supported).
OS Version	Cisco IOS software that is currently running on the device.
CBAR Readiness Status	Hover over the status displayed in the CBAR Readiness Status column to view the Remedy message.
Protocol Pack Version	Shows the current version of the protocol pack installed on the device and the protocol pack update status.
Device Registry Status	Shows the synchronization status of the device with the application registry. Hover over the info icon or the error icon to view more details about the synchronization status.
CBAR Deployment Status	Shows the CBAR deployment status. For more information, see Reconfigure CBAR on Network Devices, on page 649 .

Column	Description
Service Health Status	Click the issues in the Service Health Status column to open the CBAR Service status page, which displays a complete list of issues and the service status information of a device. If you click the Cisco Catalyst 9K device name, you can view the footprint (service load, CPU, and flows) of the CBAR service.
Application Telemetry Readiness Status	Shows the device readiness for Application Telemetry.
Application Telemetry Deployment Status	Shows Application Telemetry deployment status for the device. If the deployment fails, click the link to view the details of failure.
Application QoS Policy	The application policy applied to the device. For Cisco Wireless Controllers with more than one application policy, the number of application policies applied and the name of all the applied application policies are displayed.
WAN Interfaces	Shows the number of WAN interfaces. Click the WAN interface details to view the WAN connectivity settings for the device.
Trunk Interfaces	Shows the number of Trunk interfaces. Click the Trunk interface details to view the Trunk connectivity settings for the device.

Configure CBAR Cloud

The Application Visibility service uses the CBAR cloud to enrich the protocol pack and enhance visibility for unknown applications by sending and receiving data from the cloud.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Application Visibility**.
- Step 2** Click **CBAR Extensions > CBAR Cloud** tab.
- Step 3** Click the **cloud authentication** link to connect with Cisco Cloud Services, to enable CBAR and to gain access to CBAR Application Intelligence data.
- You will be redirected to **System > Settings > Cloud Authentication** window.
- Step 4** You should generate a token in Cisco Cloud Services and enter it in **Cloud Authentication** window. Click **Where did I get my token Encryption Key** link to generate a token.
If you do not have a Cisco Cloud Services account, click dna.cisco.com link.
- Step 5** In the Cisco Cloud Services GUI, click the menu icon, click **Applications**, and choose **Products**.
- Step 6** From the **Region** drop-down list, choose the appropriate region and click **Register**.
- Step 7** In the **Register Product** pane, enter the required details, such as **Host Name/IP**, **Name**, and **Description** (if any). Choose the appropriate type of product being registered from the **Type** drop-down list, such as Catalyst Center. Click **Register**.
- Note** Check the **Enable Cloud Access Login** check box to enable automatic login from your Cisco Cloud Services to Catalyst Center.

The OTP redemption occurs automatically, and Catalyst Center opens in a new window.

Enable/Disable CBAR Cloud

- Step 8** If you want to connect manually, the **OTP Generated** dialog box appears after successful registration of Catalyst Center. To copy the OTP, click **Copy**, and click **Close**.
- Step 9** Navigate back to the **Cloud Authentication** window to establish the connection:
- In the Catalyst Center GUI, click the menu icon and choose **System > Settings > Cloud Authentication**.
 - Click **Add OTP Key**.
 - In the **OTP Code** field, paste the OTP that you generated and copied in the Cisco Cloud Services application, and click **Done**.
- On successful establishment of the connection, CBAR Cloud is enabled by default.
- Step 10** You can view the list of available **CBAR Dynamic Application Feeds** under **CBAR Cloud** tab. To enable all the application feeds, click **All** radio button.
- Note** The newly introduced application feed is automatically enabled for your network, if you select all feeds.
- To enable the required application feeds, do the following:
- Click **Selected only** radio button.
 - Check the check box next to the application feed that you want to select.
 - Click **Apply**.
- Note** In **Selected only** mode, the newly introduced application feeds are not imported to the network until you manually select it.

Enable/Disable CBAR Cloud

Before you begin

Ensure to establish connection between Catalyst Center and Cisco Cloud Services. For more information, see [Configure CBAR Cloud, on page 643](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Application Visibility**.
- Step 2** Click **CBAR Extensions > CBAR Cloud** tab.
- Step 3** To enable CBAR Cloud, click the **Enable** toggle button.
- Step 4** To disable CBAR Cloud, disable the **Enable** toggle button and click **Yes** in the subsequent dialog box.

Enable/Disable CBAR on Network Devices

Before you begin

- The devices must be assigned to a site.
- It is recommended to configure CBAR Cloud before enabling CBAR on the network devices. For more information, see [Configure CBAR Cloud, on page 643](#).

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Application Visibility > Network Devices** **Enablement** tab.

The **Site Devices** table is displayed. Click the vertical ellipsis and click **All** to view all the columns.

- Step 2** Do the following to enable CBAR on selected devices or all devices:

- a. To enable CBAR on all devices, from the **CBAR** drop-down list choose **Enable CBAR on all ready devices** and click **Yes** on the subsequent warning dialog box.
- b. To enable CBAR on selected devices, check the check box next to the device name to select the device, from the **CBAR** drop-down list choose **Enable CBAR on selected devices** and click **Yes** on the subsequent warning dialog box.
- c. After confirmation, do the following on **Enable CBAR** slide-in pane:
 1. Review the device details and click **Enable**.
 2. Based on the Visibility and Control of Configurations settings, choose an available option:
 - **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

3. Click **Apply**.
4. On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
 - Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

5. If you chose **Generate configuration preview** in the **Enable CBAR** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:
 - a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
 - b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Step 3 Do the following to disable CBAR on selected devices or all devices:

- a. To disable CBAR on all devices, from the **CBAR** drop-down list choose **Disable CBAR on all devices** and click **Yes** on the subsequent warning dialog box.
- b. To disable CBAR on selected devices, check the check box next to the device name to select the device, from the **CBAR** drop-down list choose **Disable CBAR on selected devices** and click **Yes** on the subsequent warning dialog box.
- c. After confirmation, do the following on **Disable CBAR** slide-in pane:

1. Based on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

2. Click **Apply**.

3. On the **Performing Initial Checks** window, address all of the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

4. If you chose **Generate configuration preview** in the **Disable CBAR** slide-in pane, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Enable/Disable Application Telemetry

Before you begin

We recommend that you configure CBAR Cloud before enabling Application Telemetry. For more information, see [Configure CBAR Cloud, on page 643](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Application Visibility**.

Step 2 Click the **Network Devices Enablement** tab.

Step 3 In the **Site Devices** table, do the following to enable Application Telemetry:

- a. Choose the devices.

- b. From the **Application Telemetry** drop-down list, choose **Enable Application Telemetry**.

Update the Protocol Pack on a CBAR-Enabled Device

- c. Click **Enable** in the **Enable Application Telemetry** slide-in pane.

Note If **Application Telemetry** deployment fails for a device, click the link under **Application Telemetry Deployment Status** column to view the failure reason.

A **Success** message at the bottom of the window indicates that Application Telemetry is enabled.

Step 4

To disable Application Telemetry, do the following:

- a. Choose the devices in the **Site Devices** table.
- b. From the **Application Telemetry** drop-down list, choose **Disable Application Telemetry** and click **Yes** in the subsequent warning dialog box.

Update the Protocol Pack on a CBAR-Enabled Device

You can upgrade the protocol pack on any device that supports CBAR to the latest or any specific protocol pack. You can update protocol pack manually or enable automatic protocol pack update.



Note

- Automatic Protocol Pack update menu is disabled when CBAR cloud connector is disabled.
- Manual Protocol Pack update menu is disabled when Automatic Protocol Pack is enabled.

Before you begin

- Configure Cisco credentials on **System Settings**. For more information about configuring Cisco credentials, see the *Cisco Catalyst Center Administration Guide*.
- Devices must support CBAR.
- CBAR must be enabled on the device.
- Protocol packs for the device must be available on cisco.com.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2

Click the **Network Devices Enablement** tab.

Step 3

In **Site Devices** table, check the status shown in the **Protocol Pack Version** column.

You can click the **Outdated** status to view the list of applicable protocols packs in the **Update Protocol Pack** window.

Step 4

Click **Update** corresponding to the required protocol pack version in the **Update Protocol Pack** window.

The **Protocol Pack Version** column shows **In progress** status. Click the info icon to view the current updating version. If the **Protocol Pack Version** column shows **Update failed** status, click the error icon to view the failure reason.

Step 5

If you want to manually update all the devices or selected devices to the latest protocol pack, do the following:

To update the protocol pack on all applicable CBAR-enabled devices:

- From the **Update Protocol Pack** drop-down list, choose **Update All Devices** and click **Yes** in the subsequent warning dialog box.

To update the protocol pack on the selected devices:

- Choose the devices in the **Site Devices** table.
- From the **Update Protocol Pack** drop-down list, choose **Update Selected Devices** and click **Yes** in the subsequent warning dialog box.

To update the protocol pack on the selected devices from the file:

- Choose the devices in the **Site Devices** table.
- From the **Update Protocol Pack** drop-down list, choose **Update Selected Devices From File**.
- In the **Update Protocol Pack From File** slide-in pane you can either drag and drop the file into the drag-and-drop area or click **Choose a file**, browse to the location of the file, and click **Open**.
- Click **Import**.

Step 6

If you want to automatically update protocol pack for all the devices, do the following:

- From the **Update Protocol Pack** drop-down list, enable **Auto Update** toggle button and click **Yes** in the subsequent warning dialog box.

Note By default, all ready devices are included for **Auto Update**.

To exclude selected devices from automatic protocol pack update, do the following:

- Choose the devices in the **Site Devices** table.
- From the **Update Protocol Pack** drop-down list, choose **Exclude Selected Devices** and click **Yes** in the subsequent warning dialog box.

To include selected devices for automatic protocol pack update, do the following:

- Choose the devices in the **Site Devices** table.
- From the **Update Protocol Pack** drop-down list, choose **Include Selected Devices** and click **Yes** in the subsequent warning dialog box.

Reconfigure CBAR on Network Devices

You can include or exclude interfaces from **Site Devices** table in the **Application Visibility > Network Devices Enablement** window.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Network Devices Enablement** tab.

Step 3 In the **Site Devices** table, click **Re-Configure** in the **CBAR Deployment status** column for the device that you want to configure and do the following:

Reconfigure CBAR on Network Devices

- a) In the **Enable CBAR** slide-in pane, search for the device name or locate the device and click **View Interfaces**.
- b) Locate the interface that you want to exclude.
- c) In the **Status** column, click the toggle button to disable the interface and click **Save**.

Step 4 To include interfaces, choose **Excluded Interfaces** and enable the toggle button next to the desired interfaces, and click **Save**.

Step 5 Click **Enable**.

Step 6 Based on the Visibility of Configurations settings, choose an available option. For more information, see [Visibility and Control of Device Configurations, on page 132](#).

- To immediately enable CBAR, click the **Now** radio button.
- To schedule the task for a later date and time, click the **Later** radio button and define the date and time of the deployment.
- Catalyst Center allows you to review the configurations before deploying them on Cisco network devices. The configuration can be reviewed from the Preview Configuration window.

To preview the CLI configuration, click the **Generate configuration preview** radio button.

Step 7 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.

If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.

- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see "Network Provisioning Prechecks" in the [Cisco Catalyst Center User Guide](#).

If you chose **Now** or **Later**, click **Submit**, and CBAR is enabled at the scheduled time. You can view the task on the **Tasks** window.

Step 8 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Applications and Application Sets

Applications are the software programs or network signaling protocols that are used in your network. Catalyst Center supports all of the applications in the Cisco Next Generation Network-Based Application Recognition (NBAR2) library of approximately 1400 distinct applications.

Applications are grouped into logical groups called application sets. An application set can be assigned a business relevance within a policy.

Applications are mapped into industry standard-based traffic classes, as defined in RFC 4594, that have similar traffic treatment requirements. The traffic classes define the treatments (such as Differentiated Services Code Point [DSCP] marking, queuing, and dropping) that will be applied to the application traffic, based on the business relevance group that is assigned.

If you have additional applications that are not included in Catalyst Center, you can add them as custom applications and assign them to application sets.

Unidirectional and Bidirectional Application Traffic

Some applications are completely symmetrical and require identical bandwidth provisioning on both ends of the connection. Traffic for such applications is described as bidirectional. For example, if 100 kbps of Low-Latency Queueing (LLQ) is assigned to voice traffic in one direction, 100 kbps of LLQ must also be provisioned for voice traffic in the opposite direction. This scenario assumes that the same Voice over IP (VoIP) coder-decoders (codecs) are being used in both directions and do not account for multicast Music-on-Hold (MoH) provisioning. However, certain applications, such as streaming video and multicast MoH, are most often unidirectional. Therefore, it might be unnecessary, and even inefficient, to provision any bandwidth guarantees for such traffic on a branch router for the branch-to-campus direction of traffic flow.

Catalyst Center lets you specify whether an application is unidirectional or bidirectional for a particular policy.

On switches and wireless controllers, NBAR2 and custom applications are unidirectional by default. However, on routers, NBAR2 applications are bidirectional by default.

Custom Applications

Custom applications are applications that you add to Catalyst Center. You can view the number of custom applications available in the Overview window. For wired devices, you can define applications based on server name, IP address and port, or URL. You can define custom applications for Cisco Catalyst 9800 Series Wireless Controllers and not for Cisco AireOS controllers.

Discovered Applications

When you define an application according to its IP address and port, you can also define a DSCP value and port classification.

To simplify the configuration process, you can define an application based on another application that has similar traffic and service-level requirements. Catalyst Center copies the other application's traffic class settings to the application that you are defining.

Catalyst Center does not configure ACLs for port numbers 80, 443, 53, 5353, and 8080, even if they are defined as part of a custom application. If the custom application has a transport IP defined, Catalyst Center configures the application on the devices.



Note For a custom application to be programmed on devices when a policy is deployed, you must assign the custom application to one of the application sets defined in the policy.

Discovered Applications

Discovered applications are applications that are discovered by importing from the recommended customization, such as an Infoblox DNS server, or by importing from the recommended unclassified applications flow.

The unclassified traffic can come from any flow that the CBAR-enabled device identifies, but that is not recognized by the NBAR engine. In such cases, the applications that have a meaningful bit rate are reported as unclassified and can be imported and used as applications in Catalyst Center.

The Application Visibility service lets Catalyst Center connect with external authoritative sources through the CBAR cloud to help classify the unclassified traffic or help generate improved signatures.

The available external authoritative sources are Google Meet, Service Now, Sugarcrm, Telegram, SAP, Microsoft Office 365 Cloud Connector, Box, RingCentral, Github, Crashplan, Intuit, Workday, Zscaler, Atlassian, Amazon Chime, Zoom, Dropbox, Webex, Whatsapp, Cisco Meraki, and Salesforce. This list is dynamic. As new sources are added to the cloud, the list is updated. To view the list, choose **Application Visibility > CBAR Extensions > CBAR Cloud**.



Note You must configure a CBAR cloud connector before configuring the applications.

The discovered applications are imported to the application registry.

Favorite Applications

Catalyst Center lets you flag applications that you want to configure on devices before all other applications. Flagging an application as a favorite helps to ensure that the QoS policies for your favorite applications get configured on devices. For more information, see [Processing Order for Devices with Limited Resources, on page 726](#).

When custom applications are created they are marked as favorite applications.

Although there is no limit to the number of applications that you can mark as favorites, designating only a small number of favorite applications (for example, fewer than 25) helps to ensure that these applications are treated correctly from a business-relevance perspective in deployments with network devices that have limited ternary content addressable memory (TCAM).

Favorite applications can belong to any business-relevance group or traffic class and are configured system-wide, not on a per-policy basis. For example, if you flag the Cisco Jabber video application as a favorite, the application is flagged as a favorite in all policies.

Keep in mind that not only can business-relevant applications be flagged as favorites, even business-irrelevant applications can be flagged as such. For example, if administrators notice a lot of unwanted Netflix traffic on the network, they might choose to flag Netflix as a favorite application (despite it being assigned as business-irrelevant). In this case, Netflix is programmed into the device policies before other business-irrelevant applications, ensuring that the business intent of controlling this application is realized.

Configure Applications and Application Sets

The following subsections describe the various tasks that you can perform in the context of applications and application sets.



Note You can edit or delete only custom and discovered applications. You can edit or delete a maximum of 100 custom and discovered applications at one instance. If you choose applications for editing or deleting, a notification message indicates the number of applications that can be edited or deleted, excluding the number of chosen applications.

Change an Application's Settings

You can change the application set or traffic class of an existing CBAR, custom, or discovered application.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click **Applications** tab.

Step 3 Use the **Search**, **Show**, or **View By** fields to locate the application that you want to change.

You can search applications based on their name, port number, and traffic class.

Step 4 Click the application name.

Step 5 In the dialog box, change one or both settings:

- **Traffic Class:** Choose a traffic class from the drop-down list. Valid traffic classes are BROADCAST_VIDEO, BULK_DATA, MULTIMEDIA_CONFERENCING, MULTIMEDIA_STREAMING, NETWORK_CONTROL, OPS_ADMIN_MGMT, REAL_TIME_INTERACTIVE, SIGNALING, TRANSACTIONAL_DATA, VOIP_TELEPHONY.
- **Application Set:** Choose an application set from the drop-down list. Valid application sets are authentication-services, backup-and-storage, collaboration-apps, consumer-browsing, consumer-file-sharing, consumer-gaming, consumer-media, consumer-misc, consumer-social-networking, database-apps, desktop-virtualization, email, enterprise-ipc, file-sharing, generic-browsing, generic-media, generic-misc, tunneling, local-services, naming-services, network-control, network-management, remote-access, saas-apps, signaling, software-development-tools, software-updates, streaming-media.

Step 6 Click **Save**.

Create a Server Name-Based Custom Application

If you have applications that are not in Catalyst Center, you can add them as custom applications.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Application** tab.

Step 3 Click **Add Application** at the top-right corner of the window.

Step 4 In the slide-in pane, provide the necessary information in the following fields:

- **Application name:** Name of the custom application. The name can contain up to 24 alphanumeric characters, including underscores and hyphens. The underscore and hyphen are the only special characters allowed in the application name.
- **Type:** Method by which users access the application. Choose **Server Name** for applications that are accessible through a server.
- **Server name:** Name of the server that hosts the application.
- **Similar to:** Application with similar traffic-handling requirements. Click the radio button to select this option, and then select an application from the drop-down list. Catalyst Center copies the other application's traffic class to the application that you are defining.
- **Traffic class:** Traffic class to which the application belongs. Valid values are BULK_DATA, TRANSACTIONAL_DATA, OPS_ADMIN_MGMT, NETWORK_CONTROL, VOIP_TELEPHONY, MULTIMEDIA_CONFERENCING, MULTIMEDIA_STREAMING, BROADCAST_VIDEO, REAL_TIME_INTERACTIVE, and SIGNALING.
- **Application set:** Application set is where you want the application to reside. Valid application sets are authentication-services, backup-and-storage, collaboration-apps, consumer-browsing, consumer-file-sharing, consumer-gaming, consumer-media, consumer-misc, consumer-social-networking, custom applications, database-apps, desktop-virtualization, email, enterprise-ipc, file-sharing, generic-browsing, generic-media, generic-misc, tunneling, local-services, naming-services, network-control, network-management, remote-access, saas-apps, signaling, software-development-tools, software-updates, streaming-media.

Step 5 Click **Save**.

Create an IP Address and Port-Based Custom Application

If you have applications that are not in Catalyst Center, you can add them as custom applications.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Application** tab.

Step 3 Click **Add Application**.

Step 4 In the **Application name** field, enter a name for the custom application. The name can contain up to 24 alphanumeric characters, including underscores and hyphens. The underscore and hyphen are the only special characters allowed in the application name.

Step 5 In the **Type** area, click the **Server IP/Port** radio button to indicate that the application is accessible through an IP address and port.

- Step 6** Check the **DSCP** check box and define a DSCP value. If you do not define a value, the default value is Best Effort. Best-effort service is essentially the default behavior of the network device without any QoS.
- Step 7** Check the **IP/Port Classifiers** check box to define the IP address and subnet, protocol, and port or port range for an application. Valid protocols are IP, TCP, UDP, and TCP/UDP. If you select the IP protocol, you do not define a port number or range. Click to add more classifiers.
- Step 8** Define your application traffic-handling requirements using one of the following methods:
- **Similar To:** If your application has similar traffic-handling requirements as an existing application, click the **Similar To** radio-button and choose the application from the drop-down list. Catalyst Center copies the traffic class of the other application to the application that you are defining.
 - **Traffic Class:** If you know the traffic class that you want to define for your application, click the **Traffic Class** radio button and choose the traffic class from the drop-down list. Valid values are BULK_DATA, TRANSACTIONAL_DATA, OPS_ADMIN_MGMT, NETWORK_CONTROL, VOIP_TELEPHONY, MULTIMEDIA_CONFERENCING, MULTIMEDIA_STREAMING, BROADCAST_VIDEO, REAL_TIME_INTERACTIVE, and SIGNALING.
- Step 9** From the **Application Set** drop-down list, choose the application set to which the application will belong. Valid application sets are authentication-services, backup-and-storage, collaboration-apps, consumer-browsing, consumer-file-sharing, consumer-gaming, consumer-media, consumer-misc, consumer-social-networking, custom applications, database-apps, desktop-virtualization, email, enterprise-ipc, file-sharing, generic-browsing, generic-media, generic-misc, tunneling, local-services, naming-services, network-control, network-management, remote-access, saas-apps, signaling, software-development-tools, software-updates, streaming-media.
- Step 10** Click **Save**.

Create a URL-Based Custom Application

If you have applications that are not in Catalyst Center, you can add them as custom applications.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.
- Step 2** Click the **Application** tab.
- Step 3** Click **Add Application**.
- The **Add Application** dialog box appears.
- Step 4** In the **Application name** field, enter the name of the custom application. The name can contain up to 24 alphanumeric characters, including underscores and hyphens. (Underscores and hyphens are the only special characters allowed in the application name.)
- Step 5** For **Type**, click the **URL** radio button.
- Step 6** In the **URL** field, enter the URL used to reach the application.
- Step 7** Configure the traffic class:
- To use the same traffic class as another application with similar traffic-handling requirements, click the **Similar To** radio button and choose an application from the drop-down list.
 - To specify the traffic class, click the **Traffic Class** radio button and choose a traffic class from the drop-down list. Valid values are BULK_DATA, TRANSACTIONAL_DATA, OPS_ADMIN_MGMT, NETWORK_CONTROL, VOIP_TELEPHONY, MULTIMEDIA_CONFERENCING, MULTIMEDIA_STREAMING, BROADCAST_VIDEO, REAL_TIME_INTERACTIVE, and SIGNALING.
- Step 8** From the **Application Set** drop-down list, choose an application set in which you want the application to reside.

Edit or Delete a Custom Application**Step 9** Click **Save**.**Edit or Delete a Custom Application**

If required, you can change or delete a custom application.



Note You cannot delete a custom application that is directly referenced by an application policy. Application policies typically reference application sets and not individual applications. However, if a policy has special definitions for an application (such as a consumer or producer assignment or bidirectional bandwidth provisioning), the policy has a direct reference to the application. As such, you must remove the special definitions or remove the reference to the application entirely before you can delete the application.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.**Step 2** Click the **Application** tab.**Step 3** Use the **Search**, **Show**, or **View By** fields to locate the application that you want to change.

You can search applications based on their name, port number, and traffic class.

Step 4 To edit the application:

- Click the application name and make the required changes. For information about the fields, see [Create a Server Name-Based Custom Application, on page 654](#), [Create an IP Address and Port-Based Custom Application, on page 654](#), or [Create a URL-Based Custom Application, on page 655](#).
- Click **Save**.

Alternatively, choose the application and from the **Actions** drop-down list, click **Edit** to edit an application.

Note When policy is redeployed, the edited custom applications are not reconfigured on Cisco Catalyst 9800 Series Wireless Controller.

Step 5 To delete the application, click in the application box, and then click **OK** to confirm.

Alternatively, you can follow the steps below to delete the application:

- Check the check box next to an application name. You can also choose multiple applications.
- From the **Actions** drop-down list, click **Delete** option.
- Click **OK** to confirm.

Mark an Application as Favorite

You can mark an application as a favorite to designate that the application's QoS configuration must be deployed to devices before other applications' QoS configuration. An application marked as favorite has a yellow star next to it.

When you add or edit a policy, applications marked as favorites are listed at the top of the application set.

Applications are configured system-wide, not on a per-policy basis. For more information, see [Favorite Applications, on page 652](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Application** tab.

Step 3 Locate the application that you want to mark as a favorite.

Step 4 Click the star icon.

Create a Custom Application Set

If none of the application sets fits your needs, you can create a custom application set.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Application Sets** tab.

Step 3 Click **Add Application Set**.

Step 4 In the slide-in pane, enter a name for the new application set.

Catalyst Center creates the new application set; however, it contains no applications.

Step 5 Choose a Default Business Relevance from the drop-down list. Default Business Relevance is the business relevance level in the absence of a concrete application QoS, this level will appear in Assurance for sites that are not assigned to a policy.

Step 6 Click **Save**.

Step 7 Use the **Search**, **Show**, or **View By** fields to locate the application set.

You can search applications based on their name, port number, and traffic class.

Step 8 Locate the applications that you want to move into the new application set.

Step 9 Check the check box next to the applications that you want to move.

Step 10 Drag and drop the applications into the new application set.

Edit or Delete a Custom Application Set

If required, you can change or delete a custom application set.



Note You cannot delete a custom application set that is referenced by an application policy. You must remove the application set from the policy before you delete the application set.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Application Sets** tab.

Step 3 Use the **Search**, **Show**, or **View By** fields to locate the application set that you want to change.

You can search applications based on their name, port number, and traffic class.

Step 4 Do one of the following:

Discover Unclassified Applications

- To edit the application set, drag and drop applications into or out of the application set. Click **OK** to confirm each change.
- To delete the application set, click  in the application set box, and then click **OK** to confirm.

Discover Unclassified Applications

The Application Visibility service in Catalyst Center obtains information on classified and unclassified domains and sockets from devices and displays that information in the **Observed Traffic** chart. The number of unclassified server names and IP/ports that are discovered by the Application Visibility service is shown under **Recommendations**.

You can add the unclassified server names and IP/ports to the Application Registry.



Note You can add a maximum of 1100 discovered applications in the Application Registry.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **CBAR Extensions > Discovered Applications** tab.

Step 3 The table lists the discovered servers or IP/ports that are not classified. Choose the server and check the **Hide Ignored Applications** check box if you want to hide the selected server or IP/ports in the table.

Step 4 Choose the server or IP/ports that you want to import as an application in the Application Registry.

Step 5 Choose the required **Application**, **Application Set**, and **Traffic Class** from the drop-down list.

Step 6 Click **Import**.

Step 7 Click the **Applications** tab and from **Show** drop-down list choose **Discovered** to view the imported application.

Application Visibility Service Support for the Catalyst Center Traffic Telemetry Appliance

The Catalyst Center Traffic Telemetry Appliance generates endpoint telemetry from mirrored IP network traffic and shares the telemetry data with Catalyst Center for endpoint visibility and segmentation.

The prerequisites for enabling CBAR on the Catalyst Center Traffic Telemetry Appliance include:

- The device must be assigned to a site.
- The device role must be set to **Distribution** mode.

You can configure custom applications with attribute sets and maps on the Catalyst Center Traffic Telemetry Appliance without configuring a QoS policy. For more information, see [Create an Application Policy, on page 732](#) and [Deploy an Application Policy, on page 737](#).

Discover Infoblox Applications

You can integrate Catalyst Center with an organizational Infoblox DNS server to resolve unclassified traffic based on server names.

Before you begin

- The Infoblox WAPI version must be 1.5 or later. To check the Infoblox WAPI version, log in to the Infoblox server and choose **Help > Documentation > WAPI Documentation**.
- Create a role with at least Read Only permissions and assign the role to the Infoblox user. For more information, see Manage Users in the *Cisco Catalyst Center Administrator Guide*.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **CBAR Extensions > Infoblox** tab.

Step 3 Under **Infoblox**, click the **Here** link to configure IPAM/DNS server credentials in Catalyst Center.

Step 4 Complete the IPAM settings. For more information, see Configure an IP Address Manager in the *Cisco Catalyst Center Administrator Guide*.

Step 5 Go back to **Infoblox** and click the  icon to complete the following settings:

- Check the **All DNS Zones** check box, or choose the required DNS zones from the **DNS Zones to Inspect** drop-down list. The drop-down list shows the DNS zones defined in the Infoblox server.
- From the **Inspect** drop-down list, choose the required inspection record.
- Check the **Read Application name from** check box and click the **Extensible Attribute** or **AVC RRTYPE format** radio button. If you click the **Extensible Attribute** radio button, enter the extensible attribute name that contains descriptive application names.
- From **Default Traffic Class**, choose the default traffic class for classifying the Infoblox applications.
- From **Default Application Set**, choose the default application set for classifying the Infoblox applications.

Step 6 Click **Save**.

Step 7 Choose the application that you want to import and complete the following:

- If the application does not have a name defined in the Infoblox server, edit the application name.
- Choose the required application set and traffic class from the drop-down list if you want to change the default application set and traffic class defined in the **Infoblox**.

Step 8 Click **Import**.

Step 9 Click the **Applications** tab and choose **Discovered** in the **Show** drop-down list to view or edit the imported Infoblox applications.

If you change the server name of an application after importing the application, the **Application Status** column in the **Infoblox** window shows the status of the application as **Updated**. The application name that you see in the **Application Status** column is the new server name of the application. Click the info icon to view the old server names of the application.

Edit or Delete a Discovered Application

If required, you can edit or delete a discovered application.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Visibility**.

Step 2 Click the **Applications** tab.

Step 3 Use the **Search**, **Show**, or **View By** fields to locate the discovered application that you want to change.

You can search for applications based on their name, port number, and traffic class.

Step 4 To edit the application:

- Click the application name and make the required changes.

For discovered applications, you can edit only the **Attribute Set** and **Traffic Class**.

- Click **Save**.

Step 5 To delete the application, select the application and choose **Delete** option from the **Action** drop-down list at the top of the window, and then click **OK** in the subsequent warning dialog box that appears on the window.

Application Hosting

The following sections provide information about application hosting.

About Application Hosting

Application hosting lets you manage the lifecycle of third-party applications on devices managed by Catalyst Center. You can host third-party docker applications on Cisco Catalyst 9300 Series switches running Cisco IOS-XE software version 16.12.1s or later, Cisco Catalyst 9100 Series Access Points running Cisco IOS-XE software version 17.3.1 or later, and Cisco Catalyst 9400 Series switches running Cisco IOS-XE software version 17.1 or later.



Note The disk space allocated in Catalyst Center for the hosted applications is limited to 5 GB.

Install or Update the Application Hosting Service Package

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.

Step 1 From the top-left corner, click the menu icon and choose **System > Software Updates**. Alternatively, click the cloud icon and click the **Go to Software Updates** link.

Step 2 In the Software Updates window, review the following tabs:

- **Updates:** Shows the system and application updates. System Update shows the system version that is installed and the system updates that are available and have been downloaded from the Cisco cloud. Application Updates shows the available applications that can be downloaded and installed from the Cisco cloud, the size of the application, and the appropriate action (**Download**, **Install**, or **Update**). Hover your cursor over the package to view the available version and a basic description.
- **Installed Apps:** Shows the application packages that are currently installed.

Step 3 To download the Application Hosting package, click **Install** next to the Application Hosting name under **Updates > Application Updates**.

Step 4 To update the Application Hosting package, click **Update** next to the Application Hosting name under **Updates > Application Updates**.

Step 5 Ensure that the application has been updated by reviewing the version on the **Installed Apps** tab.

Note After installing the Application Hosting service package, you must log out of Catalyst Center, clear your browser cache, and log in to Catalyst Center again.

Prerequisites for Application Hosting

To enable application hosting on a Cisco Catalyst 9000 device, the following prerequisites must be fulfilled:

- Configure NETCONF port on the device before discovery.
- Configure a secure HTTP server on the switch where the applications will be hosted.
- Configure local or AAA authentication server for HTTPS user authentication on the switch. You must configure the username and password with privilege level 15.
- Ensure Cisco Catalyst 9300 Series switches are running Cisco IOS XE 16.12.x or later version and Cisco Catalyst 9400 Series switches are running Cisco IOS XE 17.1.x or later version.
- Ensure that the device has an external USB SSD pluggable storage (only for the switches of 9300 family).
- Verify that the configuration on the switch is correct. Open the WebUI on the switch and log in as the HTTPS user.

The following example shows a working configuration on a switch:

```
prompt# sh run | sec http
ip http server
ip http authentication local
ip http secure-server
ip http max-connections 16
ip http client source-interface Loopback0
```

Additional configuration for switches with a Cisco IOS XE release that is earlier than 17.3.3:

```
ip http secure-active-session-modules dnac
ip http session-module-list dnac NG_WEBUI
ip http active-session-modules none
```

Additional configuration for switches with Cisco IOS XE 17.3.3 or later:

```
ip http secure-active-session-modules webui
ip http session-module-list webui NG_WEBUI
```

View Device Readiness to Host an Application

```
ip http session-module-list pki OPENRESTY_PKI
ip http active-session-modules pki
```

- On Catalyst Center, configure the HTTPS credentials while manually adding the device. The HTTPS username, password, and port number are mandatory for application hosting. The default port number is 443. You can also edit the device credentials; see [Update Network Device Credentials, on page 92](#). If you edit a device that is already managed, resynchronize that device in the inventory before it is used for application hosting-related actions.



Note Application hosting HA is not supported on three-node Catalyst Center clusters.

View Device Readiness to Host an Application

You must check the readiness of the Cisco Catalyst 9300 Series switch to host the application before you can install an application on the switch.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 Click **All Devices**.

Step 3 View the list of devices that are capable of hosting applications. The **App Hosting Status** indicates the readiness of the device to host an application. Click **See Details** to view the list of readiness checks performed on the device.

Add an Application

You can add a Cisco package or a docker application.

Before you begin

- Cisco Package:** You must package the application using IOS SDK tools so that the application is compatible with IOS XE operating systems.
- Docker:** You must save the docker image as a tar file. Enter the following command to store the docker image as a tar file:

```
docker save -o <path for generated tar file> <image name:tag>
Example: docker save -o alpine-tcpdump.tar itsthenetwork/alpine-tcpdump:latest
```

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 Click **New Application**.

Step 3 Choose the application and category from the drop-down list.

Step 4 Click **Select** and choose the application to upload.

Step 5 Click **Upload**.

You can view the newly added application in the **App Hosting** page.

Automatic Download of ThousandEyes Enterprise Agent Application

The ThousandEyes Enterprise Agent application lets you monitor your network and oversee the network traffic paths across internal, external, carrier, and internet networks in real time. The advantage of the ThousandEyes Enterprise Agent application is that you do not have to import this application manually in your Catalyst Center Application Hosting Service. When the switches and hubs in the network are enabled, the ThousandEyes Enterprise Agent application is downloaded automatically within 10 minutes of starting the Application Hosting Service. To manually download the application, click the following link to the ThousandEyes Enterprise Agent .tar file:

[thousandeyes-enterprise-agent.cat9k.tar](#)

If there is no internet connection, you can set a proxy connection from the console using the following command:

```
magctl service setenv app-hosting http_proxy <proxy-value>
```

Set the proxy value to connect to the ThousandEyes Enterprise Agent application.

Update an Application

You can update the application added in Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

You can view the available applications in the **App Hosting** window.

Step 2 Choose the application that you want to update.

Step 3 Click **Update App**.

Step 4 Choose a new version of the application to be uploaded.

Step 5 Click **Upload**.

Start an Application

You can start an application in Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 Choose the application and click **Manage** to view the devices that use the application.

Step 3 Choose the device that has the application that you want to start.

Step 4 From the **Actions** drop-down list, choose **Start App**.

Stop an Application

You can stop an application in Catalyst Center.

View Applications Hosted on a Device

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 Choose the application and click **Manage** to view the devices that use the application.

Step 3 Choose the device that has the application that you want to stop.

Step 4 From the **Actions** drop-down list, choose **Stop App**.

View Applications Hosted on a Device

Before you begin

Complete the prerequisites in [Prerequisites for Application Hosting](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 To view all devices, click **All Devices** at the top-right corner, or to view only the devices that use a particular application, choose the application and click **Manage**.

If you chose to view all devices, the **All Devices** window shows the following information about the devices that are capable of hosting applications: **Hostname**, **IP Address**, **Image Version**, **App Hosting Status**, and **Last Updated**.

If you chose to view a list of devices for a particular application, the **Devices** window shows the following information about the devices that are capable of hosting applications: **Hostname**, **Device IP**, **App Version**, **App Status**, **Last Heard**, **Platform Version**, and **Action Status**.

Step 3 In the **Devices** window, click **Summary** to view a summary of failed, stopped, and running applications on a device.

Step 4 To take an action on an application, click the **Action** drop-down list and choose **Start**, **Stop**, **Edit**, **Upgrade**, or **Uninstall**.

Step 5 Click the device link in which you want to view the installed hosting applications.

The **Applications** window shows the **Name**, **Version**, **App Status**, **Monitor App**, **Health**, and **Details** of the installed applications.

Note **Monitor App** contains a link to the Application Monitoring dashboard. This link is provided in the Catalyst Center application package controller .yaml file. If the file does not contain the application dashboard URL, the **Monitor App** column isn't applicable.

Step 6 In the **Details** column, click **View** to get more information about an application status on the device.

Step 7 To download the log for a particular application, select the application and click **Application Logs**.

Step 8 To download tech support logs from the device, click **Tech Support Logs**.

Install an Application on a Cisco Catalyst 9300 Device

Catalyst Center allows you to install an application on a Cisco Catalyst 9300 Series switch.

Before you begin

- Complete the prerequisites. For more information, see [Prerequisites for Application Hosting, on page 661](#).

- Add the application to Catalyst Center. For more information, see [Add an Application, on page 662](#).
- Check the readiness of the switch to host the application. For more information, see [View Device Readiness to Host an Application, on page 662](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.
- Step 2** Choose the application and click **Install**.
- Step 3** In the **Get Started** window, enter a unique name for your workflow in the **Task Name** field and click **Next**.
- Step 4** In the **Select Site** window, choose the site where you want to enable the application, and click **Next**.
- Step 5** In the **Select Switches** window, choose the devices on which you want to install the application and click **Next**.
You can choose the devices that are in **Ready** and **Partially Ready** status. Click **See Details** to view the list of readiness checks performed on the device.
For devices that are in **Partially Ready** status, click the **Check Now** link in the **Readiness Check** window to validate the HTTPS credentials.
If you don't find your device in the **Devices Table**, click **Import** to add devices from a CSV file.
- Step 6** In the **Configuration App** window, complete the following settings:
 - **Network Settings:**
 - From the **Select Network** drop-down list, choose a VLAN to configure the application.
 - From the **Address Type** drop-down list, choose **Static** or **Dynamic**. If you choose **Static**, click the thumbnail icon and enter the **IP Address**, **Gateway**, **Prefix/Mask**, and **DNS** for the application.
 - **App Resources:** Check the **Allocate all resources available on a device** or the **Customize resource allocation** check box. You can check the **Customize resource allocation** check box and modify the maximum **CPU**, **Memory**, and **Persistent Storage** values to a lower value.
 - **Custom Settings:** Applicable only for Cisco package applications. Enter the configuration details for the attributes that are specified by the application.
 - **App Data:** Browse and upload the application-specific files. For information about how to identify the required application-specific files, see the relevant application document.
 - **Docker Runtime Options:** Enter the docker runtime options required by the application.
- Step 7** In the **Summary** window, review the application configuration settings.
- Step 8** (Optional) Click **Configuration Preview** to view the configuration template used to push the configuration settings on the selected devices.
- Step 9** Click **Provision**.
- Step 10** In the confirmation window, click **Yes** to complete the application installation on the selected devices.
- Note** The installation of the application also modifies the Cisco IOS-XE configuration on the device. This change in the running configuration must be copied to the startup configuration to ensure applications function as expected after a router reload. After the application installation is complete, use the **CLI Templates** to copy the running configuration to the startup configuration.

Uninstall an Application from a Cisco Catalyst 9300 Device

You can uninstall an application from a Cisco Catalyst 9300 Series switch.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.
- Step 2** Choose the application and click **Manage** to view the devices that use the application.
- Step 3** Choose the devices that have the application that you want to uninstall.
- Step 4** From the **Actions** drop-down list, choose **Uninstall App**.
-

Edit an Application Configuration in a Cisco Catalyst 9300 Device

You can edit an application configuration if the application requires a configuration to be up and running in a Cisco Catalyst 9300 Series switch.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.
- Step 2** Choose the application and click **Manage** to view the devices that use the application.
- Step 3** Choose the device that has the application that you want to edit.
- Step 4** From the **Actions** drop-down list, choose **Edit App Config**.
-

Delete an Application

You can delete an application from Catalyst Center.

Before you begin

You must uninstall the application from all devices that are using it. For more information, see [Uninstall an Application from a Cisco Catalyst 9300 Device, on page 666](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.
You can view the available hosted applications in the **App Hosting** window.
- Step 2** Choose the application that you want to delete.
- Step 3** Click **Delete Application**.
- Step 4** In the confirmation dialog box, click **OK**.
- The application is deleted only if it is not used by any of the devices managed by Catalyst Center.
Otherwise, an error message shows the number of devices that are using the application. Click **Cancel** in the confirmation dialog box and uninstall the application. For more information, see [Uninstall an Application from a Cisco Catalyst 9300 Device, on page 666](#).
-

Download App Logs

You can download application logs from Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > IoT Services**.

Step 2 Click **All Devices**.

You can view the list of devices that are capable of hosting applications.

Step 3 Click **App logs** to download the application logs from Catalyst Center.

Step 4 In the **App Logs** pop-up window, choose the application logs file that you want to download and click **Download**.

Download Device Tech Support Logs

You can download the device tech support logs from Catalyst Center for troubleshooting purposes.

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > IoT Services**.

Step 2 Click **All Devices**.

A list of devices that are capable of hosting applications is displayed.

Step 3 Click **Tech Support logs** to download the device tech support logs.

Application Hosting on Cisco Catalyst 9100 Series Access Points

The following sections provide information about application hosting on Cisco Catalyst 9100 Series Access Points.

About Application Hosting on Cisco Catalyst Access Points

The move to virtual environments has prompted the need to build applications that are reusable, portable, and scalable. Application hosting gives administrators a platform for leveraging their own tools and utilities. An application, hosted on a network device, can serve a variety of purposes. This ranges from automation, configuration management monitoring, and integration with existing tool chains.

Application hosting lets you manage the lifecycle of third-party applications on devices managed by Catalyst Center. This release lets you bring in the third-party SES-imagotag IoT Connector application on Cisco Catalyst 9100 Series Access Points with Cisco IOS-XE software version 17.3 or later.

The SES-imagotag IoT Connector on Cisco Catalyst 9100 Series Access Points can handle all Electronic Shelf Label (ESL) communication.

Application Hosting Workflow to Install and Manage USB on Cisco Catalyst 9100 Series Access Points

Before you begin

To enable application hosting on a device, the following prerequisites must be completed:

- Enable NETCONF and set the port to 830 to discover Cisco Catalyst 9100 Series Access Points.
- Make sure that the Cisco Catalyst 9100 Series Access Points have direct IP reachability to Catalyst Center.
- Make sure that the Cisco Catalyst 9800 Series Wireless Controller is running Cisco IOS XE 17.3.x or later software.
- Make sure that the Catalyst Center appliance is running the latest Catalyst Center ISO.
- Make sure that the USB dongle is inserted in the AP. This is required for the SES-imagotag Connector application to run.

Step 1

Check the readiness of the Cisco Catalyst 9800 Series Wireless Controller and Cisco Catalyst 9100 Series Access Points to host the application before you install it.

For more information, see [View Device Readiness to Host an Application, on page 662](#).

Step 2

Install the Application Hosting service on Catalyst Center.

For more information, see [Install or Update the Application Hosting Service Package, on page 660](#).

Step 3

Add the Cisco Catalyst 9800 Series Wireless Controller to Catalyst Center.

For more information, see [Add a Network Device, on page 87](#).

Note Make sure that you enable NETCONF and set the port to 830.

You must wait for the Cisco Catalyst 9800 Series Wireless Controller to move to a Managed state.

Step 4

Assign APs to a floor on the Network Hierarchy window.

For more information, see [Work with APs on a Floor Map, on page 180](#).

Step 5

Upload the USB application (the SES-imagotag Connector) to Catalyst Center.

For more information, see [Add an Application, on page 662](#).

Step 6

Enable the IoT services.

For more information, see [Enable IoT Services on Cisco Catalyst 9100 Series Access Points, on page 850](#).

Step 7

Configure the container as described in the [Application Hosting on Catalyst APs Deployment Guide](#).

View Installed Hosting Applications on Cisco Catalyst 9100 Series Access Points

Before you begin

Make sure the prerequisites have been met. For more information, see [Prerequisites for Application Hosting](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > IoT Services**.
- Step 2** To view all devices, click **All Devices** at the top-right corner, or to view only the devices that use a particular application, choose the application and click **Manage**.
- If you chose to view all devices, the **All Devices** page shows the following information about the devices that are capable of hosting applications: **Hostname**, **IP Address**, **Image Version**, **App Hosting Status**, and **Last Updated**.
- Note** When the **App Hosting Status** of an AP is **Ready**, to configure the updates on the AP, check the check box next to the required hostname and click **Resync**.
- If you chose to view a list of devices for a particular application, the **Devices** page shows the following information about the devices that are capable of hosting applications: **Hostname**, **Device IP**, **App Version**, **App Status**, **Last Heard**, **Platform Version**, and **Action Status**.
- Step 3** In the **Devices** page, click **Summary** to view the summary of failed, stopped, and running applications on a device.
- Step 4** Click the **Action** drop-down list to start, stop, edit, upgrade, and uninstall an application.
- Step 5** Click the device link in which you want to view the installed hosting applications.
- The **Applications** page shows the **Name**, **Version**, **App Status**, **IP Address**, **Health**, and **Details** of the installed applications.
- Step 6** In the **Details** column, click **View** to get more information about an application status on the device.
App details window shows the **REOURCES** and **NETWORK** information of an application.
- Step 7** To download the application log, select an application for which you want to download the application log and click **Application Logs**.
- Step 8** To download the tech support log, select an application for which you want to download the tech support log and click **Tech Support Logs**.
-

Uninstall an Application from a Cisco Catalyst 9100 Device

You can uninstall an application from a Cisco Catalyst 9100 Series AP.

-
- Step 1** From the top-left corner, click the menu icon and choose **Provision > Services > IoT Services**.
- Step 2** Choose the application and click **Manage** to view the devices that use it.
- Step 3** Choose the devices that have the application that you want to uninstall.
- Step 4** From the **Actions** drop-down list, choose **Uninstall App**.
-

Delete an Application from a Cisco Catalyst 9100 Device

You can delete an application from a Cisco Catalyst 9100 Series AP.

Before you begin

You must uninstall the application from all devices that are using it. For more information, see [Uninstall an Application from a Cisco Catalyst 9100 Device](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > IoT Services**.

You can view the available hosted applications in the **IoT Services** page.

Step 2 Choose the application that you want to delete.

Step 3 Click **Delete Application**.

Step 4 In the confirmation dialog box, click **OK**.

The application is deleted only if it is not used by any of the devices managed by Catalyst Center.

Otherwise, an error message shows the number of devices using the application. Click **Cancel** and uninstall the application. For more information, see [Uninstall an Application from a Cisco Catalyst 9100 Device](#).

Configure a Site-to-Site VPN

You can create a site-to-site VPN and edit or delete existing site-to-site VPNs.

- [Create a Site-to-Site VPN, on page 670](#)
- [Edit a Site-to-Site VPN, on page 671](#)
- [Delete a Site-to-Site VPN, on page 671](#)

Create a Site-to-Site VPN

This procedure shows how to create a site-to-site VPN.

Before you begin

- Define the sites within the network hierarchy. See [Network Hierarchy Overview, on page 157](#).
- Configure IP address pools to be used for the VPN tunnels. The IP address pools must have a minimum of six free IP addresses. See [Configure IP Address Pools, on page 247](#).

Step 1 From the top-left corner, click the menu icon and choose **Provision > Site to Site VPN**.

Alternatively, you can create a site-to-site VPN from the **Workflows > Site to Site VPN** window.

Step 2 To create a VPN, click **Add**.

The **Choose Your Sites** workflow is displayed.

Step 3 In the **Choose Your Sites** workflow, do the following:

- a) Enter a VPN name in the first field.
- b) Select the first site, a device in that site, and a WAN interface on that device from the Site 1 drop-down lists. The WAN interface is set by default if the device is provisioned.
- c) Select the second site, a device in that site, and a WAN interface on that device from the Site 2 drop-down lists. The WAN interface is set by default if the device is provisioned.

Step 4 In the **Select Networks** window, do the following:

- a) From the **Tunnel IP Pool** drop-down list, choose an IP address pool.
- b) Check the boxes next to the subnets that you want to use for each site.
- c) (Optional) If you want to add a custom network for a site, click the **Add Custom Networks** link at the bottom and complete the required fields.

Step 5 In the **Configure VPN** window, do the following:

- a) Enter a preshared key for encryption.
- b) Set the encryption and integrity algorithms as desired. We recommend that you use the default settings. If you change any settings, you can go back to the default choices by checking the **Use Cisco recommended IKEV2 & Transform Set Values** check box.

Step 6 In the **Summary** window, review the VPN settings. To make any changes, click **Edit**.

Step 7 To proceed, click **Create VPN**.

In the status screen that follows, a check mark is shown next to each step as it is completed. Click **Services** to return to the **Site to Site VPN** window, which shows the newly created VPN.

Edit a Site-to-Site VPN

Step 1 From the top-left corner, click the menu icon and choose **Provision > Site to Site VPN**.

Step 2 Check the check box next to the VPN that you want to edit.

Step 3 Click **Edit** in the menu bar above the list.

Step 4 In the **Summary** window, review the VPN settings. To make any changes, click **Edit**.

Step 5 Click **Edit VPN** to submit the changes.

In the status screen that follows, a check mark is shown next to each step as it is completed. Click **Services** to return to the **Site to Site VPN** screen.

Delete a Site-to-Site VPN

Step 1 From the top-left corner, click the menu icon and choose **Provision > Site to Site VPN**.

Step 2 Check the check box next to the VPN that you want to delete.

Step 3 Click **Delete** in the menu bar above the list.

Create a User-Defined Network Service

A confirmation dialog box is displayed.

- Step 4** Click **Yes** to confirm that you want to delete the VPN.
-

Create a User-Defined Network Service

Catalyst Center allows you to configure **Cisco User Defined Network** services from **Provision > Service Catalog > Cisco User Defined Network** page. Alternatively, you can create **Cisco User Defined Network** service from **Workflows > Configure Cisco UDN** page. For more information, see [Configure Cisco User-Defined Network](#).

View the User-Defined Network Service Provisioning Status

This procedure shows you how to view the Cisco User-Defined Network service provisioning status from the **Provision > All Services** window. You can also click the **View Provisioning Status** button in the **Configure Cisco User Defined Network** screen after configuring a Cisco User-Defined Network successfully.

Before you begin

Configure and provision the Cisco User-Defined Network service from the **Workflows > Configure Cisco User Defined Network** window.

- Step 1** From the top-left corner, click the menu icon and choose **Provision > All Services > Cisco User Defined Network**.

The **Site Provisioning Status** window displays the site name, device name, number of SSIDs used, and status of site provisioning.

- Step 2** Click **Refresh** to see the latest provisioning status.

- Step 3** Click the site name to view additional details for the provisioned device, such as SSID name, User-Defined Network (UDN) status, and Unicast Traffic Containment.

- Step 4** Click **Activities** to track the scheduled task status.
-

Configure Cisco Umbrella

The following sections provide information about integrating Cisco Umbrella with Catalyst Center.

About Cisco Umbrella

The DNS-layer security in Cisco Umbrella provides the fastest and easiest way to improve your network security. It helps improve security visibility, detect compromised systems, and protect your users on and off the network by stopping threats over any port or protocol before they reach your network or endpoints.

Catalyst Center supports Cisco Umbrella configuration on the following devices:

- Cisco Catalyst 9800 Series Wireless Controllers with Cisco IOS-XE software version 16.12 or later

- Cisco Catalyst 9100 Series APs
- Cisco Catalyst 9200 Access Switch with Cisco IOS-XE software version 17.3.1 or later
- Cisco Catalyst 9300 Access Switch with Cisco IOS-XE software version 17.3.1 or later

Role-Based Access Control Settings for Cisco Umbrella

To configure Cisco Umbrella with Catalyst Center and to provision Cisco Umbrella on network devices, you must create a user role with the necessary RBAC permission for Cisco Umbrella. For more information, see "Manage Users" in the [Catalyst Center Administrator Guide](#).

Table 37: RBAC Permission Matrix for Cisco Umbrella

Function	Access	Permission
Configure Cisco Umbrella with Catalyst Center	Network Design > Advanced Network Settings	Write
Add Umbrella dashlet in System 360	Network Design > Advanced Network Settings	Write
Provision Cisco Umbrella on network devices	Network Provision > Provision	Write
	Network Design > Network Hierarchy	Read
	Network Provision > Inventory Management	Read
	System	Read
	Network Provision > Scheduler	Write
	Network Services > Umbrella	Write

Configure Cisco Umbrella with Catalyst Center

Before you begin

- Create a Cisco Umbrella account.
- Log in to login.umbrella.com and create the necessary keys, such as the API key, legacy token, management key, and secret.
- Note down the organization ID from the Cisco Umbrella login URL.
- Create the local bypass domains in Cisco Umbrella.
- If Catalyst Center has a proxy server configured as an intermediary between itself and the network devices it manages or the Cisco cloud from which it downloads software updates, you must configure access to the proxy server. For more information, see the Configure the Proxy section in the [Catalyst Center Administrator Guide](#).

Add the Umbrella Dashlet

- Install the Cisco Umbrella package in Catalyst Center. See the Download and Install Packages and Updates section in the [Catalyst Center Administrator Guide](#).
- Create a user role with necessary RBAC permission for Cisco Umbrella. See [Role-Based Access Control Settings for Cisco Umbrella, on page 673](#).



Note

You cannot install Cisco Umbrella package on a Catalyst Center cluster configured with IPv6.

Step 1 From the top-left corner, click the menu icon and choose **System > Settings > External Services > Umbrella**.

Step 2 Enter the following details that you retrieved manually from Cisco Umbrella:

- **Organization ID**
- **Network Device Registration API Key**
- **Network Device Registration Secret**
- **Management API Key**
- **Management Secret**
- **Legacy Device Registration Token**

Step 3 Click **Save**.

Add the Umbrella Dashlet

You can add the **Umbrella** dashlet in the **System 360** page. The **Umbrella** dashlet shows the configuration status of Cisco Umbrella with Catalyst Center.

Before you begin

You must install the Cisco Umbrella package.

Step 1 From the top-left corner, click the menu icon and choose **System > System 360**.

Step 2 From the **Actions** menu, choose **Edit Dashboard** and click **Add Dashlet**.

Step 3 Choose **Umbrella Dashlet** and click **Add**.

The **Umbrella** dashlet appears under **Externally Connected Systems** in the **System 360** page. The **Umbrella** dashlet shows the status as **Available** and displays the organization ID, if Cisco Umbrella is configured with Catalyst Center.

If Cisco Umbrella is not configured with Catalyst Center, you can click the **Configure** link and complete the fields in **System > Settings > External Services > Umbrella**. See [Configure Cisco Umbrella with Catalyst Center, on page 673](#).

If the keys are changed in Cisco Umbrella, you can click the **Update** link and update the keys in **System > Settings > External Services > Umbrella**. See [Configure Cisco Umbrella with Catalyst Center, on page 673](#).

View the Umbrella Service Statistics Dashboard

From the top-left corner, click the menu icon and choose **Provision > Services > Umbrella** to view the **Umbrella Service Stats** dashboard.

The dashboard displays the following dashlets:

- **Total Umbrella DNS Queries:** Shows the number of blocked DNS queries and allowed DNS queries for the selected site.
- **Blocked Umbrella DNS Queries:** Shows the number of DNS queries blocked by security policy and content policy for the selected site.

By default, the dashlet shows statistics for the last 3 hours. You can view statistics for the last 24 hours or 7 days by choosing the required time from the drop-down list in the top-left corner of the **Umbrella Service Stats** page.

Prerequisites for Provisioning Cisco Umbrella on Network Devices

Before provisioning Cisco Umbrella on network devices, ensure that:

- Cisco Umbrella is configured with Catalyst Center.
- Wireless provisioning is complete for the devices on which you want to provision Cisco Umbrella.
- The SSID configuration is nonfabric.
- The AP is provisioned, if the device is configured with a nonfabric SSID in FlexConnect mode.
- The device has direct internet access to establish connection with Cisco Umbrella.
- The Cisco Umbrella root certificate is available in the Catalyst Center trusted certificates bundle. See the "Configure Trusted Certificates" topic in the *Cisco Catalyst Center Administrator Guide*.
- If the device has a Cisco Umbrella configuration that is not set from Catalyst Center, remove the Cisco Umbrella configuration from the device and resync the device with Catalyst Center.

Provision Cisco Umbrella on Network Devices

Before you begin

Make sure the prerequisites have been met. For information, see [Prerequisites for Provisioning Cisco Umbrella on Network Devices, on page 675](#).



Note

Cisco umbrella deployment on your organization's network can be monitored only from *login.umbrella.com*.

Step 1

From the top-left corner, click the menu icon and choose **Workflows > Umbrella Deployment**.

Alternatively, do the following:

- From the top-left corner, click the menu icon and choose **Provision > Umbrella**.

Provision Cisco Umbrella on Network Devices

- Choose a site from the network hierarchy for which you want to deploy Cisco Umbrella.
- The **Select Devices** window appears. Go to Step 4 to continue the deployment workflow.

Step 2 If a task overview window appears, click **Let's Start** to go directly to the workflow.

Step 3 The **Choose Site** window appears.

- a) You can view the device readiness status in each site, as follows:

- **Eligible Devices:** Devices that are eligible for Cisco Umbrella configuration. See [Prerequisites for Provisioning Cisco Umbrella on Network Devices, on page 675](#).
- **Enabled Devices:** Devices that are already configured from Catalyst Center.

- b) Choose a site to deploy and click **Next**.

Note You can choose only one site at a time. If you choose a parent site, Cisco Umbrella can be deployed on all child sites at the same time.

Step 4 In the **Select Device Type** window, choose **Switches or Wireless Controllers**.

Step 5 If you have chosen **Switches** in the **Select Device Type** window, do the following:

- a) In the **Select Devices** window, choose the wired device.
- b) In the **Configure Interface** window, do the following:

1. Choose the ports you want to configure and click **Define Umbrella Interfaces**.
2. In the **Select Configuration** dialog box, click the **Define Umbrella Interfaces** drop-down list and choose **IN(LAN), OUT(WAN)** or **Disable Umbrella** and click **Save**.

Note You must choose at least one **IN** and one **OUT** interface to proceed further.

- c) In the **Define Umbrella Policy Mapping (Wired)** window, choose Umbrella policies at a global or interface level.
- d) In the **Configure Policies for Your Devices** window, choose the **IN(LAN)** interface and click **Define Umbrella Policies**.
- e) In the **Select Policy** dialog box, choose the policy for the selected interfaces and click **Save**.

Step 6 If you have chosen **Wireless Controllers** in the **Select Device Type** window, do the following:

- a) In the **Select Devices** window, choose the wireless device.
- b) Choose the SSIDs and select the required Cisco Umbrella policy for each SSID.

Note

- Only nonfabric SSIDs are listed on this page.
- If you choose an SSID and don't select the Cisco Umbrella policy, the default policy is mapped with the SSID.
- If you choose multiple policies, the order of enforcement of policies is defined in the Cisco Umbrella cloud portal.

- c) In the **Umbrella Policy Association (Wireless)** window, view the default policies applied to the SSIDs.

If you want to change the policies associated with the SSIDs, click the **Cisco Umbrella** link. In the Cisco Umbrella console, you can see the network identity after you have completed the deployment of Cisco Umbrella from Catalyst Center. For devices with Cisco IOS-XE software version 16.xx, the network identity is shown as global. For devices

with a Cisco IOS-XE software version later than 16.xx, the network identity is shown as a custom name created based on the site and SSID name.

- Step 7** In the **Review Internal Domains** window, add or delete the list of internal domains. The DNS queries that match a domain in the **Internal Domain** list are forwarded to the local DNS server instead of Cisco Umbrella.
- Step 8** The **DNS Crypt** window appears. The **Enable DNS Packet Encryption** option is selected by default.
- In the **DNS Crypt** window, click **Next**.
 - If you don't want DNS packet encryption, uncheck the **Enable DNS Packet Encryption** check box.
- Step 9** In the **Summary** window, review the details. To make any changes, click **Edit**.
- Step 10** To proceed, click **Deploy**.
- Step 11** In the **Schedule** window, choose whether you want to deploy the configuration now or schedule it later.
- Step 12** To proceed, click **Apply**.
- Step 13** In the **Deployment** window, click **View Status** to view the deployment status.

You can view the Cisco Umbrella deployment status of the device and the device configuration status in Cisco Umbrella. You can also view the Cisco Umbrella deployment logs in the **Audit Logs** window.

Disable Cisco Umbrella on Network Devices

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Umbrella Deployment**.
Alternately, do the following:
- From the top-left corner, click the menu icon and choose **Provision > Services > Umbrella**.
 - Choose a site from the network hierarchy from which you want to disable Cisco Umbrella.
 - The **Select Devices** window appears. Go to Step 4 to continue the disable workflow.
- Step 2** If a task overview window appears, click **Let's Start** to go directly to the workflow.
- Step 3** The **Choose Site** window appears.
- You can view the device readiness status in each site, as follows:
 - **Ready Devices**: Devices that meet the prerequisites for Cisco Umbrella configuration. See [Prerequisites for Provisioning Cisco Umbrella on Network Devices, on page 675](#).
 - **Not Ready Devices**: Devices that do not meet the prerequisites.
 - **Enabled Devices**: Devices that are already configured from Catalyst Center.
 - Choose the site that you want to disable, and click **Next**.
- Note** You can choose only one site at a time. If you choose a parent site, Cisco Umbrella is disabled on all the child sites at the same time.
- Step 4** In the **Select Device Type** window, choose **Switches** or **Wireless Controllers**.
- Step 5** In the **Select Devices** window, click the **Enabled** tab and choose the devices.

Update the Cisco Umbrella Configuration on Network Devices

- Step 6** Click the **Disable** radio button and choose the devices.
- Step 7** In the **Summary** window, review the details. To make any changes, click **Edit**.
- Step 8** To proceed, click **Deploy**.
- Step 9** In the **Schedule** window, choose whether you want to deploy the configuration now or schedule it later.
- Step 10** To proceed, click **Apply**.
- Step 11** In the Deployment window, click **View Status** to view the deployment status.
You can view the Cisco Umbrella deployment logs in the **Audit Logs** window.

Update the Cisco Umbrella Configuration on Network Devices

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Umbrella Deployment**.
Alternately, do the following:
- From the top-left corner, click the menu icon and choose **Provision > Services > Umbrella**.
 - Choose a site from the network hierarchy for which you want to update the Cisco Umbrella configuration.
 - The **Select Devices** window appears. Go to Step 4 to continue the update workflow.
- Step 2** If a task overview window appears, click **Let's Start** to go directly to the workflow.
- Step 3** The **Choose Site** window appears.
- a) You can view the device readiness status in each site, as follows:
 - **Ready Devices**: Devices that meet the prerequisites for Cisco Umbrella configuration. See [Prerequisites for Provisioning Cisco Umbrella on Network Devices, on page 675](#).
 - **Not Ready Devices**: Devices that do not meet the prerequisites.
 - **Enabled Devices**: Devices that are already configured from Catalyst Center.
 - b) Choose the site that you want to update and click **Next**.
- Note** You can choose only one site at a time. If you choose a parent site, Cisco Umbrella is updated on all child sites at the same time.
- Step 4** In the **Select Device Type** window, choose **Switches** or **Wireless Controllers**.
- Step 5** If you have chosen **Switches** in the **Select Device Type** window, do the following:
- a) In the **Select Devices** window, choose the wired device and click the **Update** radio button.
 - b) In the **Configure Interface** window, do the following:
 1. Choose the ports and click **Define Umbrella Interfaces**.
 2. In the **Select Configuration** dialog box, click the **Define Umbrella Interfaces** drop-down list and choose **IN(LAN)**, **OUT(WAN)** or **Disable Umbrella** and click **Save**.
- Note** You must choose at least one **IN** and one **OUT** interface to proceed further.

- c) In the **Define Umbrella Policy Mapping (Wired)** window, choose Umbrella policies at a global or interface level and click **Next**.
- d) In the **Configure Policies for Your Devices** window, choose the **IN(LAN)** interface and click **Define Umbrella Policies**.
- e) In the **Select Policy** dialog box, choose the policy for the selected interfaces and click **Save**.

Step 6

If you have chosen **Wireless Controllers** in the **Select Device Type** window, do the following:

- a) In the **Select Devices** window, choose the wireless device and click the **Update** radio button.
- b) In the **Define Umbrella Policy Map (Wireless)** window, choose the SSIDs and select the desired Cisco Umbrella policies to map, or unselect SSIDs to disable Cisco Umbrella.

Step 7

In the **Review Internal Domains** window, add or delete the list of internal domains. The DNS queries that match a domain in the **Internal Domain** list are forwarded to the local DNS server instead of Cisco Umbrella.

Step 8

The DNS Crypt window appears. The **Enable DNS Packet Encryption** option is selected by default.

If you don't want DNS packet encryption, uncheck the **Enable DNS Packet Encryption** check box.

Step 9

In the **Summary** window, review the details. To make any changes, click **Edit**.

Step 10

To proceed, click **Deploy**.

Step 11

In the **Schedule** window, choose whether you want to deploy the configuration now or schedule it later.

Step 12

To proceed, click **Apply**.

Step 13

In the Deployment window, click **View Status** to view the deployment status.

You can view the Cisco Umbrella deployment logs in the **Audit Logs** window.

Create Secure Tunnel

Catalyst Center allows the user to plan and deploy VPN Tunnels, which establishes secure connection between enterprise and branch location.



Note This feature is currently supported only on the Cisco Catalyst 9300X Series Switches.

Configure Secure Tunnel

You can use this procedure to plan and deploy secure tunnels on day *n*.

Step 1

From the top-left corner, click the menu icon and choose **Provision > Secure Tunnels**.

Alternatively, you can create a secure tunnel from the **Workflows > Create Secure Tunnel** window.

Step 2

In the **Secure Tunnel** window, click **Create Secure Tunnel**.

Step 3

If the task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 4

In the **Select Tunnel Type** window, choose the type of secure tunnel to create by clicking the **Site To Secure Access Service Edge (SIG/SASE)** tile.

Configure Secure Tunnel

This action creates a secure tunnel between the Cisco Catalyst 9300X Series switch and the Secure Internet Gateway.

Step 5 In the **Select Secure Internet Gateway** window, click the drop-down list to choose the **Secure Internet Gateway**.

Do one of the following for the chosen Secure Internet Gateway:

- **Umbrella:** Ensure that you created a tunnel in Cisco Umbrella. You will need the tunnel ID and preshared key in the subsequent steps. For more information, see [Configure Cisco Umbrella with Catalyst Center, on page 673](#). If the tunnel is created in the Cisco Umbrella portal, check the confirmation check box.
- **Zscaler:** Ensure that the tunnel is already created on the Zscaler portal. After you create the tunnel in Zscaler, the preshared key and the FQDN defined there are required to configure the tunnel parameters on the selected Cisco Catalyst 9300X Series switch. If the tunnel is created in the Zscaler portal, check the confirmation check box.

Step 6 In the **Choose Site and Device** window, do the following for site and tunnel mapping:

- a. Choose the **Site** from the drop-down list.
- b. Choose the **Device** from the drop-down list.
- c. Choose the **Number of Tunnels** to create from the drop-down list.
- d. For Zscaler, choose the **Tunnel Type** from the drop-down list.
- e. Enter the **Tunnel Name**.
- f. Choose the **Tunnel Source Interface**.
- g. Check the check box if you want to use the same interface for the tunnel IP. If you do not want to use the same interface, uncheck the check box and choose the **Interface**.
- h. Enter the **Data Center Location**.

Step 7 In **Define Tunnel Settings** window, do the following:

- a. For Umbrella, enter the **Pre-Shared Key (PSK)** for authentication.
- b. If the Secure Internet Gateway integration is not complete, do the following:
 1. Enter the **Tunnel ID** and choose one of the following:
 - a. **Fully Qualified Domain Name (FQDN):** Use the **Tunnel ID** generated in Cisco Umbrella or the **User ID** generated in Zscaler.
 - b. **IP Address:** Use the IP address to which you want to connect.
 - c. Check the check box to use the Cisco-recommended settings. To customize the values, uncheck the check box.

Step 8 In the **Configure Tunnel Traffic** window, choose from the following options to route the traffic:

- **Send all traffic:** To send all traffic through the IPsec tunnel to Umbrella.
- **Send Selected Traffic:** Enter the subnet and ingress interface for the subnet. You can add more subnets by clicking .

Step 9 In the **Schedule Task** window, choose whether you want to create the tunnel now or schedule it for later. Also, you can choose to **Generate CLI Preview**.

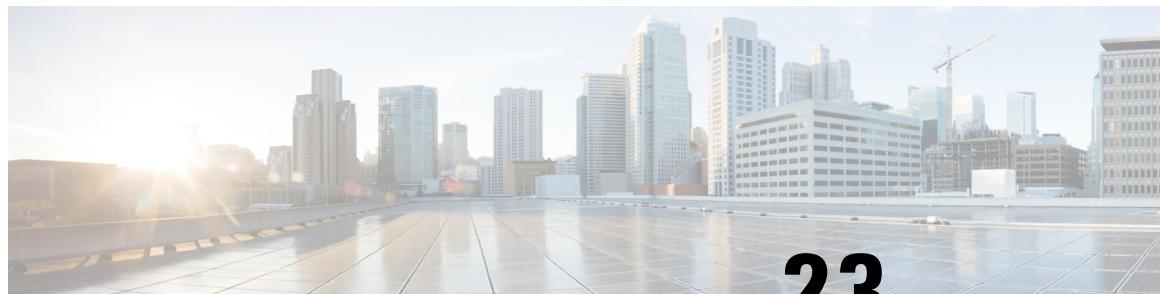
- Step 10** In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
- Step 11** Click **Create Secure Tunnel**.
- The **Done!** window appears.
- Step 12** Click the **View all Tunnels** tab to view the status of the tunnel creation.
- This process might take some time. Click **Refresh**. When the tunnel is up, the status changes from Provision to Up.
-



PART VI

Configure Policies

- [Configure Group-Based Access Control Policies and Analytics, on page 685](#)
- [Configure IP-Based and URL-Based Access Control Policies, on page 711](#)
- [Configure Application Policies, on page 719](#)
- [Configure Traffic-Copy Policies, on page 747](#)



CHAPTER 23

Configure Group-Based Access Control Policies and Analytics

- [Group-Based Access Control, on page 685](#)
- [Cisco Group-Based Policy Analytics, on page 698](#)

Group-Based Access Control

Catalyst Center implements Software-Defined Access in two ways:

- Virtual networks (VNs) provide macro-level segmentation, such as to separate IoT devices from the corporate network.
- Group-based policies provide micro-level segmentation, such as to control what types of network traffic to permit or deny between engineering and HR groups.

Group-Based Access Control policies provide the following benefits:

- Rich identity-based access control functionality with network automation and assurance benefits.
- Granular access control.
- Security groups apply to all virtual networks, which simplifies policy management.
- Policy views help you to understand the overall policy structure, and create or update required access control policies.
- Eliminates the need to switch between different applications to manage security groups and define protected assets.
- Provides enhanced features for deploying enterprise-wide access control policies.
- Restricts lateral movement of threats like ransom ware before you have identity or Network Admission Control (NAC) applications in place.
- Provides an easy migration path to Cisco Identity Services Engine (Cisco ISE) for users who are using third-party identity applications, but want to move to Cisco ISE.

For information about creating IP pools, sites, and virtual networks in Catalyst Center, see the [Catalyst Center Administrator Guide](#).

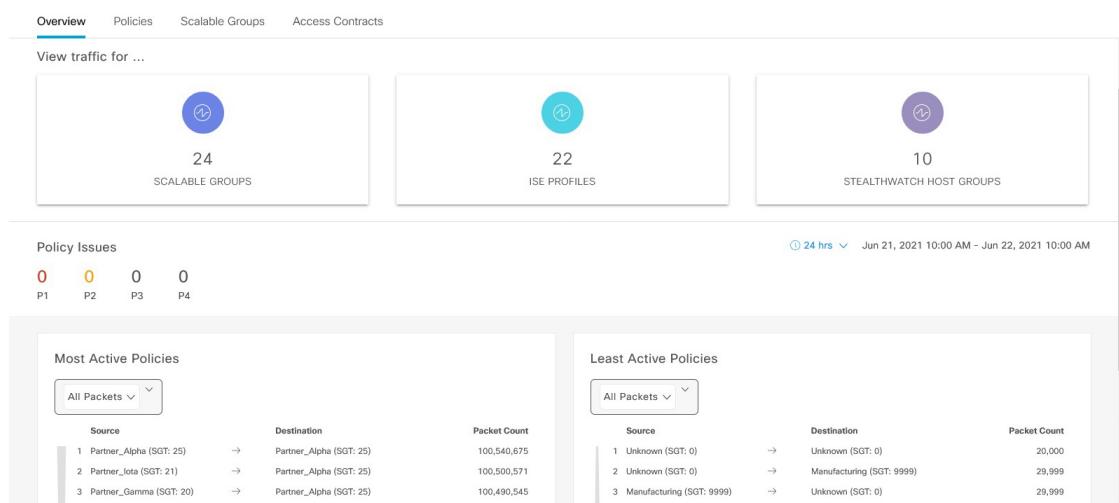
For information about configuring Catalyst Center for Cisco ISE, see the [Catalyst Center Installation Guide](#).

For information about configuring Cisco ISE for Catalyst Center, see the [Cisco Identity Services Engine Administrator Guide](#).

Group-Based Access Control Policy Dashboard

The Group-Based Access Control Policy dashboard provides you with a summary of network activity, policy-related issues, and traffic trends. From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Overview** to view this dashboard.

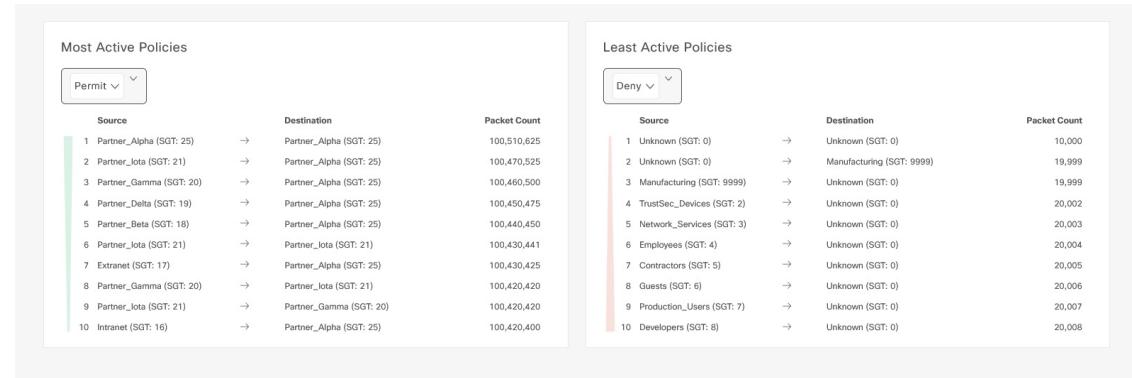
Figure 23: Group-Based Access Control Policy Dashboard



You can view the following details in this dashboard:

- View Traffic:** You can view the traffic for security groups, Cisco ISE profiles, and stealthwatch host groups. You must install the Group-Based Policy Analytics package to view this data. Group-Based Policy Analytics provides you with insights to create group-based policies by visualizing communications between assets in order to assess the impact of introducing new access controls, and understand exactly which protocols you need to allow in the policies. Cisco Group-Based Policy Analytics aggregates information on groups of assets on your network, and their communication. For more information, see [Cisco Group-Based Policy Analytics, on page 698](#).
- View Policy-Related Issues:** It displays a count of policy-related issues. Click a counter to view the details. It opens the **Assurance Issues** dashboard in a new browser tab, where you can view the details. Note that this view of policy-related issues is for the currently selected time period. Use the time selector to adjust the time window, as needed.
- View Most Active and Least Active Policies:** It provides the details about the most active and least active policies. By default, this view is based on the count of total number of packets seen in the network for each policy (for each source-to-destination group pairing). You can use the drop-down list to select only the permitted packets or dropped packets. You can use the dropped packets option to see which policies are enforcing policy-based drops most actively.

Figure 24: Most and Least Active Policy Dashlets



Note that this view of policy activity is for the currently selected time period. Use the time selector to adjust the time window, as needed.

Group-Based Access Control Policies

Access control policies define which network traffic can pass from a source security group to a destination security group.

- **Security Group:** A classification category to which you can assign users, network devices, or resources. Security groups are used in access control policies. You can associate security groups with virtual networks based on your organization's network configuration, access requirements, and restrictions.
- **Contract:** An access contract is a set of rules that controls the type of network traffic that is allowed to pass between the source and destination security groups. In other words, a contract is a traffic filter definition. Access contracts define the actions (permit or deny) that are performed when the traffic matches a network application, protocol, and port. The default action is to use the catch all rule when no other rules match.
- **Group-Based Access Control Policies:** A group-based access control policy identifies a specific source and destination group pair and associates an access contract. The access contract specifies what types of traffic are permitted or denied between the source group and the destination group. These policies are unidirectional.

Security groups and access contracts are the basic building blocks of access control policy. While creating an access control policy, you can use the security groups and contracts that you have created earlier, or create new security groups and contracts while creating the policy. If you want to specify the network resources that can be accessed from a specific source group, you can create an access control policy with a single source and multiple destination groups. On the other hand, if you want to specify the source groups that are permitted to access a particular network resource, you can create an access control policy with a single destination and multiple source groups. For example, if you want to specify the network resources that can be accessed by the users associated with the Contractors source security group, you can create an access control policy with a single source and multiple destination groups. If you want to specify the source groups that are permitted to access the Finance Servers destination security group, you can create an access control policy with single destination and multiple source groups.

You can specify the default policy to be used when no contract is specified for a source and destination security group combination. The default policy is **Permit**. You can change this policy to **Deny**,

Permit_IP_Log, or **Deny_IP_Log**, if necessary. You can set the default policy based on your network type—an open or closed network.



Note We recommend that you change the default policy from **Permit** to **Deny** only if you have created explicit policies to permit necessary network traffic for all your network infrastructure devices. Failure to do so can result in loss of network connectivity.

List View

Click the **List** icon at the top-right corner of the **Group-Based Access Control** window to launch the **List** view.

- **Source View:** Displays a list of existing policies that are organized based on the source groups. You can expand each row to view the specific source-destination policy details.
- **Destination View:** Displays a list of existing policies that are organized based on the destination groups. You can expand each row to view the specific source-destination policy details.

To see which destination groups are available from a specific source group, use the **Source** view. To see which source groups are permitted to access a particular destination group, use the **Destination** view. For example, to see which destination groups are available to users who are part of the Contractors source security group, use the **Source** view. To see which source groups can access the Finance Servers destination security group, use the **Destination** view.

You can also view the policy enforcement statistics data in the policies listing table. The total number of permitted and denied policies are displayed for the selected time period.

The policy enforcement statistics are collected from the network devices that are provisioned for group-based policy and telemetry data language (TDL) subscription. These configurations are normally provisioned automatically for network devices that are part of a fabric. Manual configuration can be done for nonfabric network devices.

Note the following points while using the policy enforcement statistics data:

- Policy enforcement statistics data is available only when the Group-Based Policy Analytics package is deployed.
- Telemetry subscription is added as part of base provisioning for both fabric and nonfabric network devices. The TrustSec enforcement action is invoked when a new network device is added to Catalyst Center and assigned to a site.
- Software-Defined Access (SD-Access) adds TrustSec enforcement for the network devices that are added to a fabric. TrustSec telemetry data is collected only when this enforcement is enabled on a network device. If it is not enabled, the telemetry subscriptions used for policy monitoring are used to collect the TDL data for TrustSec.
- Cisco IOS XE 16.12 and later supports TDL streaming data.
- NETCONF must be enabled on the network devices.
- The following configuration must be added manually for the nonfabric network devices:

```
cts role-based enforcement vlan-list <VLAN of the endpoints>
```

- After upgrading, you will see the following message in the **Provision > Network Devices > Inventory** window:

We detected IOS-XE devices in your network where new telemetry subscription for assurance data needs to be enabled and some of the existing subscription needs to be optimized for performance. Please note that you will have to enable netconf and configure the netconf port in the Inventory credentials for these devices. Also note that these devices will receive a new subscription for group based policy monitoring telemetry. Do you want to take an action to provision these subscriptions?

Click **Apply Fix** to push the configuration to all the network devices with site assigned.

Matrix View

Click the **Grid** icon at the top-right corner of the **Group-Based Access Control** window to launch the Matrix view. The Matrix view is a core policy view that provides an overview of all the policies for all the security groups (whether explicit or default). You can use the Matrix view to view all the source and destination policies and understand the overall policy structure. You can view, create, and update access control policies from the Matrix view.

The Matrix view contains two axes:

- Source axis: The vertical axis lists all the source security groups.
- Destination axis: The horizontal axis lists all the destination security groups.

Place the cursor over a cell to view the policy for a given source security group and a destination security group. The color of a cell is based on the policy that applies to that cell. The following colors indicate which policies are applied to each cell:

- **Permit**: Green
- **Deny**: Red
- **Custom**: Gold
- **Default**: Gray

Place the cursor over the **Permit**, **Deny**, **Custom**, or **Default** icon that is displayed at the top of the matrix to view the cells to which the policy is applied.

The Matrix view highlights a cell and the corresponding row (source security group) and column (destination security group) when a cell is selected. The coordinates (source and destination security groups) of the selected cell are displayed near the matrix content area.

Click a cell to open the **Create Policy** or **Edit Policy** slide-in pane for that cell. The **Create Policy** slide-in pane shows the source and destination security groups as read-only fields. You can only update the policy status and access contract for that cell.

You can create custom views of the policy matrix to focus only on the policies that you are interested in. To do this, from the **View** drop-down list, choose **Create View**. While creating a custom view, you can specify the subset of the security groups that you want to include in the custom view. You can save the custom views and edit them later, if required. From the **View** drop-down list, choose **Manage Views** to create, edit, duplicate, or delete custom views. The **Default View** shows all the source and destination security groups.

You can navigate through the matrix by dragging the cursor over the matrix content area, or by using the horizontal and vertical scroll bars. You can also use the mini-map to navigate through the matrix. The mini-map

helps you to easily navigate through the matrix when the matrix size is large and extends beyond the screen size. You can move and place the mini-map anywhere on your screen. The mini-map provides the whole matrix view. The light gray portion in the mini-map represents the portion of the matrix that is currently displayed on your screen. You can drag your cursor over that area to scroll through the matrix.



Note The mini-map is closed by default. Click the **Expand** icon to expand and view the mini-map.

Use the **Filter** option to view a subset of the policy matrix for the selected set of source and destination groups. You can create a filter to focus only on the policies that you are interested in. To create the filter, select the source and destination groups that you want to include.

Policy Creation Overview

1. Define the categorizations for your organization or the portion of your organization that you plan to start with.
2. Create security groups for the categorizations that you identified.
3. Create access contracts for the types of network traffic that you wish to control. There are predefined sample access contracts to Permit or Deny all traffic, and also some example contracts showing more specific traffic filtering. You can create additional, more granular access contracts based on specific application definitions.
4. Decide which categories of network users require access to particular network resources, such as application servers and connections to other networks.
5. Create access policies, associate a source group, a destination group, and an access contract, to define how traffic is allowed to flow from the source to the destination.

Create a Security Group

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Security Groups**.

Step 2 Click **Create Security Group**.

Step 3 In the **Create Security Group** slide-in pane, enter a name and description (optional) for the security group.

Note The following characters are supported for the **Name** field:

- alphanumeric characters
- underscore (_)

The security group name must start with an alphabetic character.

Catalyst Center generates the tag value. You can update this value, if necessary. An error message is displayed if the value that you specified is already used by an existing security group. The valid range is from 2 to 65519.

Step 4 From the **Virtual Networks** drop-down list, choose the virtual networks to be associated with this security group. By default, the default virtual network is selected.

Note When Catalyst Center 2.3.3 or later is integrated with Cisco ISE 3.2 or later, security groups are not associated with virtual networks, and the **Virtual Networks** field is not displayed for these releases. However, if you are using Cisco ISE 3.1 or earlier, the security group and virtual network association details are displayed.

Step 5 Check the **Propagate to ACI** check box if you want the security group to be propagated to Cisco Application-Centric Infrastructure (ACI).

Step 6 Choose whether you want to create the security group now or schedule it for later.

If the **Automation Events for ITSM (ServiceNow)** bundle is enabled, the **Save Now** option is disabled, and only the **Schedule Later** option is enabled for group-based policy changes. The scheduled task must be approved in IT Service Management (ITSM) before the scheduled time. If the task is not approved before the scheduled time, the task fails. For information on how to integrate ITSM with Catalyst Center, see the [Cisco Catalyst Center ITSM Integration Guide](#).

You can view the total number of upcoming, in-progress, and failed tasks at the top-right corner of the **Security Groups** window. Click the task status link to view the task details in **Activities > Tasks**. You can edit or cancel a task before it is executed.



Note You cannot create a security group with the name ANY or the tag value 0xFFFF/65535. Security Group ANY/65535 is a reserved internal security group that is used for the Catalyst Center default policy.

Edit a Security Group

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Security Groups**.

Step 2 In the **Security Groups** window, check the check box next to the security group that you want to edit, and then click **Edit**.

Step 3 In the **Edit Security Group** slide-in pane, after making the necessary changes:

- Click **Save Now** to save the changes immediately.
- Click **Schedule Later** to schedule the update at a specific time. In the **Scheduler** slide-in pane, specify the start time, date, and time zone, and then click **Apply**.

When you update the security groups, you must deploy the changes on the network devices. Click **Deploy Now** to deploy the changes immediately, or click **Deploy Later** to deploy the changes later.

Delete a Security Group

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Security Groups**.

Step 2 Check the check box next to the security group that you want to delete.

Step 3 Choose one of the following options:

- To delete the security group immediately, click **Delete Now**.
- To delete the security group later, click **Delete Later**. In the **Schedule Delete** slide-in pane, specify the start time, date, and time zone, and then click **Apply**.



Note Click the link in the **Policies** column of a security group to view the access control rules using that security group and the policy to which it belongs. You cannot delete a security group if it is used in any access policy.

Synchronization of Security Groups Between Catalyst Center and Cisco ISE

While synchronizing the security groups in Catalyst Center with Cisco ISE:

- If a security group is present in Catalyst Center and is not present in Cisco ISE, it is created in Cisco ISE.
- If a security group is present in Cisco ISE and is not present in Catalyst Center, it is created in Catalyst Center.
- If a security group name is the same in both Catalyst Center and Cisco ISE, but the description and ACI data are different, Catalyst Center is updated with the data specified in Cisco ISE.
- If a security group name is the same in Catalyst Center and Cisco ISE, but the tag values are different, a new security group with the tag value specified in Cisco ISE is created in Catalyst Center. The name of the existing security group in Catalyst Center is updated with the suffix **_DNAC**.
- If a tag value is the same but the security group name is different, the security group name in Catalyst Center is updated with the name specified in Cisco ISE.

An orange triangle icon is displayed next to a security group if synchronization with Cisco ISE is not completed.

Cisco ISE supports the packets coming from ACI to the TrustSec domain by synchronizing the Internal Endpoint Groups (IEPGs) and creating correlating read-only security groups in Cisco ISE. These security groups are displayed in the **Security Groups** window with the value **ACI** in the **Created In** column. You cannot edit or delete the security groups that are learned from ACI, but you can use them in the policies.

The **Associated Contracts** column shows the associated contracts for the security groups that are learned from ACI. Click the link displayed in the **Associated Contracts** column to view the details about the associated contracts.

When an IEPG is updated in ACI, the corresponding security group configuration is updated in Cisco ISE. A new EEPG is created in ACI when a security group is created in Cisco ISE.

Create an Access Contract

An access contract is a set of rules that controls the type of network traffic that is allowed to pass between the source and destination security groups. Access contracts define the actions (permit or deny) that are performed when the traffic matches a network application, protocol, and port.

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Access Contracts**.

Step 2 Click **Create Access Contract**.

Step 3 In the **Create Access Contract** slide-in pane, enter the required details.

The **Modeled Access Contract** check box is enabled by default. This enables Catalyst Center to generate the valid commands for the underlying Security Group ACLs (SGACLs). When this option is enabled, the access contract is based on a model that allows you to create and edit without the need to know the underlying command line syntax.

Uncheck the **Modeled Access Contract** check box if you want to enter the SGACL command lines directly and store the access contract as text. Syntax checking is not done for the command line text that you enter. You must ensure that the command syntax is valid.

- Note**
- You can enable or disable this option only at the time of creating the access contracts. You cannot update this option for the existing access contracts.
 - Some of the advanced SGACL commands might not be supported on all Cisco network devices.

Step 4 Create the traffic filter rules:

- From the **Action** drop-down list, choose **Deny** or **Permit**.
- From the **Application** drop-down list, choose the application for which you want to apply that action. The port and protocol are automatically selected based on the application that you select.

If you want to specify the transport protocol, source port, and destination port, choose the **Advanced** option from the **Application** drop-down list.

You can create multiple rules. To create multiple rules for a contract, click the + symbol and choose the settings for the **Action** and **Application** columns. The rules are checked in the order in which they are listed in the contract. Use the handle icon at the left end of a rule to drag and change the order of the rule.

You can enable or disable logging for any traffic filter rule (including the default action) by using the **Logging** toggle. Logging is disabled by default. When logging is enabled, the network device sends a syslog message when the traffic filter rule is hit. This might be helpful in troubleshooting and initial testing of a policy. However, we recommend that you use this option sparingly because it might have a resource and performance impact on the network devices.

Step 5 From the **Default Action** drop-down list, choose **Deny** or **Permit**.

You can enable logging for the default action, if required.

Step 6 Choose whether you want to create the access contract now or schedule it for later.

Edit an Access Contract

If the **Automation Events for ITSM (ServiceNow)** bundle is enabled, the **Save Now** option is disabled, and only the **Schedule Later** option is enabled for group-based policy changes. The scheduled task must be approved in IT Service Management (ITSM) before the scheduled time. If the task is not approved before the scheduled time, the task fails. For information on how to integrate ITSM with Catalyst Center, see the [Cisco Catalyst Center ITSM Integration Guide](#).

You can view the total number of upcoming, in-progress, and failed tasks at the top-right corner of the **Access Contract** window. Click the task status link to view the task details in **Activities > Tasks**. You can edit or cancel a task before it is executed.

Edit an Access Contract

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Access Contracts**.
 - Step 2** In the **Access Contracts** window, check the check box next to the access contract that you want to edit.
 - Step 3** Choose **Actions > Edit**.
 - Step 4** In the **Edit Access Contract** window, after making the necessary changes, choose whether you want to update the access contract now or schedule it for later.
-

You can use the **Filter** option to search for the contracts.

You can duplicate an existing access contract and create a new access contract by editing the required details. When you duplicate an access contract, all information in the existing access contract is copied and the copied contract has the existing contract name with the string **Copy** appended at the end. Click **Save Now** to create the duplicate contract immediately, or click **Schedule Later** to create the duplicate contract later.

When you update the security groups, contracts, or policies, you must deploy the changes on the network devices. If you update the policies and do not deploy the updated policies, notifications about the policy changes are not sent to the network devices, and the policies that are currently active in the network may not be consistent with the policy information displayed in Catalyst Center. To resolve this situation, you must deploy the updated policies on the network devices. Click **Deploy Now** to deploy the changes immediately, or click **Deploy Later** to deploy the changes later.

Cisco ISE provides the runtime policy platform for providing policy download to the network devices on behalf of Catalyst Center. The TrustSec Workcenter user interface screens for Security Groups, Security Group Access Control Lists (SGACLs), and Egress Policy are displayed in Read-Only mode in Cisco ISE to prevent policy synchronization issues.

Delete an Access Contract

Before you begin

To perform the following task, you must be a Super Admin or Network Admin.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Access Contracts**.
-

- Step 2** In the **Access Contracts** window, check the check box next to the access contract that you want to delete, and then choose whether you want to delete the access contract now or schedule it for later.

You can view the sample contracts in the **Access Contracts** window. You can use or delete those sample contracts. However, you cannot delete the default contracts (Permit IP, Deny IP, Permit_IP_Log, and Deny_IP_Log).

Click the link in the **Policies** column of an access contract to view the policies that use that contract. You cannot delete a contract if it is used in a policy. You must delete the contract from that policy before you delete the contract.

Synchronization of Access Contracts Between Catalyst Center and Cisco ISE

While synchronizing the access contracts in Catalyst Center with Cisco ISE:

- If a contract is present in Catalyst Center and is not present in Cisco ISE, it is created in Cisco ISE.
- If a contract is present in Cisco ISE and is not present in Catalyst Center, it is created in Catalyst Center.
- If a contract name is the same in Catalyst Center and Cisco ISE, but the description and traffic rule content are different, Catalyst Center is updated with the data specified in Cisco ISE.
- If the contract name and rule are the same, but the description is different, Catalyst Center is updated with the description specified in Cisco ISE.
- Text SGACL command lines in Cisco ISE are migrated as content that cannot be parsed. You can edit these contracts, but Catalyst Center does not parse them or check the syntax. The changes that you make in Catalyst Center are reflected in Cisco ISE.
- If a policy has multiple SGACLS in Cisco ISE, those contracts are migrated as default policies in Catalyst Center.

An orange triangle icon is displayed next to an access contract if synchronization with Cisco ISE is incomplete.

The contracts that are learned from ACI are displayed in the **Access Contracts** window with the value **ACI** in the **Created In** column. You cannot edit or delete the access contracts that are learned from ACI, but you can use them in the policies while using the ACI-learned security groups. While creating or updating a policy from the Matrix view, if you select an ACI-learned security group as the destination group, the associated access contracts are displayed in the **Preferred Contracts** tab. You can view all the access contracts in the **All Contracts** tab.

Create Group-Based Access Control Policy

Security groups and access contracts are the basic building blocks of an access control policy. While creating an access control policy, you can use the security groups and contracts that you have created before, or create new security groups and contracts while creating the policy.

To specify the network resources that can be accessed from a specific source group, you can create an access control policy with a single source and multiple destination groups. On the other hand, to specify the source groups that are permitted to access a particular network resource, you can create an access control policy with a single destination and multiple source groups.

For example, if you want to specify the network resources that can be accessed by the users associated with the *Contractors* source security group, you can create an access control policy with a single source and multiple destination groups. If you want to specify the source groups that are permitted to access the *Finance Servers* destination security group, you can create an access control policy with a single destination and multiple source groups.

Group-based access control policies can also be created or updated based on the traffic flows for a given source and destination group pair.

Step 1

In the **Policy List** or **Matrix** view, click **Create Policies**.

Step 2

To create an access control policy with a single source and multiple destination groups, click **Source to Destination(s)** and complete these steps:

- Click the radio button next to the source security group that you want to select.

If the security group that you want does not exist, click **Create Security Group** to create a new security group. This option is not available if the **Automation Events for ITSM (ServiceNow)** bundle is enabled.

- Click **Next**.

- Choose the destination security groups to map to the selected source security group.

You can view the security group details and edit the security groups, if necessary.

Note If a policy already exists between the source and destination, an orange triangle icon is displayed near a security group.

- Click **Next**.

- Click the radio button next to the contract that you want to select. You can view and edit the contract details, if necessary.

If the contract that you want does not exist, click **Create Contract** to create a new contract. This option is not available if the **Automation Events for ITSM (ServiceNow)** bundle is enabled.

Note You can choose only one contract for a policy.

- Click **Next**.

The **Summary** window lists the policies that are created based on the selected security groups and contract.

- Choose whether you want to create the policy now or schedule it for later.

Step 3

To create an access control policy with a single destination and multiple source groups, click **Destination to Source(s)** and complete the following steps:

- Click the radio button next to the destination security group that you want to select.

If the security group that you want does not exist, click **Create Security Group** to create a new security group. This option is not available if the **Automation Events for ITSM (ServiceNow)** bundle is enabled.

- Click **Next**.

- Choose the source security groups to map to the selected destination security group.

You can view the security group details and edit the security groups, if necessary.

Note If a policy already exists between the source and destination, an orange triangle icon is displayed near a security group.

- Click **Next**.

- e) Click the radio button next to the contract that you want to select.

If the contract that you want does not exist, click **Create Contract** to create a new contract. This option is not available if the **Automation Events for ITSM (ServiceNow)** bundle is enabled.

Note You can choose only one contract for a policy.

- f) Click **Next**.

The **Summary** window lists the policies that are created based on the selected security groups and contract.

- g) Choose whether you want to create the policy now or schedule it for later.

If the **Automation Events for ITSM (ServiceNow)** bundle is enabled, the **Save Now** option is disabled, and only the **Schedule Later** option is enabled for group-based policy changes. The scheduled task must be approved in IT Service Management (ITSM) before the scheduled time. If the task is not approved before the scheduled time, the task fails. For information on how to integrate ITSM with Catalyst Center, see the [Cisco Catalyst Center ITSM Integration Guide](#).

You can view the total number of upcoming, in-progress, and failed tasks at the top-right corner of the **Policies** window. Click the task status link to view the task details in **Activities > Tasks**. You can edit or cancel a task before it is executed.

Update a Group-Based Access Control Policy Based on Traffic Flows

Step 1 From the policy matrix view, click the cell for which you want to update the group-based access control policy.

Step 2 In the **Policy Details** slide-in pane, click **View Traffic Flows**.

In the **View Traffic Flows** slide-in pane, you can see the rules for the selected contract or the default policy in the left pane. You can view the traffic flows that match any selected rule in the right pane.

Step 3 Click **View Traffic** in the Default Action rule to see the list of flows that match that rule. While modifying an existing policy using access contracts with additional rules, use the **View Traffic** option for any rule to see the list of flows matching that rule.

For policies that are using the Default Action rule (with no explicitly selected access contract), you can select an access contract or create a new access contract to be used by that policy.

For policies with the access contract PERMIT or DENY, you can select an access contract or create a new access contract to be used by that policy.

For policies with the custom access contract, you can edit the selected access contract.

Step 4 After making the required changes, choose one of the following options:

- **Save the changes to the existing contract. Changes affect all the policies that reference the contract.**
- **Save the changes as a new contract. Changes are applied only to the current policy.**
- **Save the changes as a new contract. Changes are not applied to any policy.**

Synchronization of Policies Between Catalyst Center and Cisco ISE

While synchronizing the policies in Catalyst Center with Cisco ISE:

- If a policy is present in Catalyst Center and is not present in Cisco ISE, it is created in Cisco ISE.
- If a policy is present in Cisco ISE and is not present in Catalyst Center, it is created in Catalyst Center.
- If a policy contract is different in Cisco ISE, Catalyst Center is updated with the contract specified in Cisco ISE.
- Policy mode information (Enabled, Disabled, or Monitor) is also imported from Cisco ISE.

Cisco ISE has an option to allow multiple SGACLs for a single policy (this option is not enabled by default in Cisco ISE). Catalyst Center does not support the use of multiple access contracts for a single policy. During policy synchronization, if a policy in Cisco ISE has multiple SGACLs, the Catalyst Center administrator is given the option to change that policy to have no contract selected (to use the default policy). The administrator can select a new or existing access contract for that policy after the policy synchronization is complete.

Cisco Group-Based Policy Analytics

About Cisco Group-Based Policy Analytics

Group-Based Policy Analytics enables you with insights, to create group-based policies by visualizing communications between assets, to assess the impact of introducing new access controls, and understand exactly which protocols you need to allow in the policies.

Cisco Group-Based Policy Analytics aggregates information on groups of assets on your network and their communication to answer the following questions:

- Which groups are communicating with each other?
- What kind of communication is this?
- Which group does a given asset belong to?

You can purchase one of following types of licenses for Catalyst Center:

- Essentials
- Advantage
- Premier

The Advantage and Premier licenses contain the Group-Based Policy Analytics package. This package consists of the following archives (.tar.gz files):

- Backend
- User Interface
- Summarizer Pipeline
- Aggregation definitions

Install Group-Based Policy Analytics

Cisco Group-Based Policy Analytics is a part of Catalyst Center, but it is not installed by default.

To install Group-Based Policy Analytics, perform the following steps:

Step 1 From the top-left corner, click the menu icon and choose **System > Software Management**.

Step 2 Scroll down to the **Available Applications for 2.3.x.x-xxxxx** area and select **Group-Based Policy Analytics**.

Step 3 Click **Install** to install the application.

Hardware and Software Compatibility

Platform Support

Cisco Group-Based Policy Analytics is supported on the following hardware platforms:

- 44 cores, single node or three-node cluster
- 56 cores, single node or three-node cluster
- 112 cores, single node or three-node cluster

These platforms must meet the performance and scalability requirements mentioned here.

For details about the supported hardware, see [Cisco UCS M4 appliances](#) or [Cisco UCS M5 appliances](#).

The following table lists the performance metrics that Catalyst Center and Cisco Group-Based Policy Analytics support on each of the core platforms. The NetFlow metrics were introduced by Cisco Group-Based Policy Analytics.



Note

The following table lists the performance metrics for a standalone deployment. These values might vary based on the number of nodes in the cluster and the number of installed packages.

Table 38: Performance Metrics

Metric	44 cores, three nodes	56 cores	112 cores
Devices (NADs)	5000 1000 switches or 1000 routers or a combination of both; 4000 APs	8000 2000 switches or 2000 routers or a combination of both; 6000 APs	18,000 5000 switches or 5000 routers or a combination of both; 13,000 APs
Clients (endpoints)	25,000 20,000 wireless; 5,000 wired	40,000 30,000 wireless; 10,000 wired	100,000 60,000 wireless; 40,000 wired
NetFlows per sec	30,000	48,000	120,000

Device Support

You must enable NetFlow to use Cisco Group-Based Policy Analytics. The following table shows the various ways in which NetFlow can be enabled on different network devices.

Table 39: Device Support

Network Devices	Series	NetFlow Configurable in telemetry section of Network Settings in Catalyst Center UI (Flexible NetFlow or Application Visibility and Control Based NetFlow)	NetFlow Configurable using the CLI Template tool in the Catalyst Center UI (Flexible NetFlow or Application Visibility and Control Based NetFlow)	NetFlow Collection in Fabric Deployment	NetFlow Collection in Nonfabric Deployment
Routers	Cisco 1000 Series Integrated Services Routers (ISR1K)	Yes	Yes	Yes	Yes
	Cisco 4000 Series Integrated Services Routers (ISR4K)	Yes	Yes	Yes	Yes
	Cisco Cloud Services Router 1000v Series (CSR 1000v)	Yes	Yes	Yes	Yes
	Cisco 1000 Series Aggregation Services Routers (ASR1K)	Yes	Yes	Yes	Yes
Switches	Cisco Catalyst 9200 Series	Yes	Yes	Yes	Yes
	Cisco Catalyst 9300 Series	Yes	Yes	Yes	Yes
	Cisco Catalyst 9400 Series	Yes	Yes	Yes	Yes
	Cisco Catalyst 9500 Series	No	Yes	Yes	Yes
	Cisco Catalyst 9600 Series	No	Yes	Yes	Yes
	Cisco Catalyst 2k Series	No	Yes	NA	Yes
	Cisco Catalyst 3560 Series	No	Yes	NA	Yes
	Cisco Catalyst 3650 Series	No	Yes	Yes	Yes
	Cisco Catalyst 3850 Series	No	Yes	Yes	Yes
	Cisco Catalyst 4k Series	No	Yes	Yes	Yes
	Cisco Catalyst 6500 Series Switches	No	Yes	Yes	Yes
	Cisco Catalyst 6800 Series Switches	No	Yes	Yes	Yes

Network Devices	Series	NetFlow Configurable in telemetry section of Network Settings in Catalyst Center UI (Flexible NetFlow or Application Visibility and Control Based NetFlow)	NetFlow Configurable using the CLI Template tool in the Catalyst Center UI (Flexible NetFlow or Application Visibility and Control Based NetFlow)	NetFlow Collection in Fabric Deployment	NetFlow Collection in Nonfabric Deployment
Wireless Controllers	Cisco 3504 Wireless Controller (AireOS-Based)	Yes	Yes	No	Yes, only central switching SSID
	Cisco 5520 Wireless Controller (AireOS-Based)	Yes	Yes	No	Yes, only central switching SSID
	Cisco 8540 Wireless Controller (AireOS-Based)	Yes	Yes	No	Yes, only central switching SSID
	Cisco Catalyst 9800 Based Controller	Yes	Yes	Yes	Yes

Cisco ISE

Cisco ISE 2.4 Patch 7 and later, Cisco ISE 2.6 Patch 1 and later, and Cisco ISE 2.7 and later are supported.

Cisco Stealthwatch

Cisco Stealthwatch 7.x or later is supported.

Understand Connectors

Cisco Group-Based Policy Analytics gathers telemetry from the following sources, which are also known as connectors. You can configure the connectors either by following the [Initial Configuration of Cisco Group-Based Policy Analytics](#), on page 702 workflow, or by choosing **Policy > Group-Based Access Control > Analytics > Configurations > Analytics Settings**.

Group Data Connectors

The group data connectors collect information about groups that assets are classified into. Cisco ISE and Cisco Stealthwatch are group data connectors.

- **Cisco ISE**

Cisco ISE is a next-generation identity and access control policy platform that enables enterprises to enforce compliance, enhance infrastructure security, and streamline their service operations. Cisco ISE is installed on a virtual machine, a physical machine, or a combination of both. Cisco ISE uses the Cisco Platform Exchange Grid (pxGrid) service as the publisher-subscriber module for sharing Session Directory, security groups, and other information. PxGrid uses a query interface and supports bulk download. Users on the network are authenticated, authorized, and accounted for, and a Session Directory is maintained. User events are published to the connectors that are subscribed to the Session Directory service. Other services, like security group notifications, can also be subscribed to.

User identity and device information obtained during authentication is used to classify the packets as they enter the network. This packet classification is maintained by tagging packets when they enter the

network so that they can be properly identified for applying security and other policy criteria along the data path. The tag, also called the security group tag (SGT), allows Cisco ISE to enforce access control policies by enabling the network device to act upon the SGT to filter traffic.

In addition, Cisco ISE collects information about endpoints connected to your network, such as the type of device, OS, OS version, IP address and other attributes. These are called ISE profiles.

The Cisco ISE connector provides Cisco Group-Based Policy Analytics with SGT definitions and profiles from Cisco ISE.

- **Cisco Stealthwatch**

Cisco Stealthwatch is a network-based anomaly detection system that provides advanced threat detection, accelerated threat response, and network traffic security analysis. The Cisco Stealthwatch connector obtains the host groups that are configured on Cisco Stealthwatch. A host group is essentially a virtual container containing multiple host IP addresses or IP address ranges that have similar attributes, such as location, function, or topology.

Communication Connector

The communication connector helps gather information on traffic seen between groups that could be leveraged in Group-Based Policy decisions. This is done using NetFlow from network devices managed by Catalyst Center. NetFlow is collected and aggregated natively by Catalyst Center.

Initial Configuration of Cisco Group-Based Policy Analytics

This workflow helps you configure the data connectors that are required to collect telemetry data related to the network activity and endpoints from specific sources, such as Cisco ISE, Cisco Stealthwatch, and NetFlow. This task is useful when you are configuring the data connectors for the first time.

Before you begin

Catalyst Center must have Cisco Group-Based Policy Analytics installed.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Overview**. The **Create policies with more confidence** window is displayed.

Step 2 Click **Get Started**.

The **Configure your data connectors** window is displayed.

Step 3 Click **Let's Do It**.

The **Configure Group Data Connectors** window is displayed.

Note If the Cisco ISE version is earlier than the version required for running Cisco Group-Based Policy Analytics, an error message is displayed.

Step 4 Click **Configure** at the bottom of the connector that you want to configure.

A new window opens, redirecting you to the Catalyst Center **Settings** window, where you can configure the required connectors. You must configure the Cisco ISE connector. Configuring the Cisco Stealthwatch connector is optional.

Step 5 Close the **Settings** window. You will see a green dot next to the **Configure** option for the successfully configured connectors in the **Configure Group Data connectors** window.

Step 6 Click **Next**.

The **Configure Communication Connectors** window is displayed.

Step 7 Configure the communication connector (NetFlow) by using one of the following options:

- Provision NetFlow on the Catalyst Center device interface manually.
- Click **CLI Templates** to configure NetFlow using the **CLI Templates** tool in Catalyst Center.
- Click **Telemetry in Network Settings** to configure NetFlow in the telemetry section of network settings.

Step 8 Click **Next**.

The **Summary** window displays the configuration details of the connectors.

Step 9 Click **Done** to start discovering your groups and endpoints.

Explore Groups and Endpoints

The following section provides information about the different ways to visualize traffic between different groups.

Multiple Groups to Multiple Groups

When you click the number that is displayed in the **Security Groups** box in the **Overview** window, the **Explore Security Groups** window is displayed. In this window, you can see a summary of all the group-to-group communication among security groups. By default, the time range for this view is the last available 24 hours of data. Note that this is different from the time range mentioned in the **Overview** window, where it is set to the last 14 days. The chart shows the top 25 source security groups and their corresponding interactions, starting with the source security group with the highest number of unique flows within the given time period and so on.

Click the  icon to display the chart view or  to display the table view.

In the table view, if you click the **See destinations** link on a particular row, it opens a window showing all the destination security groups for the selected source security group and the unique flow count for each destination security group.

Click a source group to view the **Single Group to Multiple Groups** window.

When you hover your cursor over a link, the link is highlighted and a tooltip shows the number of unique traffic flows. Clicking the link takes you to the **Single Group to Single Group** window.

When you click the number displayed in the **ISE Profiles** box in the **Overview** window, the **Explore ISE Profiles** window is displayed. In this window, you can see a summary of all the communication from ISE Profiles as the source and security groups as the destination. In order to focus on the group-based policy decisions, either the source or destination category must be the security groups in this view.

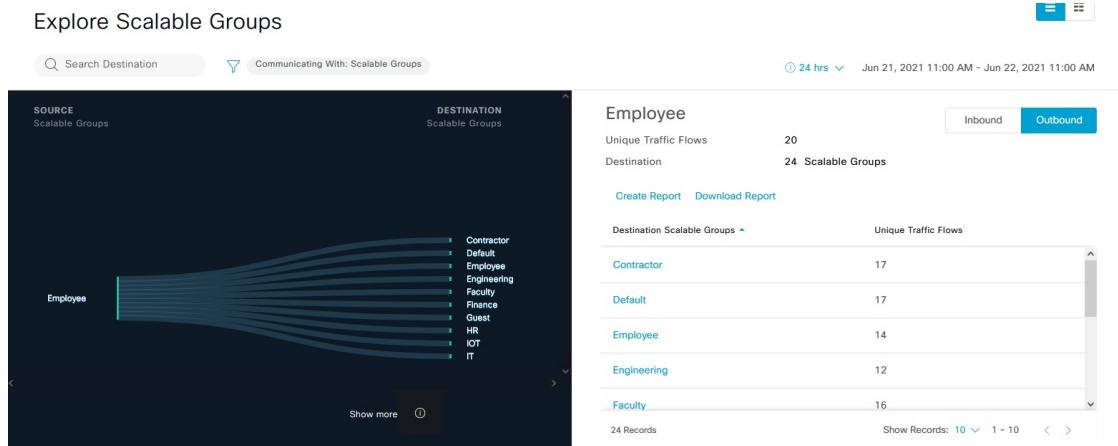
When you click the number displayed in the **Stealthwatch Host Groups** box in the **Overview** window, the **Explore Stealthwatch Host Groups** window is displayed. In this window, you can see a summary of all the communication, with Stealthwatch Host Groups as the source and the security groups as the destination. In order to focus on the group-based policy decisions, either the source or destination category must be the security groups in this view.

Single Group to Multiple Groups

Single Group to Multiple Groups

Single Group to Multiple Groups: Outbound

This window displays the activity between a single source group and multiple destination groups. The source or the destination or both must be a security group. By default, the time range for this view is the last available 24 hours of data, and the default number of links or records shown is 10.



Click the icon to display the chart view or to view the table view.

Outbound displays the connections initiated by the selected security group. **Inbound** displays the connections initiated by another group to this security group.

Click any column to sort it in ascending or descending order.

Click a group to view the **Single Group to Single Group** window with the corresponding destination as the selected group. The source group does not change.

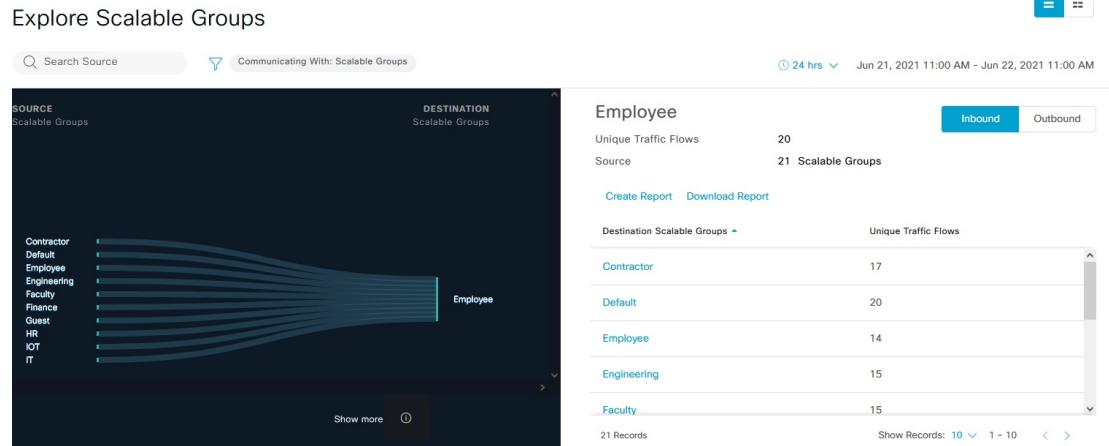
When you hover your cursor over a link, it is highlighted, and a tooltip shows the number of unique traffic flows. If you click this link, it takes you to the **Single Group to Single Group** window.

Click **Create Report** to generate a new report in CSV format with the information in this view. The **Reports** window opens, where you can see the generated report. This window also provides you access to previously generated reports and allows you to download the reports.

Click **Download Report** to view the generated reports. The **Reports** window opens, where you can click the *download* icon under the **Last Run** column to download a report.

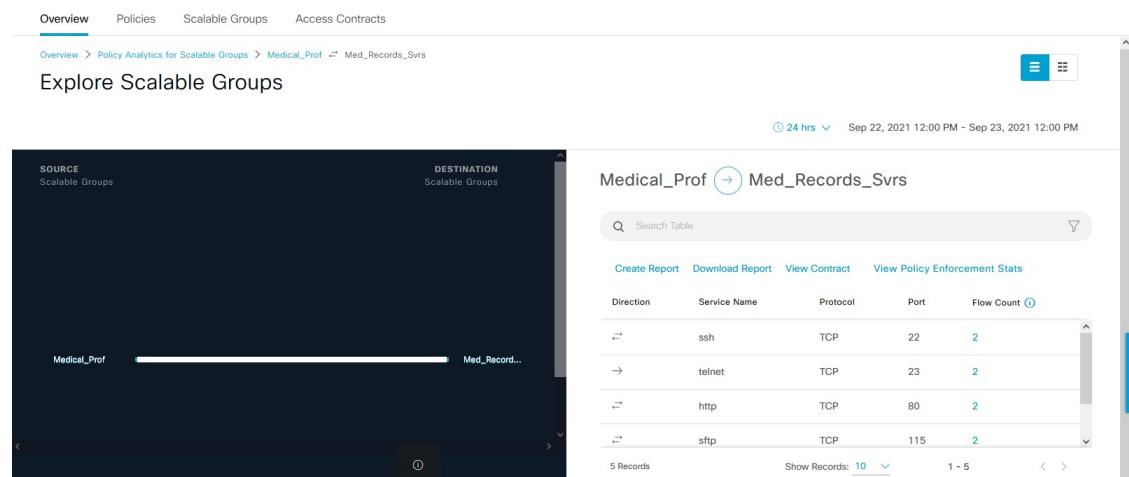
Single Group to Multiple Groups: Inbound

If you click **Inbound**, it shows all the connections initiated by any group as the source and the selected security group as the destination.



Single Group to Single Group

This window shows the activity between a source group and a destination group. Either the source group, the destination group, or both must be a security group. By default, the time range for this visual is the last available 24 hours of data, and the default number of links or records shown is 10.



When you click the directional arrow displayed between the source and destination groups, the source and destination groups are interchanged in this view.

Click **View Contract** to view a side-by-side comparison of traffic flows with the access contract rules that are in effect for this source and destination group pair.

Single Group to Single Group

The screenshot shows the 'View Contract' window for a contract named 'Secure_Web_SFTP'. The left pane displays three permit rules for TCP port 443. The right pane shows all unique traffic flows for the selected time period (Sep 22, 2021 12:00 PM - Sep 23, 2021 12:00 PM), with a total of 2 flows. The flow details include ssh (TCP port 22), telnet (TCP port 23), http (TCP port 80), sftp (TCP port 115), and https (TCP port 443).

#	Action	Application	Protocol	Source Port	Destination Port	Logging	Action	Direction	Service Name	Protocol	Port	Flow Count
1	PERMIT	advanced	TCP		443	OFF	View traffic		ssh	TCP	22	2
2	PERMIT	advanced	TCP		115	OFF	View traffic		telnet	TCP	23	2
3	PERMIT	advanced	TCP		22	OFF	View traffic		http	TCP	80	2
									sftp	TCP	115	2
									https	TCP	443	2

The left pane in the **View Contract** window displays the rules for permitted and denied traffic between the source and destination groups. You can view the traffic flows that match any selected rule in the right pane. You can view the flow direction, service name, flow count, ports, and protocol details in the right pane. The **Flow Count** column displays the number of flows detected for that particular service, port, and protocol combination for the selected time period. You can click the flow count link to view the flow details for each endpoint.

The screenshot shows the 'Endpoint List' window for the contract 'Secure_Web_SFTP'. It displays two entries for TCP port 22. Both entries show traffic from 'Global/MYAREA/MYSITE9' to 'Global/MYAREA/MYSITE2'. The flow count for both entries is 1.

Source IP Address	Source MAC Address	Source Location	Destination IP Address	Destination MAC Address	Destination Location	Flow Count
[REDACTED]	[REDACTED]	Global/MYAREA/MYSITE9	[REDACTED]	[REDACTED]	Global/MYAREA/MYSITE2	1
[REDACTED]	[REDACTED]	Global/MYAREA/MYSITE1	[REDACTED]	[REDACTED]	Global/MYAREA/MYSITE2	1



Note When you sort the **Traffic Flows** table based on the flow count, only 1000 records are displayed.

Click **View Policy Enforcement Stats** to view a time-series graph of the permit and deny counts for any source and destination group pair. It provides per-policy enforcement statistics visibility. You can use the **All Packets** drop-down list to select only the permitted or dropped packets. Graph data points are displayed for each 15-minute data collection period. You can hover over any data point to view the number of permits and denies. You can click a data point or time period to view the contract and traffic flow details for the selected time period.



Note Note that the selected time period will be the hour that contains the 15-minute interval corresponding to the selected data point because the flow data aggregation is done every 60 minutes.

The **Traffic Flows** table can also be accessed from the **Policy Details** slide-in pane while creating or editing a policy.

Click the icon to display the chart view or to display the table view.

You can set the date and time using the [Date and Time Selector](#).

Click **Create Report** to generate a new report in CSV format with the information in this view. The **Reports** window opens, where you can see the generated report. This window also provides you access to previously generated reports and allows you to download the reports.

Click **Download Report** to view the generated reports. The **Reports** window opens, where you can click the *download* icon under the **Last Run** column to download a report.

Access Contracts

Access Contracts can now be created and modified directly in the Analytics workflow.

View Contract

To launch the **View Contract** window, from the **Explore Security Groups** window, click **View Contract**. The left pane in the **View Contract** window displays the rules for permitted and denied traffic between the source and destination groups. You can view the traffic flows that match any selected rule in the right pane.

This table can also be accessed from the **Policies** window. From the top-left corner, click the menu icon and choose **Policy > Group-Based Access Control > Policies**.

From the policy matrix view, click the cell for which you want to create or modify contracts. In the **Policy Details** slide-in pane, click **View Traffic Flows**.

If there is currently no contract assigned between the source and destination groups, no data is displayed. You can use the **Change Contract** or **Create Access Contract** option to create or modify the contract.

Click **View traffic** in the **Action** column to see the list of flows that match that rule.

Create Access Contract

To launch the **Contract Content** window, from the **Policy Details** pane, click **Create Access Contract**. To create the traffic filter rules:

1. From the **Action** drop-down list, choose **Deny** or **Permit**.
2. From the **Application** drop-down list, choose the application for which you want to apply that action. The port and protocol are automatically selected based on the application that you select.
If you want to specify the transport protocol, source port, and destination port, choose the **Advanced** option in the **Application** drop-down list.

You can create multiple rules. To create multiple rules for a contract, click the Plus icon and choose the settings for the **Action** and **Application** columns. The rules are checked in the order in which they are listed in the contract. Use the Handle icon at the left end of a rule to drag and change the order of the rule.

You can use the **Add to Contract** option within the **All Unique Traffic Flows** pane to add an entry to the contract.

While saving a newly created or edited contract, you have the following options:

- **Update current policy only:** A duplicate of the contract is created and applied to the current policy. Other policies that reference this contract are not affected.
- **Update contract for all referenced policies:** The contract is updated and applied to the current policy and other policies that reference this contract.
- **Create a new contract with no policies affected:** A duplicate of the contract is created but not applied to any policy.

Change Contract

To launch the **Change Contract** window, from the **Policy Details** pane, click **Change Contract**. All the available contracts are displayed. You can select the required contract and click **Change** to add that contract to the policy.

Edit Contract

The **Edit** option is displayed only when a contract has already been added to the policy. If you want to edit the contract details, click **Edit** displayed after the name of the contract.

After updating the contract, click **Save**. The following options are available:

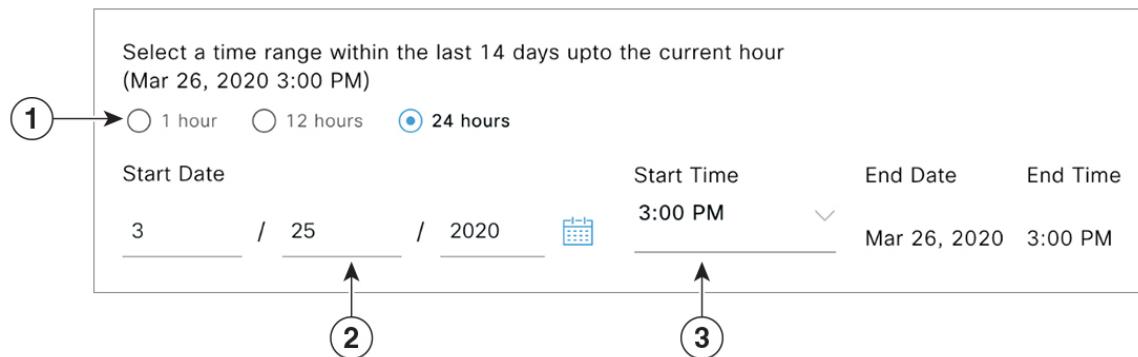
- **Update current policy only:** A duplicate of the contract is created and applied to the current policy. Other policies that reference this contract are not affected.
- **Update contract for all referenced policies:** The contract is updated and applied to the current policy and other policies that reference this contract.
- **Create a new contract with no policies affected:** A duplicate of the contract is created but not applied to any policy.

After choosing the appropriate option, enter a name and description (if you select the first or third option), and then click **Confirm**.

Date and Time Selector

You can select the time period to specify the data in the connection summary. You can select a time range within the last 14 days up to the current hour.

Figure 25: Date and Time Selector



1. Select one of the options. The **End Time** will be adjusted automatically.
2. Specify the **Start Date** by entering the month, day, and year manually or by using the calendar icon.
3. Choose the **Start Time** from the drop-down menu.

Use Search

The **Overview** window has a **Search** field that can search across the data for security groups, ISE profiles, Stealthwatch host groups, IP addresses, or MAC addresses.

As you start entering the characters in the search field, an automatic search is performed for security groups, ISE profiles, and Stealthwatch host groups, and up to three results are displayed for each group type. For MAC addresses, the relevant characters are hexadecimal and colon.

Cisco Group-Based Policy Analytics supports both IPv4 and IPv6 addresses for endpoints. You can search and filter the endpoints using an IPv4 or IPv6 address.

- The following characters can be used to search and filter IPv4 addresses:
 - Numbers (0-9)
 - Dot (.)

You can enter up to 15 characters in the filter field.

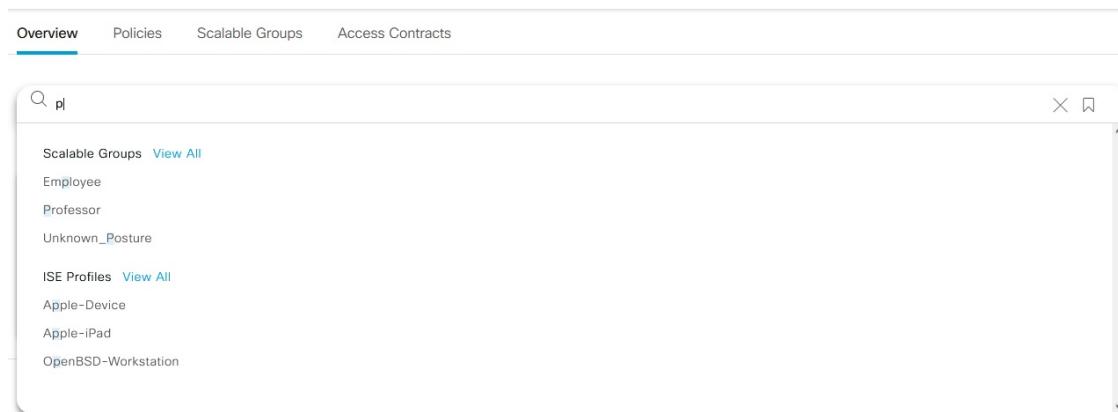
- The following characters can be used to search and filter IPv6 addresses:
 - Numbers (0-9)
 - Lowercase and uppercase alphabetic characters (a-f, A-F)
 - Colon (:)

You can enter up to 39 characters in the filter field.


Note

- The **Search Results** window does not open until you click the **View All** link.
- A read-only user cannot search for an IP address or a MAC address. For more information, see [Role-Based Access Control, on page 710](#).

Figure 26: Search Window



From the **Focus** drop-down list, choose the required option to change your search criteria.

The filter icon is used in advanced filtering and is available only when you search for a MAC address or an IP address. When you click the filter icon, each column is provided with a search field on top of the column name.

For each column, you can enter up to three search criteria. When entering more than one criterion per column, you can specify an OR operation or an AND operation. The resultant query performs an AND operation across the columns.

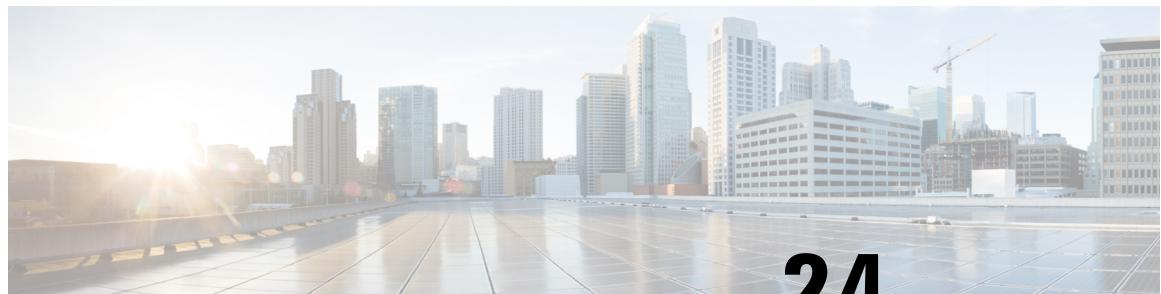
Click the bookmark icon, and use the **Save Current Search** option to save the current displayed search.

To delete a saved search, click the bookmark icon. Hover your cursor over the name of the saved search, and click the cross icon. Click **Yes** in the **Delete Saved Filter** dialog box to permanently delete the filter.

Role-Based Access Control

Cisco Group-Based Policy Analytics supports Role-Based Access Control. It differentiates between a read-write user and a read-only user. However, because Cisco Group-Based Policy Analytics is primarily based on visibility, which does not make any changes to the system, there are only a few limitations for a read-only user:

- A read-only user cannot save search queries.
- A read-only user cannot configure the data connectors.
- A read-only user cannot export data because exporting data is an HTTPS POST operation.
- A read-only user can only perform a search by group and is restricted from other search functions because they involve HTTPS POST operations.



CHAPTER 24

Configure IP-Based and URL-Based Access Control Policies

- [IP-Based Access Control Policies, on page 711](#)
- [Workflow to Configure an IP-Based Access Control Policy, on page 712](#)
- [Configure Global Network Servers, on page 712](#)
- [Create an IP Network Group, on page 713](#)
- [Edit or Delete an IP Network Group, on page 714](#)
- [Create an IP-Based Access Control Contract, on page 714](#)
- [Edit or Delete an IP-Based Access Control Contract, on page 715](#)
- [Create an IP-Based and URL-Based Access Control Policy, on page 715](#)
- [Edit or Delete an IP-Based and URL-Based Access Control Policy, on page 717](#)

IP-Based Access Control Policies

An IP-based access control policy controls the traffic going into and coming out of a Cisco device in the same way that an Access Control List (ACL) does. As with an ACL, an IP-based access control policy contains lists of permit and deny conditions that are applied to traffic flows based on various criteria, including the protocol type, source IP address, destination IP address, or destination port number.

IP-based access control policies can be used to filter traffic for various purposes, including security, monitoring, route selection, and network address translation.

An IP-based access control policy has two main components:

- **IP Network Groups:** IP network groups comprise IP subnets that share the same access control requirements. These groups can be defined only in Catalyst Center. An IP network group may have as few as one IP subnet in it.
- **Access Contract:** An access contract is a common building block that is used in both IP-based and group-based access control policies. It defines the rules that make up the access control policies. These rules specify the actions (permit or deny) performed when traffic matches a specific port or protocol and the implicit actions (permit or deny) performed when no other rules match.

Workflow to Configure an IP-Based Access Control Policy

Before you begin

- Cisco ISE is not mandatory if you are adding groups within the **Policy > IP & URL Based Access Control > IP Network Groups** window while creating a new IP-based access control policy.
- Make sure that you have defined the following global network settings and provision the device:
 - Network servers, such as AAA, DHCP, and DNS servers. For more information, see [Configure Global Network Servers, on page 234](#).
 - Device credentials, such as CLI, SNMP, HTTP, and HTTPS. For more information, see [Configure Global Device Credentials, on page 235](#).
 - IP address pools. For more information, see [Configure IP Address Pools, on page 247](#).
 - Wireless settings, such as SSIDs, wireless interfaces, and wireless radio frequency profiles. For more information, see [Configure Global Wireless Settings, on page 252](#).

Step 1 Create IP network groups.

For more information, see [Create an IP Network Group, on page 713](#).

Step 2 Create an IP-based access control contract.

An IP-based access control contract defines a set of rules between the source and destination. These rules dictate the action (allow or deny) that network devices perform based on the traffic that matches the specified protocols or ports. For more information, see [Create an IP-Based Access Control Contract, on page 714](#).

Step 3 Create an IP-based access control policy. The access control policy defines the access control contract that governs traffic between the source and destination IP network groups.

For more information, see [Create an IP-Based and URL-Based Access Control Policy, on page 715](#).

Configure Global Network Servers

You can define the global network servers that become the default for your entire network.



Note

You can override the global network settings on a site by defining site-specific settings.

Step 1 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

Step 2 Click the **Servers** tab.

Step 3 Expand the **DHCP** area to specify one or more dedicated Dynamic Host Configuration Protocol (DHCP) servers for managing the client device networking configuration.

Step 4 Check the **Add DHCP servers** check box to view the fields.

Step 5 In the **IP Address** field, enter the IP address of a DHCP server. Click the icon to add an IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

You must define at least one DHCP server in order to create IP address pools.

Step 6 Expand the **DNS** area to configure your network's domain name, and specify Domain Name System (DNS) servers for hostname resolution.

Step 7 Check the **Set a domain name** check box to enter the domain name of a DNS server.

Step 8 Check the **Add DNS servers** check box to enter the IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

You must define at least one DNS server in order to create IP address pools.

Step 9 Expand the **NTP** area to specify one or more Network Time Protocol (NTP) servers to facilitate system clock synchronization for your network.

Step 10 Check the **Add NTP servers** check box to view the fields.

Step 11 In the **IP Address** field, enter the IP address of an NTP server. Click the icon to add an IP address.

Note

You can click the  icon and enter both IPv4 and IPv6 addresses. Click the  icon to delete an IP address.

Step 12 Click **Save**.

Create an IP Network Group

Step 1 From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > IP Network Groups**.

Step 2 Click **Add Groups**.

Step 3 In the **Name** field, enter a name for the IP network group.

Step 4 In the **Description** field, enter a word or phrase that describes the IP network group.

Step 5 In the **IP Address or IP/CIDR** field, enter the IP addresses that make up the IP network group.

Step 6 Click **Save**.

Edit or Delete an IP Network Group

- Step 1** From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > IP Network Groups**.
- Step 2** In the **IP Network Groups** table, check the check box next to the group that you want to edit or delete.
- Step 3** Do one of the following tasks:
- To make changes to the group, click **Edit**. For more information about field definitions, see [Create an IP Network Group, on page 713](#). Make the desired changes, and click **Save**.
 - To delete the group, click **Delete** and then click **Yes** to confirm.

Create an IP-Based Access Control Contract

Use this procedure to create an IP-based access contract:

- Step 1** From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > Access Contract**.
- Step 2** Click **Add Contract**.
- Step 3** In the **Name** field of the **Add Contract** slide-in pane, enter a name for the access contract.
- Step 4** (Optional) In the **Description** field, enter a description for the access contract.
- Step 5** From the **Implicit Action** drop-down list, choose either **Deny** or **Permit**.
- Step 6** Click **Add** to add a port or protocol.
- Step 7** In the **Add Port/Protocol** dialog box, do the following:
 - a) From the **Action** drop-down list, choose either **Deny** or **Permit**.
 - b) From the **Port/Protocol** drop-down list, choose a port or protocol.
 - c) Click **Save**.
- Step 8** If Catalyst Center doesn't have the port or protocol that you need, click **Create Port/Protocol** to create a port and protocol, and do the following in the **Create Port/Protocol** dialog box:
 - a) In the **Name** field, enter a name for the port or protocol.
 - b) From the drop-down list, choose a protocol: **Any**, **AHP**, **ESP**, **IGMP**, **IP**, **NOS**, **PCP**, **TDP**, **UDP**, or **TCP/UDP**.
 - c) In the **Port Range** field, enter the port range.
 - d) If you want Catalyst Center to configure the port or protocol as defined and not report any conflicts, check the **Ignore Conflict** check box.
 - e) Click **Save**.
- Step 9** (Optional) To include more rules in the access contract, click **Add** and repeat [Step 7, on page 714](#).
- Step 10** Click **Save**.

Edit or Delete an IP-Based Access Control Contract

If you edit a contract that is used in a policy, the policy's state changes to **MODIFIED** in the **IP Based Access Control Policies** window. A modified policy is considered to be stale because it is inconsistent with the policy that is deployed in the network. To resolve this situation, you need to redeploy the policy to the network.

Step 1 From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > Access Contract**.

Step 2 Check the check box next to the contract that you want to edit or delete, and do one of the following tasks:

- To make changes to the contract, click **Edit**, make the changes, and click **Save**. For more information about field definitions, see [Create an IP-Based Access Control Contract, on page 714](#).

Note If you make changes to a contract that is used in a policy, you need to deploy the modified policy by choosing **Policy > IP & URL Based Access Control > IP & URL Access Control Policies**, checking the check box next to the policy name, and clicking **Deploy**.

- To delete the contract, click **Delete**.

Create an IP-Based and URL-Based Access Control Policy

You can create a post authentication access control list (ACL) for your network. The ACL can be based on IPs, URLs, or both.

Before you begin

[Create an IP-Based Access Control Contract, on page 714](#).

Step 1 From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > IP & URL Access Control Policies**.

Step 2 Click **Add Policy**.

Alternatively, instead of the first two steps, you can click the menu icon and choose **Workflows > Create IP & URL-Based Access Control Policy**. If an **Overview** window opens, click **Let's Do it** to start the workflow.

Step 3 In the **Policy Name and Details** window:

- Enter a name and description for the policy.
- Under **Select ACL Type**, check the **IP** check box, the **URL** check box, or check both the **IP** and **URL** check boxes.

Step 4 In the **Select Site and SSID** window, choose the site where you want to apply the policy.

Make sure the site is already provisioned with a nonfabric SSID.

Step 5 If you checked the **IP** check box in the **Policy Name and Details** window, do the following in the **IP Access Control List** window:

- Click **Add New Row** and choose **Source**, **Destination**, **Contracts**, or **Direction**.
- Click **Add**.

- Step 6** If you checked the **URL** check box in the **Policy Name and Details** window, do the following in the **URL Access Control List** window:
- Enter the URL.
 - Click the **Actions** drop-down list and choose **Permit** or **Deny**.
- Step 7** In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
- Step 8** In the **Schedule Task** window, depending on the Visibility of Configurations settings, choose an available option.
- **Now**: Immediately deploy the configurations.
 - **Later**: Schedule the date and time and define the time zone of the deployment.
 - **Generate configuration preview**: Review the configurations before deploying them.
- If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Step 9** Click **Next**.
- Step 10** On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:
- Pending Operations: Wait for all pending operations to deploy or discard them.
 - Device Compliance: Fix, acknowledge, or ignore all issues.
- If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.
- For more information, see [Network Provisioning Prechecks, on page 137](#).
- If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.
- Step 11** If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:
- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
 - On the **Preview Configuration** window, review the device configurations.
- For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
- Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

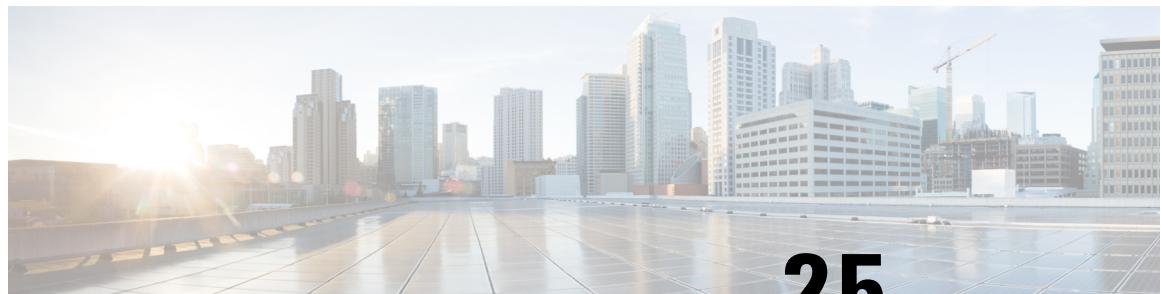
- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Edit or Delete an IP-Based and URL-Based Access Control Policy

If you need to, you can change or delete an IP-based and URL-based access control policy.

- Step 1** From the top-left corner, click the menu icon and choose **Policy > IP & URL Based Access Control > IP & URL Access Control Policies**.
- Step 2** To edit a policy, click the name of the policy that you want to edit, make the required changes, and click **Save & Schedule**. For more information, see [Create an IP-Based and URL-Based Access Control Policy, on page 715](#).
- Step 3** To delete a policy, check the check box next to the policy that you want to delete and click **Delete**.
-



CHAPTER 25

Configure Application Policies

- Application Policies Overview, on page 719
- Manage Application Policies, on page 732
- Manage Queueing Profiles, on page 742
- Manage Application Policies for WAN Interfaces, on page 743

Application Policies Overview

Quality of Service (QoS) refers to the ability of a network to provide preferential or deferential service to selected network traffic. By configuring QoS, you can ensure that network traffic is handled in such a way that makes the most efficient use of network resources while still adhering to the objectives of the business, such as guaranteeing that voice quality meets enterprise standards, or ensuring a high Quality of Experience (QoE) for video.

You can configure QoS in your network using application policies in Catalyst Center. Application policies comprise these basic parameters:

- **Application Sets:** Sets of applications with similar network traffic needs. Each application set is assigned a business relevance group (business relevant, default, or business irrelevant) that defines the priority of its traffic. QoS parameters in each of the three groups are defined based on Cisco Validated Design (CVD). You can modify some of these parameters to more closely align with your objectives.
- **Site Scope:** Sites to which an application policy is applied. If you configure a wired policy, the policy is applied to all the wired devices in the site scope. Likewise, if you configure a wireless policy for a selected service set identifier (SSID), the policy is applied to all of the wireless devices with the SSID defined in the scope.



Note For wired devices onboarded through Plug and Play, if you configure QoS policy on a site, the QoS policy is enabled by default on the devices added to the site.

Catalyst Center takes all of these parameters and translates them into the proper device CLI commands. When you deploy the policy, Catalyst Center configures these commands on the devices defined in the site scope.

**Note**

Catalyst Center configures QoS policies on devices based on the QoS feature set available on the device. For more information about a device's QoS implementation, see the corresponding device's product documentation.

CVD-Based Settings in Application Policies

The default QoS trust and queuing settings in application policies are based on the Cisco Validated Design (CVD) for Enterprise Medianet Quality of Service Design. CVDs provide the foundation 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. Each one has been comprehensively tested and documented by Cisco engineers to ensure faster, more reliable, and fully predictable deployment.

The latest validated designs relating to QoS are published in the Cisco Press book, *End-to-End QoS Network Design: Quality of Service for Rich-Media & Cloud Networks*, 2nd Edition, available at: <http://www.ciscopress.com/store/end-to-end-qos-network-design-quality-of-service-for-9781587143694>. For additional information, see the following Cisco documentation:

- [Cisco Validated Designs](#)
- [Enterprise Medianet Quality of Service Design 4.0](#)
- [Medianet Campus QoS Design 4.0](#)
- [Medianet WAN Aggregation QoS Design 4.0](#)

Site Scope

A site scope defines the sites to which an application policy is applied. When defining a policy, you configure whether a policy is for wired or wireless devices. You also configure a site scope. If you configure a wired policy, the policy is applied to all the wired devices in the site scope. Likewise, if you configure a wireless policy for a selected service set identifier (SSID), the policy is applied to all of the wireless devices in the site scope with the SSID defined in the scope.

This allows you to make tradeoffs as necessary to compensate for differences in the behaviors between wired and wireless network segments. For example, wireless networks typically have lower bandwidth, lower speed, and increased packet loss in comparison to wired networks. Individual wireless segments may exhibit further variation due to local conditions of RF interference, congestion, and other factors, such as the varying capabilities of network devices. The ability to apply per-segment policies to individual wireless segments enables the adjustment of traffic-handling rules to ensure that the highest-priority traffic is least affected by degradation of the wireless network.

Business-Relevance Groups

A business-relevance group classifies a given application set according to how relevant it is to your business and operations.

Business-relevance groups are Business Relevant, Default, and Business Irrelevant, and they essentially map to three types of traffic: high priority, neutral, and low priority.

- **Business Relevant:** (High-priority traffic) The applications in this group directly contribute to organizational objectives, and as such, may include a variety of applications, including voice, video,

streaming, and collaborative multimedia applications, database applications, enterprise resource applications, email, file transfers, content distribution, and so on. Applications designated as business relevant are treated according to industry best-practice recommendations, as prescribed in Internet Engineering Task Force (IETF) RFC 4594.

- **Default:** (Neutral traffic) This group is intended for applications that may or may not be business relevant, for example, generic HTTP or HTTPS traffic may contribute to organizational objectives at times, while at other times, such traffic may not. You may not have insight into the purpose of some applications, for instance, legacy applications or even newly deployed applications. Therefore, the traffic flows for these applications should be treated with the Default Forwarding service, as described in IETF RFC 2747 and 4594.
- **Business Irrelevant:** (Low-priority traffic) This group is intended for applications that have been identified as having no contribution towards achieving organizational objectives. They are primarily consumer-oriented or entertainment-oriented or both in nature. We recommend that this type of traffic be treated as a *Scavenger* service, as described in IETF RFCs 3662 and 4594.

Applications are grouped into application sets and sorted into business-relevance groups. You can include an application set in a policy as-is, or you can modify it to meet the needs of your business objectives and your network configuration.

For example, YouTube is a member of the consumer-media application set, which is business-irrelevant (by default), because most customers typically classify this application this way. However, this classification may not be the true for all companies, for example, some businesses may be using YouTube for training purposes. In such cases, an administrator can move the YouTube application into the streaming-video application set, which is business relevant by default.

Consumers and Producers

You can configure relationships between applications such that when traffic from one application is sent to another application (thus creating a specific a-to-b traffic flow), the traffic is handled in a specific way. The applications in this relationship are called *producers* and *consumers*, and are defined as follows:

- **Producer:** Sender of the application traffic. For example, in a client/server architecture, the application server is considered the producer because the traffic primarily flows in the server-to-client direction. In the case of a peer-to-peer application, the remote peer is considered the producer.
- **Consumer:** Receiver of the application traffic. The consumer may be a client endpoint in a client/server architecture or it may be the local device in a peer-to-peer application. Consumers may be endpoint devices, but may, at times, be specific users of such devices (typically identified by IP addresses or specific subnets). There may also be times when an application is the consumer of another application's traffic flows.

Setting up this relationship allows you to configure specific service levels for traffic that matches this scenario.

Marking, Queuing, and Dropping Treatments

Catalyst Center bases its marking, queuing, and dropping treatments on IETF RFC 4594 and the business relevance category that you have assigned to the application. Catalyst Center assigns all of the applications in the Default category to the Default Forwarding application class and all of the applications in the Irrelevant Business category to the Scavenger application class. For applications in the Relevant Business category,

Catalyst Center assigns traffic classes to applications based on the type of application. The following table lists the application classes and their treatments.

Table 40: Marking, Queuing, and Dropping Treatments

Business Relevance	Application Class	Per-Hop Behavior	Queuing and Dropping	Application Description
Relevant	VoIP ⁵	Expedited Forwarding (EF)	Priority Queuing (PQ)	VoIP telephony (bearer-only) traffic; for example, Cisco IP phones.
	Broadcast Video	Class Selector (CS) 5	PQ	Broadcast TV, live events, video surveillance flows, and similar inelastic streaming media flows; for example, Cisco IP Video Surveillance and Cisco Enterprise TV. (Inelastic flows refer to flows that are highly drop sensitive and have no retransmission or flow-control capabilities or both.)
	Real-time Interactive	CS4	PQ	Inelastic high-definition interactive video applications and audio and video components of these applications; for example, Cisco TelePresence.
	Multimedia Conferencing	Assured Forwarding (AF) 41	Bandwidth (BW) Queue and Differentiated Services Code Point (DSCP) Weighted Random Early Detect (WRED)	Desktop software multimedia collaboration applications and audio and video components of these applications; for example, Cisco Jabber and Cisco Webex.
	Multimedia Streaming	AF31	BW Queue and DSCP WRED	Video-on-Demand (VoD) streaming video flows and desktop virtualization applications, such as Cisco Digital Media System.
	Network Control	CS6	BW Queue only ⁶	Network control-plane traffic, which is required for reliable operation of the enterprise network, such as EIGRP, OSPF, BGP, HSRP, IKE, and so on.
	Signaling	CS3	BW Queue and DSCP	Control-plane traffic for the IP voice and video telephony infrastructure.
	Operations, Administration, and Management (OAM)	CS2	BW Queue and DSCP ⁷	Network operations, administration, and management traffic, such as SSH, SNMP, syslog, and so on.
	Transactional Data (Low-Latency Data)	AF21	BW Queue and DSCP WRED	Interactive (foreground) data applications, such as enterprise resource planning (ERP), customer relationship management (CRM), and other database applications.
	Bulk Data (High-Throughput Data)	AF11	BW Queue and DSCP WRED	Noninteractive (background) data applications, such as email, file transfer protocol (FTP), and backup applications.

Business Relevance	Application Class	Per-Hop Behavior	Queuing and Dropping	Application Description
Default	Default Forwarding (Best Effort)	DF	Default Queue and RED	Default applications and applications assigned to the default business-relevant group. Because only a small number of applications are assigned to priority, guaranteed bandwidth, or even to differential service classes, the vast majority of applications continue to default to this best-effort service.
Irrelevant	Scavenger	CS1	Minimum BW Queue (Deferential) and DSCP	Nonbusiness related traffic flows and applications assigned to the business-irrelevant group, such as data or media applications that are entertainment-oriented. Examples include YouTube, Netflix, iTunes, and Xbox Live.

⁵ VoIP signaling traffic is assigned to the Call Signaling class.

⁶ WRED is not be enabled on this class because network control traffic should not be dropped.

⁷ WRED is not enabled on this class because OAM traffic should not be dropped.

Service Provider Profiles

Service provider profiles define the class of service for a particular WAN provider. You can define 4-class, 5-class, 6-class, and 8-class models.

When application policies are deployed on the devices, each service provider profile is assigned a certain service-level agreement (SLA) that maps each service provider class to a DSCP value and a percentage of bandwidth allocation.

You can customize the DSCP values and the percentage of bandwidth allocation in a service provider profile when configuring an application policy.

After you create the service provider profile, you need to configure it on the WAN interfaces.

Table 41: Default SLA Attributes for Service Provider Profiles with 4 Classes

Class Name	DSCP	Priority Class	SLA	
			Bandwidth (%)	Remaining Bandwidth (%)
Voice	EF	Yes	10	—
Class 1 Data	AF31	—	—	44
Class 2 Data	AF21	—	—	25
Default	0	—	—	31

Table 42: Default SLA Attributes for Service Provider Profiles with 5 Classes

Class Name	DSCP	Priority Class	SLA	
			Bandwidth (%)	Remaining Bandwidth (%)
Voice	EF	Yes	10	—
Class 1 Data	AF31	—	—	44
Class 2 Data	AF21	—	—	25
Class 3 Data	AF11	—	—	1
Default	Best Effort	—	—	30

Table 43: Default SLA Attributes for Service Provider Profiles with 6 Classes

Class Name	DSCP	Priority Class	SLA	
			Bandwidth (%)	Remaining Bandwidth (%)
Class 1 Data	AF31	—	—	10
Class 3 Data	AF11	—	—	1
Video	AF41	—	—	34
Voice	EF	Yes	10	—
Default	0	—	—	30
Class 2 Data	AF21	—	—	25

Table 44: Default SLA Attributes for Service Provider Profiles with 8 Classes

Class Name	DSCP	Priority Class	SLA	
			Bandwidth (%)	Remaining Bandwidth (%)
Network-Control Management	CS6	—	—	5
Streaming Video	AF31	—	—	10
Call Signalling	CS3	—	—	4
Scavenger	CS1	—	—	1
Interactive Video	AF41	—	—	30
Voice	EF	Yes	10	—
Default	0	—	—	25

Class Name	DSCP	Priority Class	SLA	
			Bandwidth (%)	Remaining Bandwidth (%)
Critical Data	AF21	—	—	25

Queuing Profiles

Queuing profiles allow you to define an interface's bandwidth allocation based on the interface speed and the traffic class.



Note Queuing profiles do not apply to WAN-facing interfaces that are connected to a service provider profile.

The following interface speeds are supported:

- 100 Gbps
- 10/40 Gbps
- 1 Gbps
- 100 Mbps
- 10 Mbps
- 1 Mbps

If the speed of an interface falls between two interface speeds, Catalyst Center treats the interface at the lower interface speed.



Note Catalyst Center attempts to detect the operational speed of the interface in order to apply the correct policy. However, if a switch port is administratively down, Catalyst Center cannot detect the speed. In this case, Catalyst Center uses the interface's supported speed.

You define a queuing policy as part of an application policy. When you deploy the application policy, the devices in the sites that are selected in the site scope are configured with the assigned LAN queuing policy. If no LAN queuing policy is assigned, the application policy uses the default CVD queuing policy.

If you change the queuing policy in an application policy that has already been deployed, the policy becomes stale, and you need to redeploy the policy for the changes to be configured on the devices.

Note the following additional guidelines and limitations of queuing policies:

- You cannot delete a LAN queuing profile if it is used in a policy.
- If you update a queuing profile that is associated with a policy, the policy is marked as stale. You need to redeploy the policy to provision the latest changes.
- Traffic class queuing customization does not affect interfaces on Cisco service provider switches and routers. You should continue to configure these interfaces without using Catalyst Center.

Table 45: Default CVD LAN Queuing Policy

Traffic Class	Default Bandwidth (Total = 100%) ⁸
Business Relevant Voice	10%
Business Relevant Broadcast Video	10%
Business Relevant Real-Time Interactive	13%
Business Relevant Multimedia Conferencing	10%
Business Relevant Multimedia Streaming	10%
Business Relevant Network control	3%
Business Relevant Signaling	2%
Business Relevant OAM	2%
Business Relevant Transactional Data	10%
Business Relevant Bulk Data	4%
Business Relevant Scavenger	1%
Business Relevant Best Effort	25%

⁸ We recommend that the total bandwidth for Voice, Broadcast Video, and Real-Time Interactive traffic classes equals no more than 33%.

Processing Order for Devices with Limited Resources

Some network devices have a limited memory (called TCAM) for storing network ACLs and access control entries (ACEs). So, because ACLs and ACEs for applications are configured on these devices, the available TCAM space is used. When the TCAM space is depleted, QoS settings for additional applications cannot be configured on that device.

To ensure that QoS policies for the most important applications get configured on these devices, Catalyst Center allocates TCAM space in the following order:

1. **Rank:** Number assigned to custom and favorite applications, but not to existing, default NBAR applications. The lower the rank number, the higher the priority. For example, an application with rank 1 has a higher priority than an application with rank 2, and so on. Having no rank is the lowest priority.



Note

- Custom applications are assigned rank 1 by default.
- If we mark the NBAR application as favorite, the rank is set to 1000.

2. **Traffic Class:** Priority based on the following order: Signaling, Bulk Data, Network Control, Operations Administration Management (Ops Admin Mgmt), Transactional Data, Scavenger, Multimedia Streaming, Multimedia Conferencing, Real Time Interactive, Broadcast Video, and VoIP Telephony.

3. **Popularity:** Number (1–10) that is based on CVD criteria. The popularity number cannot be changed. An application with a popularity of 10 has a higher priority than an application with a popularity of 9, and so on.

**Note**

- Custom applications are assigned popularity 0.
- Default NBAR applications are assigned a popularity number (1–10) that is based on CVD criteria. When you mark an application as a favorite, this does not change the popularity number; only the rank is changed.

4. **Alphabetization:** If two or more applications have the same rank and popularity number, they are sorted alphabetically by the application's name, and assigned a priority accordingly.

For example, let us assume that you define a policy that has the following applications:

- Custom application, custom_realtime, which has been assigned rank 1 and popularity 10 by default.
- Custom application, custom_salesforce, which has been assigned rank 1 and popularity 10 by default.
- Application named corba-iiop, which is in the transactional data traffic class, and you have designated as a favorite, giving that application a ranking of 10,000 and popularity of 9 (based on CVD).
- Application named gss-http, which is in the Ops Admin Mgmt traffic class, and you have designated as a favorite, giving that application a ranking of 10,000 and popularity of 10 (based on CVD).
- All other, default NBAR applications, which have no rank, but will be processed according to their traffic class and default popularity (based on CVD).

According to the prioritization rules, the applications are configured on the device in this order:

Application Configuration Order	Reason
1. Custom application, custom_realtime	Custom applications are given highest priority. Given that the custom_salesforce and custom_realtime applications have the same rank and popularity, they are sorted alphabetically, custom_realtime before custom_salesforce.
2. Custom application, custom_salesforce	
3. Favorite application, gss-http	Because both of these applications have been designated as favorites, they have the same application ranking. So, Catalyst Center evaluates them according to their traffic class. Because gss-http is in the Ops Admin Mgmt traffic class, it is processed first, followed by the corba-iiop application, which is in the Transactional Data traffic class. Their popularity does not come into play because the processing order has been determined by their traffic class.
4. Favorite application, corba-iiop	
5. All other, default NBAR applications	All other applications are next and are prioritized according to traffic class and then popularity, with the applications having the same popularity being alphabetized according to the application's name.

Policy Drafts

When you create a policy, you can save it as a draft without having to deploy it. Saving it as a draft allows you to open the policy later and make changes to it. You can also make changes to a deployed policy, and save it as a draft.



Note After you save or deploy a policy, you cannot change its name.

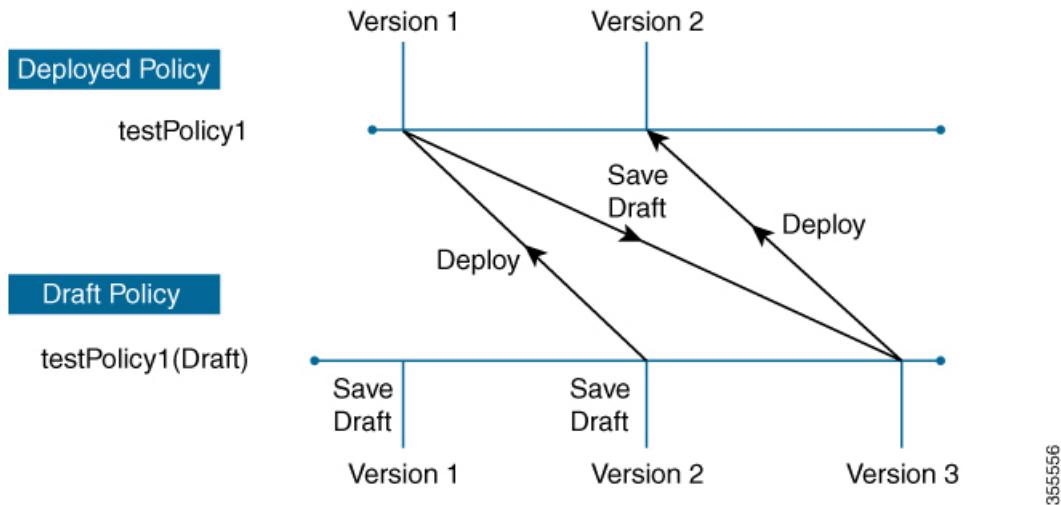
Draft policies and deployed policies are related to one another, but they have their own versioning.

When you save a policy as a draft, Catalyst Center appends the policy name with (Draft), and increments the version number. When you deploy a policy, Catalyst Center increments the version number of the deployed policy.

For example, as shown in the following figure, you create a policy named testPolicy1 and save it as a draft. The policy is saved as testPolicy1 (Draft), version number 1. You make a change to the draft and save it again. The policy has the same name, testPolicy1 (Draft), but its version number is incremented to 2.

You decide you like the policy, and you deploy it to the network. The policy is deployed with the name testPolicy1 and its version number is 1. You make a change to the deployed policy and save it as a draft. The draft policy, testPolicy1 (Draft), is incremented to version number 3. When you ultimately deploy that version, testPolicy1 is incremented to version 2.

Figure 27: Deployed Policy and Draft Policy Versioning



Any time you modify and save either a draft policy or a deployed policy, the draft policy version number is incremented. Similarly, any time you deploy either a draft policy or a modified deployed policy, the deployed policy version is incremented.

Just as with deployed policies, you can display the history of draft policies and roll them back to previous versions.

For more information about viewing the history of policy versions and rolling back to a previous version, see [Policy Versioning, on page 729](#).

Policy Preview

Before you deploy a policy, you can generate the CLI that will be applied to a device.

The Preview operation generates the CLI commands for a policy, compares them with the CLI commands in the running configuration on the device, and returns only the remaining CLI commands that are required to configure the policy on the device.

After reviewing the preview output, you can deploy the policy to all of the devices in the scope, or you can continue to make changes to the policy.

Policy Precheck

When you create an application policy, you can verify if it will be supported on the devices in the site scope before you deploy it. The precheck function verifies if the device type, model, line cards, and software images support the application policy that you created. If any of these components are not supported, Catalyst Center reports a failure for the device. Catalyst Center also provides possible ways to correct the failures. If these remedies do not fix the failure, you can remove the device from the site scope.

If you deploy the application policy as-is, the policy will fail to deploy on the devices that reported a failure during the precheck process. To avoid the failure, you can remove the device from the site scope or update the device components to a level that the application policy supports. For a list of supported devices, see the [Cisco Catalyst Center Compatibility Matrix](#).

Policy Scheduling

After you create or change a policy, you can deploy or redeploy the policy to the devices associated with it. You can deploy or redeploy a policy immediately or at a specific date and time, for example, on a weekend during off-peak hours. You can schedule a policy deployment for wired or wireless devices.

After you have scheduled a policy to be deployed, the policy and site scope are locked. You can view the policy, but you cannot edit it. If you change your mind about deploying the policy, you can cancel it.



Note When the scheduled event occurs, the policy is validated against the various policy components, for example, applications, application sets, and queuing profiles. If this validation fails, the policy changes are lost.

Policy Versioning

Policy versioning allows you to do the following tasks:

- Compare a previous version to the current (latest) one to see the differences.
- Display previous versions of a policy and select a version to reapply to the devices in a site scope.

Editing one version of a policy does not affect other versions of that policy or the components of the policy, such as the application sets that the policy manages. For example, deleting an application set from a policy does not delete the application set from Catalyst Center, other versions of that policy, or even other policies. Because policies and application sets exist independent of each other, it is possible to have a policy version that contains application sets that no longer exist. If you attempt to deploy or roll back to an older version of a policy that references an application set that no longer exists, an error occurs.



Note Policy versioning does not capture changes to applications (such as rank, port, and protocol), application set members, LAN queuing profiles, and sites.

Original Policy Restore

The first time that you deploy a policy to devices, Catalyst Center detaches the device's original Cisco Modular QoS CLI policy configurations, but leaves them on the device. Catalyst Center stores the device's original NBAR configurations in Catalyst Center. This allows you to restore the original Modular QoS CLI policies and NBAR configuration onto the devices later, if needed.



Note Because the Modular QoS CLI policies are not deleted from the device, if you remove these policies, you will not be able to restore them using the Catalyst Center original policy restore feature.

When you restore the original policy configuration onto a device, Catalyst Center removes the existing policy configuration that you deployed and reverts to the original configuration that was on the device.

Any Modular QoS CLI policy configurations that existed before you deployed application policies are reattached to the interfaces. However, queuing policies, such as multilayer switching (MLS) configurations, are not restored; instead, the devices retain the MLS configurations that were last applied through Catalyst Center.

After you restore the original policy configuration to the device, the policy that is stored in Catalyst Center is deleted.

Note the following additional guidelines and limitations for this feature:

- If the first attempt to deploy a policy to a device fails, Catalyst Center automatically attempts to restore the original policy configurations onto the devices.
- If a device is removed from an application policy after that policy has been applied to the device, the policy remains on the device. Catalyst Center does not automatically delete the policy or restore the QoS configuration on the device to its original (pre-Catalyst Center) configuration.

Stale Application Policies

An application policy can become stale if you change the configuration of something that is referenced in the policy. If an application policy becomes stale, you need to redeploy it for the changes to take affect.

An application policy can become stale for any of the following reasons:

- Change to applications referenced in an application set.
- Change to interfaces, such as service provider profile assignment, WAN subline rate, or WAN or LAN marking.
- Change to the queuing profile.
- New site added under a parent site in the policy.
- Device added to a site that is referenced by the policy.

- Devices moved between sites in the same policy.
- Change in interfaces exclusion/inclusion.
- Change in device Controller-Based Application Recognition (CBAR) status.

Application Policy Guidelines and Limitations

- Catalyst Center cannot learn multiple WLANs with the same SSID name on a wireless controller. At any point, Catalyst Center has only one entry for a WLAN with a unique name, although it is possible for the Cisco Wireless Controller to contain multiple entries with the same name and different WLAN profile names.

You might have duplicate SSID names per wireless controller by design, or you might have inadvertently added a wireless controller with a duplicate SSID name using Catalyst Center. In either case, having duplicate SSID names per wireless controller is problematic for several features:

- **Learn Config:** Catalyst Center learns only one randomly chosen SSID name per wireless controller and discards any remaining duplicate SSID names. (**Learn Config** is typically used in existing deployment scenario.)
- **Application Policy:** When deploying an application policy, Catalyst Center randomly applies the policy to only one of the duplicate SSID names and not the others. In addition, policy restore, CLI preview, EasyQoS Fastlane, and PSK override features either fail or have unexpected outcomes.
- **Multiscale Network:** In a multiscale network, multiple duplicate SSID names on multiple devices can cause issues. For example, one device has a WLAN configured as a nonfabric SSID, and a second device has the same WLAN, but it is configured as a fabric SSID. When you perform a **Learn Config**, only one SSID name is learned. The other SSID name from the other device is discarded. This behavior can cause conflicts, especially if the second device supports only fabric SSID names, but Catalyst Center is trying to perform operations on the device with nonfabric SSID names.
- **IPACL Policy:** When deploying an IPACL policy, Catalyst Center randomly applies the policy to only one of the duplicate SSIDs. In addition, scenarios involving Flex Connect are also impacted.
- Catalyst Center does not recommend out-of-band (OOB) changes to device configurations. If you make OOB changes, the policy in Catalyst Center and the one configured on the device become inconsistent. The two policies remain inconsistent until you deploy the policy from Catalyst Center to the device again.
- The QoS trust functionality cannot be changed.
- Custom applications are not supported on the wireless controller. Therefore, custom applications are not selected while creating a wireless application policy.
- Make sure you delete the corresponding wireless application policy before deleting an SSID from design and reprovisioning the wireless controller.
- Wireless application for Cisco Catalyst 9800 Series Wireless Controller is not supported on SSID provisioned through learned configuration.
- Catalyst Center provides ACL-based Application Policy support for Cisco Catalyst IE 3300 Rugged Series switches and Cisco Catalyst IE 3400 Heavy Duty Series switches. You can deploy a maximum of eight port-based custom applications. However, there is no restriction for DSCP-based applications.

**Note**

Catalyst Center does not support FlexConnect Local Switching mode for AireOS and Catalyst 9800 Series Wireless Controller platforms.

Manage Application Policies

The following sections provide information about how to manage application policies.

Prerequisites

To configure application policies, you must address the following requirements:

- Catalyst Center supports most Cisco LAN, WAN, and WLAN devices. To verify whether the devices and software versions in your network are supported, see the [Cisco Catalyst Center Compatibility Matrix](#).
- Make sure that your Cisco network devices, such as the ISR-G2, ASR 1000, and wireless controller, have the Application Visibility and Control (AVC) feature license installed. For information, see the [NBAR2 \(Next Generation NBAR\) Protocol Pack FAQ](#).
- AVC support is available for switches running Cisco IOS-XE 16.9 only if auto-QoS is not configured on the switches. You must upgrade the switches with auto-QoS to Cisco IOS-XE 16.11 or later to get AVC support.
- For Catalyst Center to identify the WAN interfaces that need policies, you must specify the interface type (WAN), and optionally, its subline rate and service-provider Class-of-Service model. For more information, see [Assign a Service Provider Profile to a WAN Interface, on page 744](#).
- Verify that the device roles that were assigned to devices during the discovery process are appropriate for your network. If necessary, change the device roles that are not appropriate. For more information, see [Change the Device Role \(Inventory\), on page 122](#).

Create an Application Policy

This section provides information about how to create an application policy.

Before you begin

- Define your business objectives. For example, your business objective might be to improve user productivity by minimizing network response times or to identify and deprioritize nonbusiness applications. Based on these objectives, decide which business relevance category your applications fall into.
- Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.
- Verify that the device roles that were assigned to devices during the discovery process are appropriate for your network. If necessary, change the device roles that are not appropriate. For more information, see [Change the Device Role \(Inventory\), on page 122](#).
- Add devices to sites. For more information, see [Add a Device to a Site, on page 108](#).

- If you plan to configure this policy with a service provider profile for traffic that is destined for a service provider, make sure that you have configured a service provider profile. After creating the application policy, you can return to the service provider profile and customize its SLA attributes and assign the service provider profile to WAN interfaces. For more information, see [Configure Service Provider Profiles, on page 252](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Click **Add Policy**.
- Step 3** In the **Application QoS Policy Name** field, enter a name for the policy.
- Step 4** Click either the **Wired** or **Wireless** radio button.
- Step 5** For wireless networks, select an SSID that is provisioned from the **SSID** drop-down list.
- Step 6** Click **Site Scope** and check the check box next to the sites where you want to deploy the policy.
- Note** For policies of wired devices, you cannot select a site that is already assigned to another policy. For policies of wireless devices, you cannot select a site that is already assigned to another policy with the same SSID. For wired devices onboarded through Plug and Play, if QoS policy is configured on a site, the QoS policy is enabled by default on the devices added to the site.
- Step 7** For policies of wired devices, you can exclude devices or specific interfaces from being configured with the policy:
- From the **Site Scope** pane, click the ellipsis icon () next to the site you are interested in.
A list of devices in the selected scope is displayed.
 - Locate the device that you want to exclude and click the toggle button in the corresponding **Policy Exclusions** column.
 - To exclude specific interfaces, click **Exclude Interfaces**.
 - From the list of **Applicable Interfaces**, click the toggle button next to the interfaces that you want to exclude.
By default, only the **Applicable Interfaces** are shown. You can choose **All** from the **Show** drop-down list to view all the interfaces.
 - Click **< Back to Devices in Site-Name**.
 - Click **< Back to Site Scope**.
- Step 8** For WAN devices, you can configure specific interfaces:
- From the **Site Scope** pane, click the ellipsis icon  next to the desired site.
 - From the list of devices in the site, click **Configure** in the **SP Profile Settings** column next to the desired device.
- Note** This option is only available for routers.
- In the **WAN Interface** column, from the **Select Interface** drop-down list, choose an interface.
 - In the **Role** column, from the **Select Role** drop-down list, choose a role according to the type of interface you are configuring:
 - Physical interface: Choose **WAN**. This role is the only valid role for a physical interface.
 - Tunnel interface: Choose either **DMVPN Branch** or **DMVPN Hub**. If you choose **DMVPN Hub**, you can also define the bandwidth to its corresponding branches.

Create an Application Policy

Note Make sure that the tunnel interfaces have been created on the devices before deploying these policy settings.

- e) In the **Service Provider Profile** column, from the **Select Profile** drop-down list, choose a service provider profile.
- f) (Optional) If necessary, in the **Sub-Line Rate (Mbps)** column, enter the upstream bandwidth that the interface requires.
- g) (Optional) To configure additional WAN interfaces, click + and repeat Step c through Step f.
- h) Click **Save**.
- i) Click < **Back to Site Scope**.

Step 9 From the **Site Scope** pane, click **OK**.

Step 10 (Optional) If the CVD queuing profile (CVD_QUEUING_PROFILE) does not meet your needs, create a custom queuing profile.

- a) Click **Queuing Profiles**.
- b) Select a queuing profile from the list in the left pane.
- c) Click **Select**.

Step 11 (Optional) If this policy is for traffic that is destined for a service provider, customize the service provider profile SLA attributes:

- a) Click **SP Profile**.
- b) Choose a service provider profile.
- c) Customize the SLA attributes (**DSCP**, **SP Bandwidth %**, and **Queuing Bandwidth %**).

Step 12 (Optional) Configure the business relevance of the application sets used in your network.

Catalyst Center comes with application sets that are preconfigured into business-relevancy groups. You can keep this configuration or modify it by dragging and dropping an application set from one business-relevancy group to another.

Applications marked as a favorites are listed at the top of the application set. To change favorites, go to the Applications registry.

Step 13 (Optional) Customize applications by creating consumers and assigning them to applications, or by marking an application as bidirectional:

- a) Expand the application group.
- b) Click the gear icon  next to the desired application.
- c) From the **Traffic Direction** area, click the **Unidirectional** or **Bi-directional** radio button.
- d) To choose an existing consumer, from the **Consumer** drop-down list, choose the consumer that you want to configure. To create a new consumer, click + **Add Consumer** and define the **Consumer Name**, **IP/Subnet**, **Protocol**, and **Port/Range**.
- e) Click **OK**.

Step 14 Configure host tracking. Click the **Host Tracking** toggle button to turn host tracking on or off.

When deploying an application policy, Catalyst Center automatically applies ACL entries to the switches to which collaboration endpoints (such as Telepresence units or Cisco phones) are connected.

The ACE matches the voice and video traffic generated by the collaboration endpoint, ensuring that the voice and video traffic are correctly marked.

When host tracking is turned on, Catalyst Center tracks the connectivity of the collaboration endpoints within the site scope and to automatically reconfigure the ACL entries when the collaboration endpoints connect to the network or move from one interface to another.

When host tracking is turned off, Catalyst Center does not automatically deploy policies to the devices when a collaboration endpoint moves or connects to a new interface. Instead, you need to redeploy the policy for the ACLs to be configured correctly for the collaboration endpoints.

Step 15 (Optional) Preview the CLI commands that will be sent to devices. For more information, see [Preview an Application Policy, on page 740](#).

Step 16 (Optional) Precheck the devices on which you plan to deploy the policy. For more information, see [Precheck an Application Policy, on page 740](#).

Step 17 Do one of the following tasks:

- Save the policy as a draft by clicking **Save Draft**. For more information, see [Policy Drafts, on page 728](#).
- Deploy the policy by clicking **Deploy**. You can deploy the policy now or schedule it for a later time.

To deploy the policy now, click the **Now** radio button and click **Apply**.

To schedule the policy deployment for a later date and time, click the **Later** radio button and define the date and time of the deployment. For more information, see [Policy Scheduling, on page 729](#).

Note Site time zone setting is not supported for scheduling application policy deployments.

View Application Policy Information

You can display various information about the application policies that you have created and deployed.

Before you begin

You must have at least one deployed application policy.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Sort the policies by name, or filter them by name, status, or queuing profile.

Step 3 View the list of policies and the following information about each:

- **Policy Name:** Name of the policy.
- **Version:** Iteration of the policy. Each time a policy is deployed or saved as a draft, it is incremented by one version. For example, when you create a policy and deploy it, the policy is at version 1. If you change the policy and deploy it again, the version of the policy is incremented to version 2. For more information, see [Policy Drafts, on page 728](#) and [Policy Versioning, on page 729](#).
- **Policy Status:** State of the policy. If the policy applied on Cisco Catalyst 3850, Catalyst 4500, and Catalyst 9000 devices and is impacted by the port channel update (create/modify/delete), an alert is shown in the policy status.
- **Deployment Status:** State of the last deployment (per device). Presents a summary of the following
 - Devices that were successfully provisioned.
 - Devices that failed to be provisioned.
 - Devices that were not provisioned due to the deployment being terminated.

Edit an Application Policy

Clicking the state of the last deployment displays the Policy Deployment window, which provides a filterable list of devices on which the policy is deployed. For each device, the following information is displayed:

- Device details (name, site, type, role, and IP address)
 - Success deployment status. Clicking the gear icon next to the status launches the **Effective Marking Policy** window that shows the **Business Relevant** and **Business Irrelevant** applications and the traffic class queue in which they end up. For devices that have limited TCAM resources or an old NBAR protocol pack, only a subset of the applications that are included in the policy can be provisioned, and they are shown in the view.
 - Failure status shows the reason for the failure.
 - **Scope:** Number of sites (not devices) that are assigned to the policy. For policies of wireless devices, the name of the SSID to which the policy applies is included.
 - **LAN Queuing Profile:** Name of the LAN queuing profile that is assigned to the policy.
-

Edit an Application Policy

You can edit an application policy.

Before you begin

You must have created at least one policy.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Use the **Filter** field to locate the policy that you want to edit.

Step 3 Click the radio button next to corresponding policy.

Step 4 From the **Actions** drop-down list, choose **Edit**.

Step 5 Make changes to the application policy, as needed.

Step 6 You can change the business relevance of an application by moving application set between business relevant, business irrelevant, and default groups.

For information about the application policy settings, see [Create an Application Policy, on page 732](#).

Step 7 To update the queuing profile, click **Queuing Profiles**, and select a queuing profile from the list in the left pane.

Step 8 Click **Select**.

Step 9 Do one of the following tasks:

- Save the policy as a draft by clicking **Save Draft**. For more information, see [Policy Drafts, on page 728](#).
- Deploy the policy by clicking **Deploy**. You can deploy the policy now or schedule it for a later time.

To deploy the policy now, click the **Run Now** radio button and click **Apply**.

To schedule policy deployment for a later date and time, click the **Schedule Later** radio button and define the date and time of the deployment. For more information, see [Policy Scheduling, on page 729](#).

Note The site time zone setting is not supported for scheduling application policy deployments.

Save a Draft of an Application Policy

When creating, editing, or cloning a policy, you can save it as a draft so that you can continue to modify it later. You can also make changes to a deployed policy and save it as a draft.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Create, edit, or clone a policy.

Step 3 Click **Save Draft**.

For more information, see [Policy Drafts, on page 728](#).

Deploy an Application Policy

If you make changes that affect a policy's configuration, such as adding a new application or marking an application as a favorite, you must redeploy the policy to implement these changes.



Note Before deploying a policy, the Auto-QoS configuration is removed automatically from Cisco Catalyst 3650, Catalyst 3850, and Catalyst 9000 devices with Cisco IOS 16.x or later.

After creating custom applications, if CBAR is enabled for a device, the custom applications are configured automatically on the device. You must wait for the synchronization to the latest application registry to complete before deploying the application policy on the device. You can view the synchronization status in **Provision > Services > Service Catalog > Application Visibility**.

If CBAR is enabled for a device, while deploying the application policy, only the attribute sets and maps are configured on the device, because the custom applications are configured through CBAR.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Use the **Filter** field to locate the policy that you want to deploy.

Step 3 Click the radio button next to the policy that you want to deploy.

Step 4 From the **Actions** drop-down list, choose **Deploy**.

- a) If you redeploy the policy, you are prompted to take an appropriate action for the devices that were removed from the policy scope. Choose any one of the following actions:
 - Delete policy from the devices (recommended)
 - Remove devices from policy scope
 - Remove devices from policy scope and restore devices to the existing configuration

Cancel a Policy Deployment

- b) Click **Apply**.

Step 5 You are prompted to deploy your policy now, or schedule it for later. Do one of the following:

- To deploy the policy now, click the **Run Now** radio button and click **Apply**.
- To schedule policy deployment for a later date and time, click the **Schedule Later** radio button and define the date and time of the deployment.

Note The site time zone setting is not supported for scheduling application policy deployments.

Cancel a Policy Deployment

After you click **Deploy**, Catalyst Center begins to configure the policy on the devices in the site scope. If you realize that you made a mistake, you can cancel the policy deployment.

The policy configuration process is performed as a batch process, in that it configures 40 devices at a time. If you have 40 devices or fewer and you cancel a policy deployment, your devices might be configured anyway, because the deployment to the first batch of devices would have already taken place. However, if you have hundreds of devices, canceling the policy deployment can be useful when needed.

When you click **Abort**, Catalyst Center cancels the configuration process on devices whose configuration has not yet started, and changes the device status to **Policy Aborted**. Catalyst Center does not cancel the deployments that are in the process of being completed or have been completed. These devices retain the updated policy configuration and reflect the state of the policy configuration, whether it is **Configuring**, **Successful**, or **Failed**.

During a policy deployment, click **Abort** to cancel the policy configuration process.

Delete an Application Policy

You can delete an application policy if it is no longer needed.

Deleting policy deletes class maps, policy map, and association of policy map with wireless policy profile.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Use the **Filter** field to locate the policy that you want to delete.

Step 3 Click the radio button next to the policy that you want to delete.

Step 4 From the **Actions** drop-down list, choose **Undeploy Policy**.

Step 5 In the **Undeploy Policy** window, click the **Delete policy from devices** radio button and click **Apply**.

Step 6 To confirm the deletion, click **OK**. Otherwise, click **Cancel**.

Step 7 When the deletion confirmation message appears, click **OK** again.

You can view the deletion status of the policies in the **Application QoS Policies** page. If the status shows deletion failed, do the following:

- a) Click the failed state link under **Deployment Status** in the **Application QoS Policies** page.
 - b) In the **Undeployment Status** window, click **Retry** to delete the policy.
-

Clone an Application Policy

If an existing application policy has most of the settings that you want in a new policy, you can save time by cloning the existing policy, changing it, and then deploying it to a different scope.

Before you begin

You must have created at least one policy.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Use the **Filter** field to locate the policy that you want to clone.
- Step 3** Click the radio button next to the policy that you want to clone.
- Step 4** From the **Actions** drop-down list, choose **Clone**.
- Step 5** Configure the application policy, as needed. For information about the application policy settings, see [Create an Application Policy, on page 732](#).
- Step 6** Do one of the following tasks:
- Save the policy as a draft by clicking **Save Draft**. For more information, see [Policy Drafts, on page 728](#).
 - Deploy the policy by clicking **Deploy**. You can deploy the policy now or schedule it for a later time.
To deploy the policy now, click the **Run Now** radio button and click **Apply**.
To schedule the policy deployment for a later date and time, click the **Schedule Later** radio button and define the date and time of the deployment. For more information, see [Policy Scheduling, on page 729](#).
- Note** The site time zone setting is not supported for scheduling application policy deployments.

Restore an Application Policy

If you create or make changes to a policy and then decide that you want to start over, you can restore the original QoS configuration that was on the device before you configured it using Catalyst Center.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Use the **Filter** field to locate the policy that you want to reset.
- Step 3** Click the radio button next to the policy.
- Step 4** From the **Actions** drop-down list, choose **Undeploy Policy**.
- Step 5** In the **Undeploy Policy** window, click the **Restore devices to original configurations** radio button and click **Apply**.
- Step 6** Click **OK** to confirm the change or **Cancel** to cancel it.
- You can view the restoration status of the policies in the **Application QoS Policies** window. If the status shows restoration failed, do the following:
- a) Click the failed state link under **Deployment Status** in the **Application QoS Policies** window.
 - b) In the **Undeployment Status** window, click **Retry** to restore the policy.

Reset the Default CVD Application Policy

The CVD configuration is the default configuration for applications. If you create or make changes to a policy and then decide that you want to start over, you can reset the applications to the CVD configuration. For more information about the CVD configuration, see [Application Policies Overview, on page 719](#).

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Use the **Filter** field to locate the policy that you want to reset.
- Step 3** Click the radio button next to the policy.
- Step 4** From the **Actions** drop-down list, choose **Edit**.
- Step 5** Click **Reset to Cisco Validated Design**.
- Step 6** Click **OK** to confirm the change or **Cancel** to cancel it.
- Step 7** Do one of the following tasks:
- To save a draft of the policy, click **Save Draft**.
 - To deploy the policy, click **Deploy**.
-

Preview an Application Policy

Before you deploy a policy, you can generate the CLI that will be applied to a device and preview the configuration.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Create or edit a policy, as described in [Create an Application Policy, on page 732](#) or [Edit an Application Policy, on page 736](#).
- Step 3** Before deploying the policy, click **Preview**.
A list of the devices in the scope appears.
- Step 4** Click **Generate** next to the device that you are interested in.
Catalyst Center generates the CLIs for the policy.
- Step 5** Click **View** to view the CLIs or copy them to the clipboard.
-

Precheck an Application Policy

Before you deploy an application policy, you can check whether the devices in the site scope are supported. The precheck process includes validating a device's model, line cards, and software image.

-
- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Create or edit a policy, as described in [Create an Application Policy, on page 732](#) or [Edit an Application Policy, on page 736](#).

Step 3 Click **Pre-check**.

Catalyst Center checks the devices and reports failures, if any, in the **Pre-Check Result** column. The **Errors** tab shows the devices that do not support this policy. The **Warnings** tab shows the restrictions or features that are not supported if you chose to deploy this policy in the device. You can still deploy the policy for the devices listed under **Warnings** tab. To resolve the failures, bring the devices into compliance with the specifications listed in the [Cisco Catalyst Center Compatibility Matrix](#).

Display Application Policy History

You can display the version history of an application policy. The version history includes the series number (iteration) of the policy and the date and time on which the version was saved.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Click the radio button next to the policy that interests you.

Step 3 From the **Actions** drop-down list, choose **History**.

Step 4 From the **Policy History** dialog box, you can do the following:

- To compare a version with the current version, click **Difference** next to the version that interests you.
- To roll back to a previous version of the policy, click **Rollback** next to the version that you want to roll back to.

Roll Back to a Previous Policy Version

If you change a policy configuration, and then realize that it is incorrect, or that is not having the desired affect in your network, you can revert to a policy that is up to five versions back.

Before you begin

You must have created at least two versions of the policy to roll back to a previous policy version.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Click the radio button next to the policy that interests you.

Step 3 From the **Actions** drop-down list, choose **Show History**.

Previous versions of the selected policy are listed in descending order, with the newest version (highest number) at the top of the list and the oldest version (lowest number) at the bottom.

Step 4 (Optional) To view the differences between the selected version and the latest version of a policy, click **Difference** in the **View** column.

Step 5 When you determine the policy version that you want to roll back to, click **Rollback** for that policy version.

Note If the selected site scope changed between policy versions, rollback is not done on the current (latest) selected site. Only the policy content is rolled back.

Step 6 Click **Ok** to confirm the rollback procedure.

The rolled back version becomes the newest version.

Manage Queuing Profiles

The following sections provide details about the various tasks that you can perform to manage queuing profiles.

Create a Queuing Profile

Catalyst Center provides a default CVD queuing profile (CVD_QUEUING_PROFILE). If this queuing profile does not meet your needs, you can create a custom queuing profile.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Queuing Profiles**.

Step 2 Click **Add Profile**.

Step 3 In the **Profile Name** field, enter a name for the profile.

Step 4 Configure the bandwidth for each traffic class by using the slider, clicking the plus (+) or minus (-) sign, or entering a specific number in the field.

The number indicates the percentage of the total interface bandwidth that will be dedicated to the selected application class. Because the total bandwidth equals 100, adding bandwidth to one application class subtracts bandwidth from another application class.

An open lock icon indicates that you can edit the bandwidth for the application class. A closed lock indicates that you cannot edit it.

If you make a mistake, you can return to the CVD settings by clicking **Reset to Cisco Validated Design**.

The graph in the middle helps you visualize the amount of bandwidth that you are setting for each application class.

Step 5 (For advanced users) To customize the DSCP code points that Catalyst Center uses for each of the traffic classes, from the **Show** drop-down list, choose **DSCP Values** and configure the value for each application class by entering a specific number in the field.

To customize the DSCP code points required within a service provider cloud, configure a service provider profile.

Step 6 Click **Save**.

Edit or Delete a Queuing Profile

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Queuing Profiles**.

Step 2 From the **Queuing Profile** pane, click the radio button next to the queuing profile that you want to edit or delete.

Step 3 Do one of the following tasks:

- To edit the profile, change the field values, except the profile name, and click **Save**. For information about the fields, see [Create a Queuing Profile, on page 742](#).
- To delete the profile, click **Delete**.

You cannot delete a queuing profile if it is referenced in an application policy.

Manage Application Policies for WAN Interfaces

The following sections provide details about the various tasks that you can perform to manage application profiles for WAN interfaces.

Customize Service Provider Profile SLA Attributes

If you do not want to use the default SLA attributes assigned to your service provider profile by its class model, you can customize the service provider profile SLA attributes to fit your requirements. For more information about the default service provider profile SLA Attributes, see [Service Provider Profiles, on page 723](#).

Before you begin

Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Step 1 From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.

Step 2 Use the **Filter** field to locate the policy that you want to change.

Step 3 Select the radio button next to the policy.

Step 4 From the **Actions** drop-down list, choose **Edit**.

Step 5 Click **SP Profiles** and choose a service provider profile.

Step 6 You can modify the information in the following fields:

- **DSCP:** Differentiated Services Code Point (DSCP) value. Valid values are from 0 to 63.

- Expedited Forwarding (EF)
- Class Selector (CS): CS1, CS2, CS3, CS4, CS5, CS6
- Assured Forwarding: AF11, AF21, AF41
- Default Forwarding (DF)

For more information about these DSCP values, see [Marking, Queuing, and Dropping Treatments, on page 721](#).

- **SP Bandwidth %:** Percentage of bandwidth allocated to a specific class of service.

- **Queuing Bandwidth %:** Percentage of bandwidth allocated to each of the traffic classes. You can make one of the following changes:

- To customize the queuing bandwidth, unlock the bandwidth settings by clicking the lock icon and adjust the bandwidth percentages.
- To calculate the queuing bandwidth automatically from the service provider bandwidth, lock the queuing bandwidth settings by clicking the lock icon and then clicking **OK** to confirm. By default, Catalyst Center automatically distributes the queuing bandwidth percentage such that the sum of the queuing bandwidth for all

Assign a Service Provider Profile to a WAN Interface

of the traffic classes in a service provider class aligns with the service provider bandwidth percentage of that class.

- Step 7** Click **OK**.
-

Assign a Service Provider Profile to a WAN Interface

If you have already created an application policy and now want to assign service provider profiles to WAN interfaces, you can edit the policy and perform this configuration, including setting the subline rate on the interface, if needed.

Before you begin

If you have not created a policy, you can create a policy and assign service provider profiles to WAN interfaces at the same time. For more information, see [Create an Application Policy, on page 732](#).

- Step 1** From the top-left corner, click the menu icon and choose **Policy > Application QoS > Application Policies**.
- Step 2** Use the **Filter** field to locate the policy that you want to edit.
- Step 3** Click the radio button next to the policy.
- Step 4** From the **Actions** drop-down list, choose **Edit**.
- Step 5** From the **Site Scope** pane, click the gear icon next to the site you are interested in.
- Step 6** Click **Configure** in the **SP Profile Settings** column for the device you are interested in.
- Step 7** In the **WAN Interface** column, from the **Select Interface** drop-down list, choose an interface.
- Step 8** In the **Role** column, from the **Select Role** drop-down list, choose a role according to the type of interface you are configuring:
- **Physical interface:** Choose **WAN**. This role is the only valid role for a physical interface.
 - **Tunnel interface:** Choose either **DMVPN Branch** or **DMVPN Hub**. If you choose **DMVPN Hub**, you can also define the bandwidth to its corresponding branches.
- Note** Make sure that the tunnel interfaces have been created on the devices before deploying these policy settings.
- Step 9** In the **Service Provider Profile** column, click the **Select Profile** drop-down field and choose a service provider profile.
- Step 10** If necessary, in the **Sub-Line Rate (Mbps)** column, enter the upstream bandwidth that the interface requires.
- Step 11** To configure additional WAN interfaces, click + and repeat Step 7 through Step 10.
- Step 12** Click **Save**.
- Step 13** Click **< Back to Site Scope**.
- Step 14** Click **OK**.
- Step 15** Click **Deploy**.
- You are prompted to deploy your policy now or to schedule it for a later time.
- Step 16** Do one of the following:

- To deploy the policy now, click the **Run Now** radio button and click **Apply**.
- To schedule policy deployment for a later date and time, click the **Schedule Later** radio button and define the date and time of the deployment.

Note The site time zone setting is not supported for scheduling application policy deployments.

Assign a Service Provider Profile to a WAN Interface



CHAPTER 26

Configure Traffic-Copy Policies

- [Traffic Copy Policies, on page 747](#)
- [Sources, Destinations, and Traffic Copy Destinations, on page 747](#)
- [Guidelines and Limitations of Traffic Copy Policy, on page 748](#)
- [Workflow to Configure a Traffic Copy Policy, on page 749](#)
- [Create a Traffic Copy Destination, on page 749](#)
- [Edit or Delete a Traffic Copy Destination, on page 749](#)
- [Create a Traffic Copy Contract, on page 750](#)
- [Edit or Delete a Traffic Copy Contract, on page 750](#)
- [Create a Traffic Copy Policy, on page 750](#)
- [Edit or Delete a Traffic Copy Policy, on page 751](#)

Traffic Copy Policies

Using Catalyst Center, you can set up an Encapsulated Remote Switched Port Analyzer (ERSPAN) configuration such that the IP traffic flow between two entities is copied to a specified destination for monitoring or troubleshooting.

To configure ERSPAN using Catalyst Center, create a traffic copy policy that defines the source and destination of the traffic flow that you want to copy. You can also define a traffic copy contract that specifies the device and interface where the copy of the traffic is sent.



Note Because traffic copy policies can contain either security groups or IP network groups, throughout this guide, we use the term *groups* to refer to both security groups and IP network groups, unless specified otherwise.

Sources, Destinations, and Traffic Copy Destinations

Catalyst Center simplifies the process of monitoring traffic. You do not have to know the physical network topology. You only have to define a source and destination of the traffic flow and the traffic copy destination where you want the copied traffic to go.

- **Source:** One or more network device interfaces through which the traffic that you want to monitor flows. The interface might connect to endpoint devices, specific users of these devices, or applications. A source

Guidelines and Limitations of Traffic Copy Policy

group comprises Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet, or port channel interfaces only.

- **Destination:** The IP subnet through which the traffic that you want to monitor flows. The IP subnet might connect to servers, remote peers, or applications.
- **Traffic Copy Destination:** Layer 2 or Layer 3 LAN interface on a device that receives, processes, and analyzes the ERSPAN data. The device is typically a packet capture or network analysis tool that receives a copy of the traffic flow for analysis.



- Note** At the destination, we recommend that you use a network analyzer, such as a Switch Probe device, or other Remote Monitoring (RMON) probe, to perform traffic analysis.

The interface type can be Ethernet, Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet interfaces only. When configured as a destination, the interface can be used to receive only the copied traffic. The interface can no longer receive any other type of traffic and cannot forward any traffic except that required by the traffic copy feature. You can configure trunk interfaces as destinations. This configuration allows the interfaces to transmit encapsulated traffic.



- Note** There can be only one traffic copy destination per traffic copy contract.

Catalyst Center supports traffic copy policy on the following devices:

- Source: Cisco Catalyst 3000, Catalyst 4000, Catalyst 9000
- Destination: Cisco Nexus 7000, ASR 1000, Catalyst 6000, ISR 4000

Guidelines and Limitations of Traffic Copy Policy

The traffic copy policy feature has the following limitations:

- You can create up to 8 traffic copy policies, 16 copy contracts, and 16 copy destinations.
- The same interface cannot be used by more than one traffic copy destination.
- Catalyst Center does not show a status message to indicate that a traffic copy policy has been changed and is no longer consistent with the one that is deployed in the network. However, if you know that a traffic copy policy has changed since it was deployed, you can redeploy the policy.
- You cannot configure a management interface as a source group or traffic copy destination.

Workflow to Configure a Traffic Copy Policy

Before you begin

- To be monitored, a source security group that is used in a traffic copy policy needs to be statically mapped to the switches and their interfaces.
- A traffic copy policy destination group needs to be configured as an IP network group. For more information, see [Create an IP Network Group, on page 713](#).

Step 1 Create a traffic copy destination.

This is the interface on the device where the traffic flow will be copied for further analysis. For information, see [Create a Traffic Copy Destination, on page 749](#).

Step 2 Create a traffic copy contract.

The contract defines the copy destination. For information, see [Create a Traffic Copy Contract, on page 750](#).

Step 3 Create a traffic copy policy.

The policy defines the source and destination of the traffic flow and the traffic copy contract that specifies the destination where the copied traffic is sent. For information, see [Create a Traffic Copy Policy, on page 750](#).

Create a Traffic Copy Destination

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Destination**.**Step 2** Enter a name and description for the traffic copy destination.**Step 3** Select the device and one or more ports.**Step 4** Click **Save**.

Edit or Delete a Traffic Copy Destination

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Destination**.**Step 2** Check the check box next to the destination that you want to edit or delete.**Step 3** Do one of the following:

- To make changes, click **Edit**, make the necessary changes, and click **Save**.

Create a Traffic Copy Contract

- To delete the destination, click **Delete**.
-

Create a Traffic Copy Contract

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Contract**.

Step 2 Click **Add**.

Step 3 In the dialog box, enter a name and description for the contract.

Step 4 From the **Copy Destination** drop-down list, choose a copy destination.

Note You can have only one destination per traffic copy contract.

If no copy destinations are available for you to choose, you can create one. For more information, see [Create a Traffic Copy Destination, on page 749](#).

Step 5 Click **Save**.

Edit or Delete a Traffic Copy Contract

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Contract**.

Step 2 Check the check box next to the contract that you want to edit or delete.

Step 3 Do one of the following:

- To make changes, click **Edit**, make the necessary changes, and click **Save**.
 - To delete the contract, click **Delete**.
-

Create a Traffic Copy Policy

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Policies**.

Step 2 Click **Add Policy**.

Step 3 In the **Policy Name** field, enter a name.

Step 4 In the **Description** field, enter a word or a phrase that identifies the policy.

Step 5 In the **Contract** field, click **Add Contract**.

Step 6 Click the radio button next to the contract that you want to use and then click **Save**.

Step 7 Drag and drop groups from the **Available Groups** area to the **Source** area.

Step 8 Drag and drop groups from the **Available Groups** area to the **Destination** area.

Step 9 Click **Save**.

Edit or Delete a Traffic Copy Policy

Step 1 From the top-left corner, click the menu icon and choose **Policy > Traffic Copy > Traffic Copy Policies**.

Step 2 Check the check box next to the policy that you want to edit or delete.

Step 3 Do one of the following:

- To make changes, click **Edit**, make the necessary changes, and click **Save**.
 - To delete the policy, click **Delete**.
-



PART **VII**

Monitor and Troubleshoot Your Network

- [Enable Advanced Feature Trials, on page 755](#)
- [Cisco AI Endpoint Analytics, on page 759](#)
- [Troubleshoot Network Devices Using Network Reasoner, on page 811](#)
- [Identify Network Bugs, on page 823](#)
- [Identify Network Security Advisories, on page 827](#)
- [Identify Network Field Notices, on page 837](#)



CHAPTER 27

Enable Advanced Feature Trials

- [Advanced Features Trial Overview, on page 755](#)
- [Enable the Network Bug Identifier Trial, on page 755](#)
- [Enable the Security Advisories Trial, on page 756](#)
- [Enable the Field Notices Trial, on page 756](#)

Advanced Features Trial Overview

Advanced Features trials are free for a limited time. These features work with the CX Cloud to provide customized insights based on your operational data and network configuration. By authorizing the CX Cloud Consent to Connect agreement through the Catalyst Center dashboard, you can enable access to the advanced features.

These advanced features help secure and keep your network up to date. Using advanced machine learning algorithms, Cisco scans and analyzes your hardware, software, and device configuration to generate customized and actionable insights specific to your environment.



Note

- When you enable these advanced features, Catalyst Center sends data to the U.S.-hosted CX Cloud only, not to other regions.
- The EoX (End of Life milestones) feature is offered independent of the Advanced Features trial. To enable access to the EoX feature, authorize the CX Cloud Consent to Connect agreement through the Catalyst Center dashboard. For information about the EoX feature, see [Types of Compliance, on page 426](#).

Enable the Network Bug Identifier Trial

You can try out this feature by enabling the CX license for a 90-day trial.

Before you begin

- You must enter the correct URL and port in your firewall for Catalyst Center to reach the CX Cloud.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Bug Identifier**.

If the feature trial hasn't started yet, Catalyst Center displays a banner with the trial offer. If the feature trial has started already, the number of days left in the trial is displayed.

Step 2 To begin the trial, you must accept the trial terms and conditions:

- If you've already accepted the trial terms and conditions for another feature trial or feature, continue to the next step.
- If you haven't accepted them yet, you are prompted to do so. In the banner, click the **Consent to Connect** link to display the trial terms and conditions and confirm that you've read and agree to them.

Step 3 Confirm that you want to enable the trial.

Enable the Security Advisories Trial

You can try out this feature by enabling the CX license for a 90-day trial.

Before you begin

- You must enter the correct URL and port in your firewall for Catalyst Center to reach the CX Cloud.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.

If the feature trial hasn't started yet, Catalyst Center displays a banner with the trial offer. If the feature trial has started already, the number of days left in the trial is displayed.

Step 2 To begin the trial, you must accept the trial terms and conditions:

- If you've already accepted the trial terms and conditions for another feature trial or feature, continue to the next step.
- If you haven't accepted them yet, you are prompted to do so. In the banner, click the **Consent to Connect** link to display the trial terms and conditions and confirm that you've read and agree to them.

Step 3 Confirm that you want to enable the trial.

Enable the Field Notices Trial

You can try out this feature by enabling the CX license for a 90-day trial.

Before you begin

- You must enter the correct URL and port in your firewall for Catalyst Center to reach the CX Cloud.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Field Notices**.

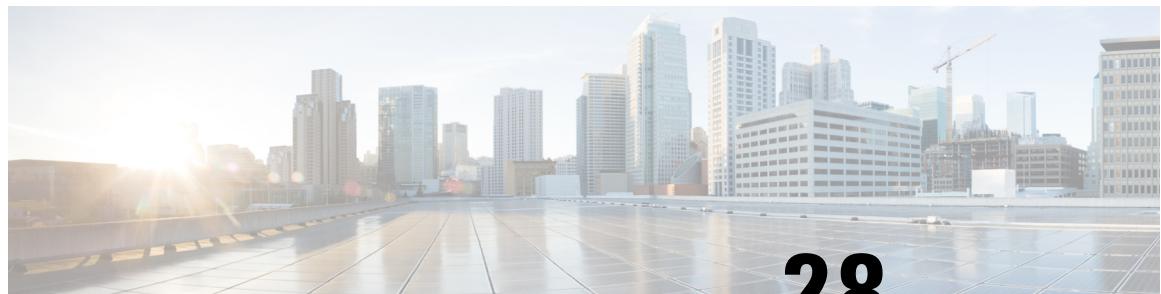
If the feature trial hasn't started yet, Catalyst Center displays a banner with the trial offer. If the feature trial has started already, the number of days left in the trial is displayed.

Step 2 To begin the trial, you must accept the trial terms and conditions:

- If you've already accepted the trial terms and conditions for another feature trial or feature, continue to the next step.
- If you haven't accepted them yet, you are prompted to do so. In the banner, click the **Consent to Connect** link to display the trial terms and conditions and confirm that you've read and agree to them.

Step 3 Confirm that you want to enable the trial.

■ **Enable the Field Notices Trial**



CHAPTER 28

Cisco AI Endpoint Analytics

- [Cisco AI Endpoint Analytics Overview, on page 759](#)
- [Key Features of Cisco AI Endpoint Analytics, on page 760](#)
- [FIPS Compliance, on page 761](#)
- [Set Up Cisco AI Endpoint Analytics in Catalyst Center, on page 762](#)
- [Cisco AI Endpoint Analytics Overview Window, on page 766](#)
- [Endpoint Inventory, on page 775](#)
- [Trust Score, on page 779](#)
- [Profiling Rules, on page 795](#)
- [Cisco AI Rules for Smart Grouping, on page 800](#)
- [Hierarchy, on page 807](#)

Cisco AI Endpoint Analytics Overview

Visibility is the first step towards securing an endpoint. Cisco AI Endpoint Analytics is an endpoint visibility solution that helps you identify and profile endpoints and Internet of Things (IoT) devices. The Cisco AI Endpoint Analytics engine enables you to assign labels to endpoints, using the telemetry information received from the network from various sources.

The profiling labels that are available in Cisco AI Endpoint Analytics are endpoint type, hardware model, manufacturer, and operating system type. This is called multifactor classification.

Cisco AI Endpoint Analytics provides nuanced visibility and enforcement in your network with features like Trust Scores that allow you to identify and act upon potentially risky endpoints and devices. You can also manage potential risks by applying ANC policies through Cisco ISE, from the Cisco AI Endpoint Analytics GUI. You can monitor and work around the issue of random and changing MAC addresses from endpoints in Cisco AI Endpoint Analytics and accurately identify endpoints through a unique attribute called the DUID instead of MAC addresses.

Cisco AI Endpoint Analytics helps you gather endpoint telemetry from different sources. The primary source is the Network-Based Application Recognition (NBAR) mechanism. The NBAR mechanism is embedded in Cisco Catalyst 9000 Series switches (access devices) and performs deep packet inspection (DPI). Cisco AI Endpoint Analytics can also receive telemetry from Catalyst Center Traffic Telemetry Appliance.

You can gather endpoint context information from various sources such as Cisco ISE, self-registration portals, and configuration management database (CMDB) software such as ServiceNow.

Cisco AI Endpoint Analytics allows data inflow from a wide range of network devices, expanding your ability to easily identify and profile endpoints with greater accuracy, and act upon any anomalies. You can aggregate

varied endpoint information and use the data to profile endpoints in Cisco AI Endpoint Analytics. After endpoints are profiled, AI and machine learning algorithms can also be used to reduce the number of unknown endpoints by intuitively leveraging different methods.

Key Features of Cisco AI Endpoint Analytics

- **Cisco AI Endpoint Analytics dashboard**

The Cisco AI Endpoint Analytics dashboard gives you a comprehensive view of the endpoints that are connected to your network. You can view the number of known, unknown, profiled, and unprofiled endpoints, endpoints with low Trust Scores, and endpoints that use random MAC addresses. The AI Proposals dashlet displays intelligent profiling suggestions to enhance endpoint profiling and management.

- **Trust Scores to flag potentially risky endpoints**

Cisco AI Endpoint Analytics assigns Trust Scores to endpoints to allow you to easily monitor and act on potentially risky endpoints in your network. Behavioral anomalies are monitored and tracked, and a Trust Score is assigned based on the number and frequency of the anomalies tracked. See [Trust Scores for Endpoints, on page 780](#).

- **Detect endpoints that use random MAC addresses**

Cisco AI Endpoint Analytics enables you to handle the issue of random and changing MAC addresses by receiving from Cisco ISE a unique endpoint identifier called the DUID (also known as GUID in Cisco ISE). Cisco AI Endpoint Analytics then uses the DUID as the identifier for an endpoint, instead of its MAC address.

- **Reduce net unknowns with machine learning capabilities**

Cisco AI Endpoint Analytics provides profiling suggestions based on learnings from endpoint groupings. You can use these suggestions to reduce the number of unknown or unprofiled endpoints in your network.

- **Manage endpoints with system and custom profiling rules**

Use Cisco-provided system rules and custom rules of your design to reliably profile and manage the endpoints connected to your network.

- **Registration of endpoints through Cisco AI Endpoint Analytics**

You can onboard and profile endpoints using Cisco AI Endpoint Analytics. The endpoint attribute data that is collected through this registration process is used to profile the endpoints.

- **Registration of endpoints using external sources**

You can connect some external sources of endpoint data, such as Configuration Management Databases (CMDB), to Cisco AI Endpoint Analytics. This allows you to easily register, manage, and profile endpoints in your network.

- **Purge endpoints after a defined period of inactivity**

Define an Endpoint Purge Policy to remove from your network the endpoints that have been inactive for a defined time. You can define the period of inactivity after which an endpoint must be removed. You can also customize a purge policy to act on a particular set of endpoints based on a profiling attribute.

FIPS Compliance

Catalyst Center supports the United States' Federal Information Processing Standards (FIPS). FIPS is an optional mode that can be enabled when installing the Catalyst Center image. By default, FIPS mode is disabled.

When FIPS mode is enabled in Catalyst Center, the following functions in the Catalyst Center GUI are *unavailable*:

- The **Enable AI Network Analytics** dashlet in the **Optional Configurations** section in **AI Endpoint Analytics Setup**.
- The **AI Proposals** dashlet in **Policy > AI Endpoint Analytics > Overview**.
- The **Profile Rule Settings** tab in **Policy > AI Endpoint Analytics > Overview > Configuration**.
- The **AI Spoofing Detection** section in **Policy > AI Endpoint Analytics > Overview > Configuration > Trust Analytics**.
- The **AI Spoofing Detection** section in **Endpoint Anomaly Detection** under **Trust Score** details for a particular endpoint in **Policy > AI Endpoint Analytics > Endpoint Inventory**.
- The **AI Spoofing Detection** column in **Policy > AI Endpoint Analytics > Endpoint inventory > Focus as Trust Score**.
- The **Talos IP Reputation** section in **Policy > AI Endpoint Analytics > Overview > Configuration > Trust Score Sources**

Set Up Cisco AI Endpoint Analytics in Catalyst Center

Set Up Cisco AI Endpoint Analytics

Software Updates

Download and install the following software packages:

- Cisco AI Endpoint Analytics
- AI Network Analytics (Optional)
- Application Visibility Service

Join and Configure Data Sources

Join and configure the following data sources:

- Cisco Identity Services Engine
- Cisco Catalyst 9000 Series Access Devices for wired endpoints visibility
- (Optional) Traffic Telemetry Appliances Appliances (DN-APL-TTA-M) for wired and wireless endpoints visibility, and for third-party network devices visibility
- (Optional) Cisco Catalyst 9800 Series Wireless Controllers for wireless endpoints visibility
- (Optional) CMDB

Install Software Updates

Install software updates in Catalyst Center to use Cisco AI Endpoint Analytics, as described in the following procedure.

Step 1 Log in to Catalyst Center.

Step 2 From the top-left corner, click the menu icon and choose **System > Software Management**.

Step 3 In the **Updates** tab, check if **Cisco AI Endpoint Analytics**, **AI Network Analytics**, and **Application Visibility Service** are listed in the **Application Updates** section. If these application updates are visible, click **Install All**.

- Install the **Cisco AI Endpoint Analytics** update to access the endpoint profiling solution in your Catalyst Center.
- Install the **AI Network Analytics** update to use machine learning and AI capabilities to receive intelligent profiling suggestions.
- Install the **Application Visibility Service** update to use NBAR and Controller-Based Application Recognition (CBAR) techniques to inform endpoint profiling.

Step 4 If these updates aren't listed in the **Updates** tab, click the **Installed Apps** tab to check if the updates are already installed and are available for use. The **Currently Installed Applications** tab also confirms if the software installation succeeded.

Connect and Enable Data Sources

The data sources that Cisco AI Endpoint Analytics uses may already be connected to your Catalyst Center. If the data sources are connected, see the following instructions to ensure that the data sources are available for use by Cisco AI Endpoint Analytics.

You must add Cisco ISE or Catalyst 9000 Series access devices to Catalyst Center for Cisco AI Endpoint Analytics to provide results.

Step 1 Connect Cisco ISE to Catalyst Center:

See the "Integrate Cisco ISE with Catalyst Center" section in "Complete First-Time Setup" in the *Cisco Catalyst Center Installation Guide*.

The following Cisco ISE releases support Cisco AI Endpoint Analytics:

- 2.4 Patch 11 and later
- 2.6 Patch 5 and later
- 2.7 Patch 1 and later
- 3.0 and later

For Cisco ISE 3.1 and later, in your Cisco ISE administration portal:

- a) Choose **Work Centers > Profiler > Settings**.
- b) In the **Endpoint Analytics Settings** area, check the following check boxes:
 - **Publish Endpoint Attributes to AI Endpoint Analytics**
 - **Consume Endpoint Profiles from AI Endpoint Analytics**

After Cisco ISE authenticates endpoints through 802.1X or MAB authentication methods, the endpoint attributes collected are made available to Cisco AI Endpoint Analytics. Cisco ISE also shares telemetry data with Cisco AI Endpoint Analytics.

For Cisco ISE 2.4, 2.6, and 3.0, in your Cisco ISE administration portal:

- a) Choose **Work Centers > Profiler > Settings**.
- b) Choose the **Enable Probe Data Publisher** option.
- c) Click **Save**.

Step 2 Connect Cisco 9000 Series access devices to Catalyst Center for wired endpoints visibility.

See "Discover Your Network" in the *Cisco Catalyst Center User Guide*.

To enable Cisco AI Endpoint Analytics features, upgrade your Cisco 9000 Series access devices to Cisco IOS-XE Release 17.6 or later.

To enable CBAR for the required access devices:

- a) In the Catalyst Center GUI, click the menu icon and choose **Provision > Services > Application Visibility**.
- b) Select the Cisco Catalyst 9000 access device that you need data from. Check the check box next to the device name in the **Site Devices** section.
- c) Click **Enable CBAR**.
- d) Click **Yes** in the subsequent confirmation window.

Connect and Enable Data Sources

- e) In the **Enable CBAR** slide-in pane, check the check box next to the supported SSID type.
- f) Click **Enable**.

Step 3

(Optional) Connect Cisco Catalyst 9800 Series Wireless Controllers to Catalyst Center for wireless endpoints visibility.

The following Cisco Catalyst 9800 Series Wireless Controller models are supported by Cisco AI Endpoint Analytics:

- 9800-CL
- 9800-40
- 9800-80
- 9800-L

Catalyst Center supports FlexConnect in Cisco Catalyst 9800 Series Wireless Controllers with Cisco IOS XE Release 17.7.1 and later.

To configure and provision a Cisco Catalyst 9800 Series Wireless Controller in Catalyst Center, see [Cisco Catalyst 9800 Series Wireless Controller Overview, on page 494](#).

Step 4

(Optional) Connect Cisco Catalyst IE9300 Rugged Series switches to Catalyst Center.

The Cisco Catalyst IE9300 Rugged Series switches are supported by Cisco AI Endpoint Analytics.

See “Discover Your Network” in the [Cisco Catalyst Center User Guide](#).

Step 5

(Optional) Connect Catalyst Center Traffic Telemetry Appliance to Catalyst Center for wired and wireless endpoints visibility, and for third-party network device visibility.

Catalyst Center Traffic Telemetry Appliance (DN-APL-TTA-M) generates telemetry from mirrored network traffic for endpoint analytics. This appliance enables Network-Based Application Recognition-based (NBAR-based) protocol inspection and endpoint attribute extraction.

To receive endpoint attributes collected through the telemetry appliance in Cisco AI Endpoint Analytics, you must integrate Cisco ISE with Catalyst Center.

See [Traffic Telemetry Appliances](#) for information on installing the appliances, connectivity configurations, and managing the appliances in Catalyst Center.

Enable CBAR on Switched Port Analyzer (SPAN)-receiving ports of access switches connected to Catalyst Center Traffic Telemetry Appliance with the following command:

```
ip nbar protocol-discovery
```

Not all endpoints that are connected to the telemetry appliances are visible in Cisco AI Endpoint Analytics. Only endpoints that are also connected to Network Access Devices (NADs) that are managed in Cisco Catalyst Assurance are visible in Cisco AI Endpoint Analytics.

Step 6

(Optional) Enable ServiceNow in Catalyst Center.

- a) After connecting ServiceNow to Catalyst Center, click the menu icon and choose **Platform > Manage > Bundles**.
- b) If the **Status** of the bundle **Endpoint Attribute Retrieval with ITSM (ServiceNow)** is **New**, click **Enable** for the bundle.

Step 7

(Optional) Enable Cisco AI Analytics in Catalyst Center.

To receive suggestions about AI-based endpoint groupings, automated custom profiling rules, and endpoint labels, and to detect potentially spoofed devices in your network, you must enable the required settings in the **Cisco AI Analytics** window.

You must install the AI Network Analytics software to receive these AI-based suggestions.

- a) From the top-left corner, click the menu icon and choose **System > Settings > External Services > Cisco AI Analytics**.
- b) Click the toggle button for each of the following services that you want to enable:

- **AI Endpoint Analytics:** AI Network Analytics leverages machine learning to drive intelligence in the network and enables you to effectively improve network performance and accelerate issue resolution. AI Network Analytics significantly reduces noise and false positives by analyzing network behavior and adapting to your network environment.
- **Endpoint Smart Grouping:** Using AI and Machine Learning, Endpoint Smart Grouping reduces the number of unknown endpoints in your network by providing AI-based endpoint groupings, automated custom profiling rules, and crowdsourced endpoint labels.
- **AI Spoofing Detection:** AI Spoofing Detection identifies spoofed endpoints based on pretrained behavioral models. Enabling the **Enable AI Spoofing Detection** toggle button allows Catalyst Center to detect spoofed endpoints using these behavioral models and the flow information provided by the network devices. Several behavioral models are built and centrally trained using the collected flow information gathered from participating customers.
 - Spoofing detection is performed in the cloud and anonymized data export to the cloud from Catalyst Center is mandatory. Catalyst Center then polls the cloud for spoofing detections.
 - An uninterrupted internet connection is required.
 - While upgrading to the latest release, if data export was disabled in the previous release, a warning stating that data export is disabled is displayed upon upgrade. You must re-enable spoofing detection.

Endpoint Telemetry Sources

Cisco AI Endpoint Analytics receives telemetry data in the following ways.

- **Deep Packet Inspection**

Deep packet inspection is an advanced method of packet analysis that is carried out by Cisco Catalyst 9000 Series access devices. These access devices run NBAR, which inspects application traffic and performs protocol analysis to discover, identify, and profile endpoints with high fidelity.

Deep packet inspection profiling is based on various attributes that are collected from endpoint traffic to the network. These attributes are collected across multiple protocols, from packet header layers 4 to 7.

- **Configuration Management Database Connection**

Cisco AI Endpoint Analytics receives endpoint data from your Configuration Management Database Connection (CMDB) for greater accuracy in endpoint profiling. The connection with ServiceNow enables you to receive information from the CMDB to Cisco AI Endpoint Analytics.

- **Machine Learning Capabilities**

Data collected for profiling is anonymized and sent to a Cisco cloud location that serves as a device data lake. Here, machine learning algorithms analyze the data available to create profiling rules that you can evaluate and apply, as needed. Smart profiling rules are suggested through Cisco AI Endpoint Analytics

to help make endpoint profiling and management simpler and more efficient for you. Existing rules are evaluated and improvement suggestions provided based on this continuous learning.

Cisco AI Endpoint Analytics Overview Window

From the top-left corner, click the menu icon and choose **Policy > AI Endpoint Analytics**.

The **Overview** window displays the following dashlets:

- **Total Endpoints**

This dashlet displays the total number of endpoints in your network in two groups, **Fully Profiled** and **Partially Profiled**. Cisco AI Endpoint Analytics profiles endpoints based on four factors, Endpoint Type, OS Type, Hardware Model, and Hardware Manufacturer. If one or more of these factors are missing for an endpoint, it is profiled in the **Partially Profiled** group.

Click **Partially Profiled Labels** to view the number of endpoints in your network with missing profiles, categorized by profile label type. To check the endpoints with a specific missing profile label, click the number next to the profile label. The **Endpoint Inventory** tab is displayed with the corresponding list of endpoints.

- **AI Proposals**

Cisco AI Endpoint Analytics uses smart grouping algorithms to group unknown endpoints in your network that have similar profiling data. If you have enabled AI Endpoint Analytics, you will receive the following types of rule proposals. These rule proposals are based on learnings from endpoint clusters:

- New rules for profiling endpoints that may be similar.
- Modification proposals for previously accepted rules.
- Review of profiling rules that are no longer needed.

For more details, see [Cisco AI Rules for Smart Grouping, on page 800](#).

- **Trust Scores**

The Trust Scores dashlet provides an overall view of the Trust Scores assigned to the endpoints in your network. See [Trust Scores for Endpoints, on page 780](#).

- **Configuration**

Click the **Configuration** link in the top-right corner of the Overview area to access the following configurations:

- **Profile Rule Settings:** Schedule automatic updates for system profile rules. See [Automatic System Rule Updates for Endpoint Profiling, on page 796](#).
- **ISE Integration:** See [Publish Authorization Attributes to Cisco ISE, on page 770](#).
- **Trust Analytics:** Click the toggle buttons to enable or disable Trust Score sources. You cannot disable the **Authentication Method** source. If an active Cisco ISE integration is configured, the authentication method used by the endpoint and its posture status will inform the Trust Score of an endpoint. You can enable or disable other sources of Trust Score data such as **AI Spoofing Detection**, **Endpoint Attribute Conflict**, **NAT Mode Detection**, **Concurrent MAC Addresses**, and **Security Sensor**.

See [Trust Scores for Endpoints, on page 780](#).

- **Endpoint Purge Policy:** See [Endpoint Purge Policies, on page 773](#).
- **Endpoint Subnet Inspection:** See [Configure Endpoint Subnet Inspection, on page 774](#).

- **Endpoint MAC Randomization**

The Endpoint MAC Randomization displays the number of static MAC addresses and random and changing MAC addresses in the network. See [Trust Scores for Endpoints with Random and Changing MAC Addresses, on page 786](#).

Cisco Talos Intelligence

Cisco Talos Intelligence is a comprehensive threat-detection network. Talos Intelligence comprises threat-detection analysts and real-time automated detection systems that span web requests, emails, malware samples, open-source data sets, endpoint intelligence, and network intrusions. Integrate Cisco AI Endpoint Analytics with Talos using the Talos IP Reputation feature to flag network connections that reach out to untrusted IP addresses, quarantine them, and protect your network from the most common cyber threats.

Catalyst Center - Cloud communicates with the Talos Intelligence Cloud Service to obtain updated IP reputation data every 30 minutes. These updates are pushed to all registered Catalyst Center devices.

There are two procedures that you can follow to set up Cisco Talos Intelligence in Catalyst Center.

Integrate Cisco AI Endpoint Analytics with Cisco Talos Intelligence Through App Activation

Before you begin

For the Talos IP Reputation feature to work smoothly, enable application telemetry and choose Catalyst Center as the NetFlow collector. See [Configure Telemetry](#) for more information on the NetFlow collector.

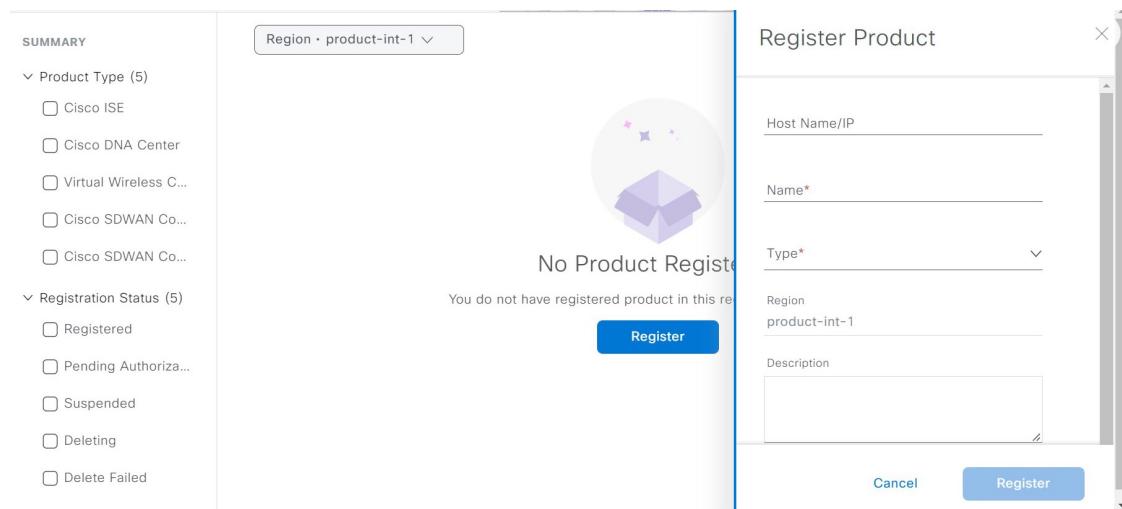
The following is the recommended procedure.

-
- Step 1** In the Catalyst Center GUI, click the menu icon and choose **System > Settings > External Services > Cisco Catalyst - Cloud**.
- Step 2** From the **Region** drop-down list, choose the appropriate region.
- Step 3** Scroll to the **Talos Threat Intelligence** App.
- Step 4** Click **Activate** on the **Talos Threat Intelligence** App. The Cisco Cloud Services homepage is displayed.
- Step 5** In the Cisco Cloud Services GUI, click the Menu icon, and click **Applications**.
- Step 6** From the **Region** drop-down list, choose the appropriate region.
- Step 7** Click **Activate** on the **Talos Threat Intelligence** App.
- If the region is not selected on the **Applications** window, a **Select Region** dialog box is displayed. You can select the required region and then click **Activate**.
- Step 8** Check the check box to agree to the terms and conditions and click **Subscribe**.
- Step 9** In the **Choose Your Product** window, click Catalyst Center to choose it for Talos Threat Intelligence activation.

- Step 10** In the **Activate Talos Threat Intelligence Application for your Product** window, such as **Host Name/IP, Name**, and **Description** (if any). Choose the appropriate type of product being registered from the **Type** drop-down list, such as Catalyst Center.
- Step 11** Click **Register**.
- Step 12** In the **Choose Your Product** window, click Catalyst Center to select it again and click **Select Product**.
- Step 13** Click **Auto Redeem** on the **Authenticate your Product** window to automatically redeem the OTP and authenticate your product. Catalyst Center opens in a new window.
You can also copy the one-time passcode (OTP) and close the window to manually register your product.
- Step 14** In the Catalyst Center window that is displayed, log in using your Catalyst Center credentials.
- Note**
- After the registration succeeds, close the window before proceeding to Cisco Cloud Services to continue with the workflow.
 - After registering Catalyst Center to Cisco Cloud Services, wait for 3 minutes before proceeding to Step 15.
 - In the Cisco Cloud Services GUI, (**Menu > Applications**), you can see the registered product with the registration status.
- Step 15** Select the scopes needed for your Catalyst Center in the **Scope Selection** window and click **Next**.
A **Summary** window is displayed that summarizes the application, product, and scope chosen for your Catalyst Center.
- Step 16** Click **Activate** to connect your Catalyst Center to Talos Threat Intelligence.
The status of the activation is displayed.
- Step 17**
- (If you registered your Catalyst Center device for the first time and activated Talos on Cisco Cloud Services) Click **Exit** and close the window.
 - (Activated Talos for a preregistered Catalyst Center device on Cisco Cloud Services) Click **Exit** to return to the **Applications** window on Cisco Cloud Services. You can find your connected application in the Applications window.

Integrate Cisco AI Endpoint Analytics with Cisco Talos Intelligence Using Cloud Authentication

- Step 1** In the Catalyst Center GUI, click the menu icon and choose **System > Settings > External Services > Cloud Authentication**.
- Step 2** Click the **dna.cisco.com** link and create a Catalyst Center - Cloud account.
- Step 3** In the Catalyst Center - Cloud GUI, click the Menu icon, click **Applications**, and choose **Products**.
- Step 4** From the **Region** drop-down list, choose the appropriate region.
- Step 5** Click **Register**.
- Step 6** In the **Register Product** pane, enter the required details, such as **Host Name/IP, Name**, and **Description** (if any). Choose the appropriate type of product being registered from the **Type** drop-down list, such as Catalyst Center. Click **Register**.

Figure 28: Registering a Product to Catalyst Center - Cloud

Note Check the **Enable Cloud Access Login** check box to enable automatic login from your Catalyst Center - Cloud to Catalyst Center.

The OTP redemption occurs automatically, and Catalyst Center opens in a new window.

Step 7 In the Catalyst Center window, log in using your Catalyst Center credentials.

- After the registration succeeds, close the window before proceeding to Catalyst Center - Cloud to continue with the workflow.
- After registering Catalyst Center device to Catalyst Center - Cloud, wait for 3 minutes before proceeding to Step 8.

Step 8 In the Catalyst Center - Cloud GUI, (**Menu > Applications**), you can see the registered product with the registration status.

Step 9 In the Catalyst Center GUI, go to the Cisco AI Endpoint Analytics window (**AI Endpoint Analytics > Configurations > Trust Analytics**) and click the **Talos IP Reputation** toggle button to enable it. You can enable **Talos IP Reputation** from either the **Trust Score Sources** window or the **System > Settings** window.

After **Talos IP Reputation** is enabled, Catalyst Center receives the updated IP Reputation data whenever it's available. If an endpoint in the network tries to access an untrusted IP address, it's flagged, and a warning message stating **Detected** is displayed for Talos IP Reputation in the Trust Score view for an endpoint. This warning reduces the overall trust score of the endpoint. The Talos IP Reputation feature stores information about the untrusted IP addresses accessed and the number of access attempts made by an endpoint. This information is useful when deciding about increasing the security of your network.

The **Talos Reputation** window (**System > Settings > Talos IP Reputation**) displays the latest versions of the various files received from Talos. The time at which these files were received is also displayed. IPv4 and IPv6 files are Talos IP Reputation data files and are typically updated once a day. However, the *Threat Level* file is metadata and changes to this file are rare.

Publish Authorization Attributes to Cisco ISE

Publish Cisco AI Endpoint Analytics profile data to Cisco ISE to authorize endpoint access to the network and for endpoint control. The attribute information that is shared by Cisco AI Endpoint Analytics is then easily accessible to a Cisco ISE administrator through the AI Endpoint Analytics dictionary. A Cisco ISE administrator can easily create authorization policies in Cisco ISE. The following attributes are shared with Cisco ISE:

1. The overall trust score and the score for each anomaly that is recorded.
2. CMDB attributes.
3. Multifactor profiling attributes: Hardware Manufacturer, Hardware Model, Operating System, and Endpoint Type.

If your Catalyst Center has an active integration with Cisco ISE Release 3.1 and later releases, and you want to publish authorization attributes to Cisco ISE, carry out the following tasks.

Step 1

To enable attribute sharing in Catalyst Center, do the following:

- a) In the Cisco AI Endpoint Analytics **Overview** window, click **Configurations**.
- b) Click **ISE Integration** from the left panel.
- c) Click the **Enable Profile Publishing to ISE** toggle button to enable the feature.
- d) Check the **Asset Topic Based Integration** or **Enhanced Authorization Integration** check boxes, or both, depending on which type of topic you want to use to publish attribute information to Cisco ISE.
- e) Click **Save**.

Step 2

To enable pxGrid subscription in Cisco ISE, do the following:

- a) In the Cisco ISE GUI, click the menu icon and choose **Work Center > Profiler > Settings**.
- b) If you are connected to Cisco ISE Release 3.1, in the **Endpoint Analytics Settings** area, check the following check boxes:
 - **Publish Endpoint Attributes to AI Endpoint Analytics**
 - **Consume Endpoint Profiles from AI Endpoint Analytics**

What to do next

To verify the subscription, from the Cisco ISE main menu, choose **Administration > pxGrid Services > Diagnostics > WebSocket > Clients**. The newly created subscription containing "com.cisco.ea.data.ise-<Cisco ISE node>" is displayed in the **Subscription** column of the PSN nodes.

In the Cisco ISE **Policy > Policy Sets** window, a new dictionary that is named **Endpoint-Analytics** is visible in the Conditions Studio.

In the Cisco ISE **Context Visibility > Endpoints** window, click **MAC Address** for endpoint details. The attributes area of the details displays attributes that contain "EA-" prefixes for the attributes that are received from Cisco AI Endpoint Analytics.

Trust Analytics

The **Trust Analytics** window displays the various trust score sources, enables you to reset alerts raised on these sources manually or automatically after a period of inactivity, and sets the impact level for each trust score source to accurately measure the overall trust score of an endpoint.

Trust Score assesses the trustworthiness of a given endpoint on the network to help achieve zero trust outcomes. Values range from 1 (low trust) to 10 (high trust) and are calculated using several sources:

- **Endpoint Context:** This category of sources provides information about the reliability of an endpoint, by knowing the authentication method used by the endpoint and posture status of the endpoint.
- **Threat and vulnerability Context:** This category of sources provides information about how vulnerable an endpoint is based on the various types of threats associated with an endpoint.
- **Network Context:** This category of sources provides information about how an endpoint is accessing the network.

Trust Score Impact allows you to control the trust score of an endpoint when an anomaly is raised. The following impact levels are available:

- **Low:** When you know that an anomaly is of low importance in your network, you can set its impact level to **Low** so that it has a low impact on the trust score. After setting this impact level, when such an anomaly is detected again, the trust score for the endpoint on which the anomaly is detected sluggishly reduces to 1 (Increases system-generated impact level by 50% of total trust score).
- **Critical:** When you know that an anomaly is of high importance in your network, you can set its impact level to **Critical** so that it has a very high impact on the trust score. After setting this impact level, when such an anomaly is detected again, the trust score for the endpoint on which the anomaly is detected quickly reduces to 1 (Reduces system-generated impact level by 50% of total trust score).
- **No Impact:** An anomaly is detected, but does not impact the overall trust score. You can use this option to test out the anomalies and view them without changing the overall trust score.
- **System Default:** Default system-generated trust score.

To know how to customize impact levels for the sources, see [Customize Impact Level](#).

Alerts appear when there is a deviation caused by anomalies or vulnerabilities, or when a weakness is identified in endpoint connections or interfaces. The alerts can be reset manually after addressing them. You can also manually reset the alerts you don't want to address. Alternatively, you can set a reset timer to reset the alerts automatically. After a period of inactivity, this alert is not detected on endpoints.

To know how to reset alerts for the sources, see [Configure Reset Alert](#).

Customize Impact Level

You can now customize the trust score of an endpoint by setting an impact level that you perceive for an endpoint. Based on the impact level that you set for a source, the overall trust score is recalculated for the endpoints. This gives you the authority to decide the trust level of an anomaly irrespective of the system-generated trust score for that anomaly.



- Note** For authentication method EAT-TLS and posture non-compliant endpoints, even if you change the impact level, the trust level remains the same. The trust level is only changed in the case of MAB authentication.

Configure Reset Alert



Note The high trust score that is earned because of the authentication method used, is not lowered even when the impact level for the authentication method is changed. If the impact level for the authentication method is increased, the endpoints continue to retain their current trust score unless a new session for that endpoint is received.

- Step 1** From the top-left corner, click the menu icon and choose **Policy > AI Endpoint Analytics > Overview > Manage Sources**.

The **Trust Analytics** window opens.

- Step 2** Click **Customize Impact Level**.

- Step 3** Click **Let's Do It**.

The **Customize Trust Score Sources** workflow begins. You can exit the workflow at any point in time by clicking the **Exit** option at the bottom of the workflow window.

- Step 4** Check the checkboxes next to the sources for which you want to change the impact level.

- Step 5** From the **More Actions** drop-down list, choose the **New Impact Level**.

- Step 6** Click **Next**.

In the next window, a comparative study of the previous and new trust score is provided that shows the trust score customization impact on individual endpoints. This pie chart includes all the endpoints in the network irrespective of whether or not they were impacted by the change in the impact level of the sources. The **Endpoints (After)** table below displays the new trust score for each endpoint that was impacted as a result of the change in the impact level configuration.

- Step 7** Click **Next**.

A summary stating the new impact level of each source is displayed. Click **Edit** to go back in the workflow to edit the impact level of the trust scores in case you are not satisfied with the result.

- Step 8** Click **Next**.

The endpoints' trust scores are updated accordingly and is also sent to Cisco ISE. This may result in a change of authorization for such endpoints if Cisco ISE is using trust score based authorization policies.

What to do next

Check the new trust score for the endpoints in **Policy > AI Endpoint Analytics > Trust Score**.

Configure Reset Alert

You can reset an alert manually or automatically after a period of inactivity. By default, the reset action is set to **Manual** for all supported sources. You can configure to reset an alert using the global configuration workflow as described here.

- Step 1** From the top-left corner, click the menu icon and choose **Policy > AI Endpoint Analytics > Manage Sources**.

The **Trust Analytics** window opens.

- Step 2** Click **Alert Configuration**.

Step 3 In the **Choose Reset Alert Type** window, click **Let's Do It**.

You can exit the workflow at any point in time by clicking the **Exit** option at the bottom of the workflow window.

Step 4 From the **Reset Alert Type** drop-down list, choose **Manual** or **Customize reset timer after alert inactivity**.

Step 5 If you choose **Customize reset timer after alert inactivity**, enter the number of days (0 to 365 days) or hours (0 to 24 hours), after which you want to reset the alert, in case of inactivity.

You can choose to remove or retain the ANC Policy. If the endpoint has a trust value from more than one trust score source, the ANC policy will not be removed even if the **Remove ANC Policy** checkbox is checked.

Step 6 Click **Next**.

Step 7 Check the check boxes next to all the sources for which you want to apply the setting that you chose in Step 4.

Step 8 Click **Apply**.

You can also configure to reset an alert locally from the **Trust Analytics** window. Choose the source for which you want to configure the reset alert. In the slide-in window on the right, choose the appropriate setting and click **Save**. Note that the reset alert configuration option is not available for all sources. When the alerts are reset, the same information is propagated back to Cisco ISE.

The alerts are checked every 30 minutes for an update. And if, during any of the checks, the time period configured in the reset alert configuration has lapsed, the trust score is reset for that anomaly. The status of the reset alert will be displayed in the Audit log.

Endpoint Purge Policies

Define an Endpoint Purge Policy to remove from your network the endpoints that have been inactive for a defined time. You can define the period of inactivity after which an endpoint must be removed. You can also customize a purge policy to act on a particular set of endpoints based on a profiling attribute. Purge policies are executed at 2 A.M. (server time) every day, and the endpoints that meet the defined purge requirements are removed from your network.

Registered endpoints and static endpoints that are imported into Cisco AI Endpoint Analytics are not affected by endpoint purge policies.

The Backup and Restore operation in your Catalyst Center and the endpoint purge activity cannot run simultaneously. If a Backup and Restore operation is in progress at 2 A.M., the purge activity is not initiated. If a Backup and Restore operation starts while an endpoint activity is in progress, the endpoint purge stops running, and the purge activity is left incomplete. The remaining endpoints are not acted on until the next purge is executed at 2 A.M. (server time) the next day.

To view, edit, or add endpoint purge policies, click the menu icon and choose **Policy > AI Endpoint Analytics > Configurations > Endpoint Purge Policy**. The following policies are available by default:

- **Default**
- **Random MAC Default**

You cannot edit these default policies. You can only enable or disable them.

You can use the **Purge Now** option to immediately run the purge policy instead of waiting until 2 AM. There are two ways to use the **Purge Now** option:

Create a Purge Policy

- Choose the purge policies that you want to run now and from the **More Actions** drop-down list, choose **Purge Now**.
- Click the icon under the **Actions** column for the purge policy that you want to run now and choose **Purge Now**.

Create a Purge Policy

- Step 1** From the top-left corner, click the menu icon and choose **Policy > AI Endpoint Analytics > Configurations > Endpoint Purge Policy**.
- Step 2** Click **Add Endpoint Purge Policy**.
- Step 3** In the **Add Endpoint Purge Policy** dialog box, click **Let's Do It** to go directly to the workflow.
- Step 4** In the **Define Policy Details** window, do the following:
- a. Enter a name for your policy in the **Rule Name** field.
 - b. From the **Select Status** drop-down list, choose **Enabled** or **Disabled**.
 - c. Define the time of inactivity after which an endpoint must be purged. Enter a value (in days) in the **Elapsed Greater than or Equal to** field. The accepted value range is from 5 to 180 days.
- Step 5** (Optional) In the **Define Additional Policy Conditions** window, choose the profiling attributes, to filter the endpoints that are impacted by this purge policy. Check the check box next to the attribute you want to select and choose the required values from the drop-down lists displayed for the attribute.
- Step 6** The **Summary** window displays your Purge Policy configuration. Review the details that are displayed and click **Done** to create the policy.

What to do next**Audit Logs of Endpoint Purge Activities**

After you enable an Endpoint Purge Policy and a purge activity is executed, you can view the audit logs. For more information, see [View Audit Logs](#) in the [Cisco Catalyst Center Administrator Guide](#).

Configure Endpoint Subnet Inspection

In a deployment, devices at the access layer and devices above the access layer have different IP subnets. In the case of Cisco TTA devices, endpoint profiling accuracy is optimum when only southbound traffic is analyzed by Cisco AI Endpoint Analytics. To allow better endpoint profiling, configure specific IP subnets or subnet ranges that must be analyzed by Cisco AI Endpoint Analytics.

This configuration of filtered subnets is then shared with Cisco SD-AVC servers. The configuration is applied on Cisco TTA devices through Cisco SD-AVC servers.

- Step 1** From the top-left corner, click the menu icon and choose **Policy > AI Endpoint Analytics > Configurations > Endpoint Subnet Inspection**.
- Step 2** Enter the required value in the **IP Subnet** field.

Step 3 Click + to add another IP subnet. You can add multiple subnets or subnet ranges in this window.

Endpoint Inventory

The **Endpoint Inventory** tab displays details of the endpoints that are connected to Cisco AI Endpoint Analytics through the configured data sources. This view displays the profiling information of all the connected endpoints.

To select the profiling information you want to view for the endpoints, click the vertical ellipsis icon at the top-right corner of the table. Choose one of the following sets of profiling information and click **Apply**:

- **All:** All the profiling information that is available is displayed. You cannot edit this set.
- **General:** This is a selection of profiling information that gives you a generic view of the endpoints. This is the set of columns that are displayed by default. You cannot edit this set.
- **Detailed:** This is a selection of profiling information that provides a deeper view of the endpoints. You cannot edit this set.
- **Custom:** This is the only set that you can edit. Check or uncheck the profiling information that you want to view in the **Endpoint Inventory** window.

You can also filter the list endpoints that is displayed in the **All Endpoints** view by clicking the required **View Known Profiles** buttons. You can filter the list of endpoints by **Endpoint Type**, **Hardware Manufacturer**, **Hardware Model**, and **OS Type**.

To edit or customize the endpoint inventory table that is displayed, click the gear icon in the right corner at the top of the table. The pane that is displayed contains the **Table Appearance**, **Edit Table Columns**, and **Edit Custom Views** menus where you can choose a table view, the information that you want displayed in the table, and create custom views.

Click **Apply** to save the changes, or click **Reset All Settings** to apply the default settings for the endpoint inventory table.

You can easily filter a set of endpoints based on your requirement. The search bar at the top of table allows you to easily find a filter parameter. You can type and use the assisted search feature, or you can scroll the drop-down that is displayed to find and select the required parameters.

Most of the columns contain quick filters. While some filters display drop-down menus for you to choose values from, some filters are text fields you can type into.

You can register endpoints, and edit, delete, and profile the registered endpoints. You can select single or multiple endpoints by checking the check box near the MAC addresses to filter and perform a particular action on the chosen endpoints from the **Actions** drop-down list.

You can delete registered endpoints, unregistered endpoints, and endpoints learned from other sources. When you select an endpoint, a banner row is displayed that allows you to select all the rows in the table. When you click the banner, the banner row now allows you to clear all the rows in the table. To delete all the endpoints, you can click the banner or choose the **Delete** option from the **More Actions** drop-down list.

To see the complete profiling details of an endpoint, click the **MAC Address** of the endpoint. A slide-in dialog box is displayed which contains user details, endpoint details, and attribute details of the endpoint.

In the **Details** tab, the following fields are displayed, with the details received from Cisco ISE:

Export Cisco AI Endpoint Analytics Data

- **Authentication Status:** This field displays **Started** when an endpoint is authenticated through Cisco ISE, and **Disconnected** when it is not.
- **Authorization Profile:** The authorization policies configured for an endpoint in Cisco ISE are displayed here.
- **Security Group Tag:** The Security Group Tags configured for an endpoint in Cisco ISE are displayed here.

For information on these attributes, see the [Cisco ISE Administrator Guide](#) for the Cisco ISE release that you use.

The **Trust Score** tab is available in the slide-in dialog box for endpoint details. This tab displays details of the various factors that inform trust score of an endpoint. See [Trust Scores for Endpoints, on page 780](#).

The **Details** tab contains the **Previous MAC Addresses** area, which displays the MAC addresses that have been used by an endpoint that has the MAC Randomization feature enabled on it. See [Trust Scores for Endpoints with Random and Changing MAC Addresses, on page 786](#).

Export Cisco AI Endpoint Analytics Data

To export a list of endpoints and their details from this window, click **Export**. If you apply any filters in the **Endpoint Inventory** window, only the filtered endpoints will be processed for export. To export the details of all the endpoints, ensure that no filters are applied when you click **Export**.

When you click **Export**, a new tab opens with the **Reports** window. The **Generated Reports** window contains a list of exports initiated, with the latest export request at the top of the list. A report generated from the Endpoint Inventory window contains **AI Endpoint Analytics** in its **Template Category** column. Report generation takes a few minutes. When a report is ready for download, the value in the **Last Run** column changes from **Not Initiated** to a timestamp with a download icon next to it. The timestamp refers to the time at which the export list was generated. Click the download icon to download a CSV file of the list of endpoints to your system.

You can also export Cisco AI Endpoint Analytics data from the **Reports** window, through the following steps:



Note You must run your first export of AI Endpoint Analytics data for endpoints from the **Endpoint Inventory** window. Then you can generate AI Endpoint Analytics reports directly from the **Reports** window.

Step 1 From the top-left corner, click the menu icon and choose **Reports > Report Templates > AI Endpoint Analytics**.

Step 2 If a task overview window appears, click **Let's Do It** to go directly to the workflow.

Note To skip this screen in the future, check the **Don't show this to me again** check box.

Step 3 In the **Select Report Template** window, the template **Endpoint Profiling** is applied by default.

Step 4 In the **Setup Report Scope** window, do the following:

- Enter a name in the **Report Name** field.
- Define the filters that you want to apply to the list of endpoints that you want to export from the **Endpoint Inventory** window.
- To export the details of all endpoints, do not choose any values in the **Scope** area.

- Step 5** In the **Select File Type** window, the **Client Details** area allows you to review the chosen parameters. Edit the information to be exported by checking or unchecking the check boxes next to the relevant fields.
- Step 6** In the **Schedule Report** window, click **Run Now**, **Run Later (One-Time)**, or **Run Recurring** radio button.
- Note** The **Run Later (One-Time)** and **Run Recurring** options display scheduling fields to define the time of export.
- Step 7** In the **Delivery and Notification** window, do not check the **Email Report** check box.
- Step 8** In the **Summary** window, review all the configurations. To make any changes, click **Edit**.
- Step 9** Click the **View Reports** link in this window for a list of generated reports. It takes a few minutes for the report to be generated and displayed in this window.

Filter Endpoints

Use this procedure to filter endpoints based on their profiling data, primary profiling labels, known profiles, and health status.

- Step 1** In the **Endpoint Inventory** window, click **Filter**.
- Step 2** Define the following filters by choosing a value from the corresponding drop-down list, clicking the radio button for the required value, or checking the check box next to the required value for a particular field, as applicable:
- **Profile Status Condition**
 - **Mac Address**
 - **Is Random Mac**
 - **Trust Score**
 - **IP Address**
 - **Last Seen**
 - **Host Name**
 - **Endpoint Type**
 - **OS Type**
 - **Hardware Model**
 - **Hardware Manufacturer**
 - **Registered**

- Step 3** Click **Apply**.

You can also filter the profiled endpoints displayed by the four primary profiling labels. Click one or more of the labels in the **View Known Profiles** section.

The health status of endpoints is updated every 5 minutes.

Attribute Glossary

Attribute glossary is a list of all the profiling attributes available from Cisco ISE probe data.

In order to view all the profiling attributes, follow the below steps.

Step 1 In the **Endpoint Inventory** window, click the MAC address of an endpoint.

Step 2 In the new area that is displayed on the right side, click **View Attribute Glossary**.

The **Attribute Glossary** window displays the following information for each attribute:

- **Key profiling attributes**
- **Description**
- **Associated Profile Labels**
- **Source**
- **Dictionary**
- **Discovery Method**

The glossary gives you a detailed view of all the profiling attributes. If a profiling attribute is frequently used to create a profile label, the label is listed in the **Associated Profile Labels** column.

You can also view the attribute glossary in the **Choose Attribute Condition** window while creating a logical condition for the rules. For more information, see [Create a Custom Rule](#).

Register Endpoints

You can onboard and profile new endpoints by registering them in Cisco AI Endpoint Analytics. The profiling information of an endpoint is the source of truth for classification. You can also update new profile information for a registered endpoint using the **Register Endpoint** option.

Step 1 Choose **Actions > Register Endpoints**.

Step 2 Choose whether you want to register a single endpoint or multiple endpoints, by clicking the **Single** or **Bulk** radio button.

a) Click **Single** radio button, enter the **MAC Address**, **Endpoint Type**, **Hardware Model** and **Hardware Manufacturer** for the endpoint.

b) Click **Bulk** radio button and do the following:

1. Download a .csv template by clicking the **Download .csv Template** option.
2. In the downloaded .csv file, enter the following details for each endpoint you must register: MAC address, endpoint type, hardware model, and hardware manufacturer. Save this file.
3. Upload the .csv file using the **Choose a File** option.

You can register a maximum of 500 endpoints at a time using the **Bulk** option.

Step 3 In the **Review Endpoint** window, review the endpoint details. To make any changes, click **Edit**.

Note While registering an existing endpoint, the profile label changes of the endpoint are reflected in purple color and can be edited.

Step 4 Click **Next** to continue with the registration process.

Step 5 Click **Register**.

Edit Registered Endpoints

You can update the profiling information of registered endpoints from the **Endpoint Inventory** window.

Step 1 Check the check box adjacent to the MAC address of the endpoint that you want to edit.

Step 2 Click **Actions**.

Step 3 Click **Edit Endpoint**.

Step 4 Enter the **Endpoint Type**, **Hardware Model**, and **Hardware Manufacturer** details.

Step 5 Click **Save**.

Delete Registered Endpoints

If there are registered endpoints that are no longer part of your network, you can delete them from Cisco AI Endpoint Analytics.

Step 1 Check the check box adjacent to the MAC address of the endpoints that you want to delete.

Step 2 Click **Actions**.

Step 3 Click **Delete Endpoint**.

The following message is displayed:

Do you really want to delete the selected endpoint(s) ?

Step 4 Click **Yes** to permanently delete the endpoint from Cisco AI Endpoint Analytics.

Trust Score

The Trust Score window consists of two tabular sections:

Alerts:

Alerts appear when there is a deviation caused by anomalies or vulnerabilities, or when a weakness is identified in endpoint connections or interfaces. These alerts reflect a detection that has a negative impact on the trust score (such as concurrent MAC address detection, NAT mode, or other untrustworthy changes). You can monitor the alerts to quickly address the most urgent risks within your network.

The **Alerts** tab displays the various alerts received by the endpoints in the network. Earlier you had to individually check the details for each endpoint to see the type of alerts the endpoint has received and there

Trust Scores for Endpoints

was no way to know what other endpoints have received the same alert. Now, you have the capability to know all the endpoints that have received a particular type of alert. You can click on any alert to view the list of endpoints that have received this alert. You can further click on each endpoint to see the details. The alerts can be in any of the following three states:

- **Open:** An alert is in the open state when the alert is initially detected for an endpoint and an action is required from your side to resolve the alert or address it later.
- **Disabled:** If you do not want to take any action on an open alert, you can move it to the disabled state. You can disable the alert for any time period and even indefinitely. During this time period, the alert remains in the disabled state even if any new endpoints are detected with this alert.
- **Reset:** If you do not want to take any action on an alert right away, you can move it to the reset state. When this alert is detected on another endpoint after resetting, the alert is brought back to the open state.

Endpoint:

This view displays columns for the various factors that inform the overall Trust Score of an endpoint. The Trust Score helps you identify the endpoints in which behavioral anomalies have been detected, so you can examine the details of the endpoint and take the necessary remediation actions. If you apply an ANC policy to an endpoint to manage its low Trust Score, the Trust Score view also displays the name of the ANC policy applied and when the policy was applied. See [Trust Scores for Endpoints, on page 780](#).

Using the option **Reset Trust Score**, you can now reset multiple endpoints at the same time with an upper limit of 10 endpoints to avoid any performance issues. While resetting the endpoints, a justification is required for the action for audit purposes. Once an endpoint is reset, the endpoint is cleared of its trust score and any ANC policy that was applied to it.

Trust Scores for Endpoints

Cisco AI Endpoint Analytics assigns Trust Scores to endpoints to allow you to easily monitor and act on potentially risky endpoints in your network. Behavioral anomalies are monitored and tracked, and a Trust Score is assigned based on the number and frequency of the anomalies tracked.

To choose the sources that must be included in the calculation of Trust Scores, from the Cisco AI Endpoint Analytics **Overview** window, choose **Configuration > Trust Analytics**. Click a source to open its slide-in configuration window on the right. Click the toggle button to enable the source.

Cisco AI Endpoint Analytics generates historical Trust Scores based on the following factors:

- The history of anomalies associated with an endpoint—how many anomalies have been detected for this endpoint?
- The severity of each anomaly detected for the endpoint.

The overall Trust Score calculation for an endpoint factors in the following anomalies and scores are displayed for each anomaly that is detected (if the corresponding source is enabled):

- **AI Spoofing Detection**

Cisco AI Endpoint Analytics analyzes NetFlow telemetry data, and network probe data from Cisco ISE and SD-AVC devices, to detect spoofed endpoints. For more information on how to configure NetFlow Collector servers, see [Configure Syslog, SNMP Traps, NetFlow Collector Servers, and Wired Client Data Collection Using Telemetry, on page 31](#). Probe and NetFlow data from Catalyst Center Traffic Telemetry Appliances (DN-APL-TTA-M) is also analyzed. Configure inbound span of traffic toward

your Catalyst Center Traffic Telemetry Appliances so the endpoint traffic data is then available to Cisco AI Endpoint Analytics for spoofing detection.

Each endpoint type has a behavior model that is developed using machine learning algorithms. Based on the data received for an endpoint, if an endpoint's behavior is unexpected of its endpoint type profile, the endpoint is assigned a low Trust Score in the AI Spoofing Detection area. The applications and server ports that are used by an endpoint are analyzed in this spoofing detection process. For example, if an endpoint profiled as a printer uses a video calling application, it is identified as a spoofed endpoint and assigned a Trust Score.

Endpoints are identified by their MAC addresses on a Catalyst Center-managed switch. Several endpoints using a single MAC address such as by using NAT, running a virtual machine or a container, is not a supported configuration on Cisco AI Endpoint Analytics.

AI Spoofing Detection covers the following device types:

- IP Phones
- Printers
- Cameras
- Building automation devices with the following hardware model attributes:
 - Automated-Logic-Device
 - Honeywell-Device
 - Johnson-Controls-Device
 - Rockwell-Automation-Device
 - Schneider-Electric-Device
 - Siemens-Automation-Device
 - Siemens-Building-Device
 - Trane-Device
- Telepresence:
 - Endpoints with one of the following hardware models:
 - Cisco-Tandberg-Device
 - Cisco-TelePresence
 - Cisco Telepresence SX80
 - Cisco Telepresence SX20
 - Cisco-Collaboration-Room-Endpoint
 - Poly-Device
 - Endpoints with the device type Video Conferencing
- **Endpoint Attribute Conflict**

Trust Scores for Endpoints

When a device joins a network, and then through periodic probing while the device is active, the profiling data for an endpoint is continuously monitored and updated. Certain changes in the profiling data that is received from an endpoint are flagged as anomalies in Cisco AI Endpoint Analytics. For example, if an endpoint was first profiled as a Linux device and is then profiled as a macOS device, this is flagged as a high-severity anomaly. A score is assigned in the Endpoint Attribute Conflict column for the endpoint and the endpoint's overall Trust Score is also updated to reflect this change.

However, if there is a change in the version of macOS and the endpoint appears to have downgraded from a later release to an earlier release, such a change is flagged as a lower priority anomaly and the corresponding scores are updated accordingly.

- **NAT Mode Detection**

If you have a NAT-enabled router in your network, an endpoint that is connected to a NAT router is recognized by the IP or MAC addresses of the router instead of the IP or MAC addresses of the specific endpoint. Information on NAT-enabled routers is collected from the Cisco Catalyst 9000 Series devices they are connected to.

- **Concurrent MAC Addresses**

Identify the endpoints that share the same MAC addresses and are connected to Cisco Catalyst 9000 Series devices. The endpoints with shared MAC addresses are assigned a Concurrent MAC Address score, and you can easily identify these endpoints and examine their details.

- **Security Sensor**

With the Security Sensor scan feature, you can install active probes on specific Cisco Catalyst 9000 Series switches, and configure Cisco AI Endpoint Analytics to scan endpoints for open ports that are not expected to be open, for credential vulnerabilities or both.

The Trust Score of an endpoint is also informed by the following events that are collected from Cisco ISE. Every endpoint that authenticates through Cisco ISE receives an initial Trust Score based on the following events:

- **Authentication Method**

- **Posture**



Note For the Trust Score sources that receive data from Cisco Catalyst 9000 Series devices, you must enable CBAR on the devices and upgrade the devices to Cisco IOS-XE Release 17.6 or later.

The Trust Score that is displayed in the **Endpoint Inventory** window is the overall trust score that takes the history and severity of anomalies for an endpoint. Click the **MAC Address** to view the details of the causes for the Trust Score that is assigned to an endpoint. This means that if a low-level anomaly was detected for an endpoint, and this is the only instance of an anomaly, the overall Trust Score for the endpoint would be a 9.

If multiple low-level anomalies are detected, the overall Trust Score would further decrease to account for the number of anomalies.

The trust scores assigned range from 1 through 10, and are categorized as follows:

Trust Score Category	Range	Threat Level of Endpoint
Low	1–3	High

Trust Score Category	Range	Threat Level of Endpoint
Medium	4–6	Moderate
High	7–10	Low

You can then apply Adaptive Network Control (ANC) policies from Cisco ISE to enforce appropriate remediation actions on the endpoints. See section “Adaptive Network Control” in Chapter “Cisco ISE Admin Guide: Maintain and Monitor” of the [Cisco ISE Administrator Guide](#).

The ANC policies are defined in Cisco ISE and allow you to apply remediation actions on chosen endpoints. You can apply ANC policies to quarantine, shut down, or port bounce an endpoint, or force endpoint reauthentication. When you apply an ANC policy to an endpoint with an undesirable Trust Score in Cisco AI Endpoint Analytics, a Change of Authorization (CoA) is sent to the endpoint from Cisco ISE.

An endpoint is identified by its MAC address. Cisco ISE sends the CoA to the endpoints that hold an active session for the identified MAC address at the time of the ANC application. Any endpoint with the same MAC address that does not have an active session in Cisco ISE at the time matches the ANC policy when a new session starts or when it must reauthenticate at the end of the configured reauthentication timer.

To verify which endpoint is being acted upon by the ANC policy, log in to your Cisco ISE administration portal. From the main menu, choose **Operations > RADIUS > Live Sessions**. Enter the MAC address of the spoofed endpoint in the **Endpoint ID** column, to filter the endpoints that share the same MAC address and currently have live sessions in Cisco ISE. These are the endpoints that will be affected by the ANC policy.

To view a historic log of the RADIUS sessions in Cisco ISE, from the main menu, choose **Operations > Reports > Reports > Endpoints and Users > RADIUS Authentications**.

To view or modify ANC policy application on endpoints in Cisco ISE, from the main menu, choose **Context Visibility > Endpoints**. Check the check box next to the MAC address of an endpoint and click the options that are displayed at the top of the list, as required.

Prerequisites

Prerequisites for receiving Trust Scores for endpoints:

- Cisco ISE is connected to your on-premises Catalyst Center.
- Network access devices are managed by both Cisco Catalyst Assurance and Cisco ISE.



Note

The endpoint spoofing detection feature supports a maximum of 500 network access devices with NetFlow export flows, as Cisco Catalyst Assurance supports only 500 NetFlow exporters.

-
- Endpoints connected to network access devices are authenticated through Cisco ISE.
 - Enable the required sources for Trust Score calculation in the Trust Score Sources window (**Policy > AI Endpoint Analytics > Configurations > Trust Analytics**).

Endpoint Attribute Conflict

Cisco AI Endpoint Analytics collects data from multiple probes from different sources continually to derive accurate profile labels for endpoints. Cisco AI Endpoint Analytics collects the following data from the following sources:

From Cisco ISE:

- RADIUS probes.
- User details from Directory.
- VPN details like AnyConnect availability.
- Optionally, other data if port forwarding is configured. For example, DHCP details.

From switches:

- Device connection messages. For example, DHCP and NetBIOS messages.
- Deep packet inspection
- Switch telemetry

Cisco AI Endpoint Analytics creates system rules based on the information received from these sources. When a device joins a network, and then through periodic probing while the device is active, the profiling data for an endpoint is continuously monitored and updated.

Certain changes in the profiling data received from the endpoint are flagged as anomalies in Cisco AI Endpoint Analytics. For example, if an endpoint was first profiled as a Linux device and is then profiled as a macOS device, this is flagged as a high-severity anomaly. A score is assigned in the Endpoint Attribute Conflict column for the endpoint and the endpoint's overall Trust Score is also updated to reflect this change.

However, if there is a change in the sub-version of macOS and the endpoint appears to have downgraded from a later release to an earlier release, such a change is flagged as a lower priority anomaly and the corresponding scores are updated accordingly.

In the **Endpoint Inventory** window, click the MAC Address of an endpoint with a **Endpoint Attribute Conflict** score to view the profiling data changes recorded. The old and new profiles for the endpoints are displayed here. If the profiling changes are not of concern for any reason, or if you think the profiling change detected is erroneous, reset the score by clicking the corresponding button in the **Endpoint Attribute Conflict** area of the endpoint's details.

You can also disable Endpoint Attribute Conflict detection for a specific endpoint by clicking the toggle button in the Endpoint Attribute Conflict area of the endpoint's details.

Data regarding this anomaly is sent to Cisco ISE if the affected endpoint is connected to Cisco ISE. The data is available as an Endpoint Analytics dictionary attribute that a Cisco ISE administrator can easily use to define policies.

Endpoint Attribute Conflict detection is not available for the endpoints that have Custom Rules applied to them.

NAT Mode Detection

Network Address Translation (NAT) allows private IP internetworks that use nonregistered IP addresses to connect to the Internet. NAT can be configured to advertise to the outside world only one address for the entire network. If you have a NAT-enabled router in your network, an endpoint connected to a NAT router

is recognized by the IP or MAC addresses of the router instead of the IP or MAC addresses of the specific endpoint. Information on NAT-enabled routers is collected from the Cisco Catalyst 9000 Series devices they are connected to.

NAT detection is included in Trust Score calculation as a device acting as a NAC-enabled router could allow unauthorized endpoints to connect to your network. For the endpoints that are assigned a NAT Mode Detection score, in the **Endpoint Inventory** tab, click the MAC Address to view the details of the endpoint in a slide-in window. If you are certain that the identity of the endpoint corresponds to a NAT-enabled router in your network:

1. Click **NAT Mode Detection** in the Trust Score tab of the details slide-in window.
2. Click the toggle button to disable NAT Detection for this specific endpoint.

Endpoints with Concurrent MAC Addresses Connected to Cisco Catalyst 9000 Series Devices

Identify the endpoints that share the same MAC addresses and are connected to Cisco Catalyst 9000 Series devices. The issue of endpoints with concurrent MAC addresses occurs in wired environments and in hybrid environments that contain wired and wireless deployments. In a wireless environment, concurrent MAC addresses do not occur as only one endpoint with a specific MAC address is allowed to access the network at any time.

Cisco AI Endpoint Analytics allows you to identify the endpoints with concurrent MAC addresses by assigning a Concurrent MAC Address score to the endpoints. To detect endpoints with shared MAC addresses in your network, you must enable CBAR in the connected Cisco Catalyst 9000 Series devices.

When devices with the same MAC Address connect to a Cisco Catalyst 9000 Series device, the endpoints are recognized as concurrent endpoints and a low score is assigned to the MAC Address. Endpoints with concurrent MAC addresses may be connected to:

- The same Cisco Catalyst 9000 Series device from different VLANs
- Different Cisco Catalyst 9000 Series devices

Table 46: Environments in Which the Concurrent MAC Address Issue Occurs

Deployment 1	Deployment 2	Can Concurrent MAC Addresses Occur in the Network?	Concurrent MAC Addresses Detection Support in this Environment
Wired	Wired	Yes	Yes
Wired	Wireless	Yes	Yes
Wireless	Wired	Yes	Yes
Wireless	Wireless	No	No

The **Trust Scores** view of the **Endpoint Inventory** tab contains the **Concurrent MAC Address** column. Shared MAC addresses are detected as an anomaly and a low score is assigned in the **Concurrent MAC Address** column. Click the MAC Address to view a slide-in window with the details of the MAC Address. Click **Concurrent MAC Address** and the field expands to display information regarding the various sources of the MAC address.

In the **Concurrent MAC Address** area, the **Network Device Name** column displays the name of the Cisco Catalyst 9000 Series device to which an endpoint is connected. The **Interface** and **VLAN** columns display the corresponding values to help you identify how the endpoint is connected to the network.

Initial Trust Score Assessment Using Posture and Authentication Values from Cisco ISE

When an endpoint authenticates through Cisco ISE, a Trust Score is immediately assigned to the endpoint based on its authentication and posture details. Authentication Method score is assigned by default and you cannot disable or act upon this score. You can choose to enable or disable Posture-based scores, either at a global level from the **Configurations** window, or for a particular endpoint in the **Endpoint Inventory** tab. The Trust Score that is assigned based on the Authentication Method and Posture values becomes the initial Trust Score for the endpoint.

Any other anomalous behaviors detected for this endpoint would then impact this initial Trust Score and drive it lower based on the severity and number of the anomalies.

The **Authentication Method** score, displayed in the details of an endpoint in the **Endpoint Inventory** tab, is based on the perceived security level of the authentication method used. For example, WebAuth Over HTTPS, certificate-based authentication, and authentication using secure tunnels receive high Trust Scores.

The **Posture** score is based on whether or not the connect endpoint is posture compliant.

If an endpoint's Trust Score consists of only the Authentication Method score, the **Reset Trust Score** button is inactive. When a Trust Score source other than the Authentication Method displays a score, you can use the reset option.

Trust Scores for Endpoints with Random and Changing MAC Addresses

As a privacy measure, mobile devices increasingly use random and changing MAC addresses for each SSID that they connect to. Some desktop operating systems offer users the ability to randomize MAC addresses at regular intervals as well. This means that an endpoint presents different MAC addresses every time they connect to a different SSID.

Cisco AI Endpoint Analytics enables you to handle the issue of random and changing MAC addresses by receiving from Cisco ISE a unique endpoint identifier called the DUID (also known as GUID in Cisco ISE). Cisco AI Endpoint Analytics then uses the DUID as the identifier for an endpoint, instead of its MAC address. For more information how GUIDs are assigned in Cisco ISE, see Cisco ISE Administration Guide, Release 3.1.

The Endpoint MAC Randomization dashlet in the Cisco AI Endpoint Analytics **Overview** window displays a graphical representation of how many endpoints in your network are using random and changing MAC addresses.

For the endpoints that are connected to Cisco ISE and have DUID information available, this information is displayed in Cisco AI Endpoint Analytics as well. The following columns display the required information in the **Endpoint Inventory** window in Cisco AI Endpoint Analytics:

- **DUID:** The DUID value for the endpoint.
- **Previous MAC Addresses:** The random and changing MAC addresses with which the endpoint previously connected to the network.

Using the DUID value, Cisco AI Endpoint Analytics is now able to reliably identify an endpoint and track the various MAC addresses that the endpoint has previously used. This means that the Trust Score for an endpoint with random and changing MAC addresses still has high fidelity. The Trust Score of the endpoint from a previous MAC addresses is carried forward to the current MAC address that the endpoint is presenting and continues to be impacted by the probe data received for the same endpoint.

If a device has the **Private Address** setting enabled, the **Is MAC Random** column for this device displays the value **Yes**. This device is then recognized as a random and changing MAC address. However, whether or

not a DUID value is available for this device depends on whether or not the endpoint was authenticated through Cisco ISE and if a GUID was generated for this endpoint in Cisco ISE.

Sensor Scans to Check for Open Ports and Credential Vulnerabilities

Install an active probes container to gain more information about the endpoints in your network. When you enable security sensor scans, the Trust Score that is assigned to an endpoint takes into account any anomalies in open ports and endpoint login credentials.

The sensor scan feature is supported by the following switches:

- Cisco Catalyst 9300 Series switches
- Cisco Catalyst 9400 Series switches



Note Cisco Catalyst 9800 Series Wireless Controllers do not support the sensor scan feature.

Cisco AI Endpoint Analytics uses the Application Hosting capability that is available on the switches to enable scans for open ports and weak credentials.

Enable and Monitor Sensor Scans

Before you begin

- Connection to Cisco ISE Release 3.1 or later releases, if you want to enforce endpoint policies based on the scan results.
- Connection to Cisco Catalyst 9300 or 9400 Series devices.
- Ensure that the switches are upgraded to Cisco IOS XE Release 17.7.1 or later releases.

Step 1 Log in to your Catalyst Center.

Step 2 From the main menu, choose **Policy > AI Endpoint Analytics**.

Step 3 In the **Overview** window that is displayed, click **Configurations**.

Step 4 From the left pane, choose **Trust Analytics**.

Step 5 In the **Security Sensor** area, the prerequisites for using the sensor scans feature to identify open ports and weak endpoint credentials are displayed. Click the corresponding links in this area to carry out the following tasks:

- a. Verify the supported Catalyst Center and Cisco IOS-XE releases from the release notes for Cisco Catalyst 9000 Series devices. Download the security sensor container from software.cisco.com for the relevant Cisco Catalyst 9000 Series device. A .tar file downloads to your system.
- b. Install App Hosting in your Catalyst Center. See [Application Hosting, on page 660](#) for instructions.
- c. Upload the .tar file in your Catalyst Center App Hosting window. The link to the App Hosting window is displayed in the **Security Sensor** area.
- d. Install and enable the .tar file in each Cisco Catalyst 9000 Series device that you want to enable sensor scans on.

In your Catalyst Center App Hosting window, check that the **App Hosting Status** is active for least one of the Cisco Catalyst 9000 Series devices on which you enabled the .tar file.

Step 6 After the active probes container is installed and enabled as explained in the previous step, in the **Security Sensor** area, you can configure Trust Score settings in Cisco AI Endpoint Analytics to scan for open ports and weak credentials on endpoints that are connected to Cisco ISE and the Cisco Catalyst devices on which the active probes application is enabled.

- Click the **Open Port Scan** toggle button to enable Cisco AI Endpoint Analytics to proactively run port scans to detect and close possible vulnerabilities on defined endpoints on the network.
- Click the **Credential Vulnerability Scan** toggle button to enable Cisco AI Endpoint Analytics to proactively detect when endpoints on your network are using weak credentials in order to prevent malicious activity.

Step 7 (Optional) If you choose to enable scanning for open ports, you can define the scan by clicking **Scan Configuration** in the **Open Port Scan** area.

- a) In the **Scan Configuration** window, in the **Defined Scans** tab, click the **Define Scan** button.
- b) A dialog box is displayed that allows you to define the scope of a port scan:
 - To scan each endpoint at the time of endpoint enrollment, choose the **On enrollment, scan all endpoints** radio button.
 - To define the scope of the open port scan by subnet, profiling attributes, and more, choose the **Create a Custom Scan** radio button.

In both types of port scan, you define a list of unauthorized ports to specify the ports that must always be closed. This list allows Cisco AI Endpoint Analytics to recognize anomalous port activity on an endpoint and assign it a low trust score. For both port scan types, the minimum frequency of scan that you can configure is 12 hours.

- c) In the **Scan Configuration** window, in the **Open Ports List** tab, specify the type and range of ports, or individual ports, that must be scanned.
- d) In the **Scan Configuration** window, in the **Unauthorized Ports** tab, define by port number and port type, the ports that are unauthorized in your network. If Cisco AI Endpoint Analytics detects these ports as active, the endpoint is given a low trust score for the anomaly of an active unauthorized port.

Step 8 (Optional) If you choose to enable the detection of weak credentials, you can define the scan by clicking **Scan Configuration** in the **Credential Vulnerability Scan** area. SSH and TELNET protocols are supported by this feature.

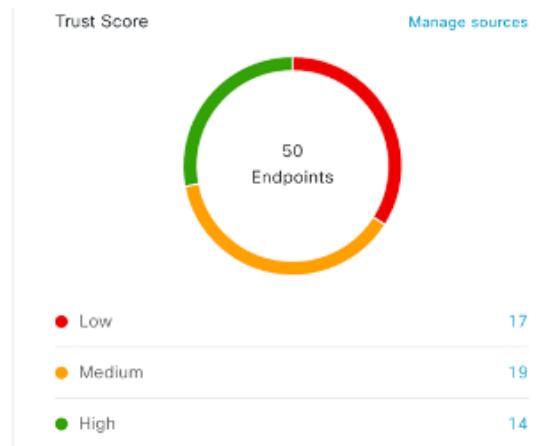
- a) In the **Credential Vulnerability Scan** window, in the **Scan** tab, define a list of credentials that you want to identify as weak credentials. Define lists of usernames and passwords that are considered vulnerable according to your enterprise requirements.
- b) In the **Credentials** tab, a default list of more than 3500 weak credentials is available by default. You can use this default list to create a credential vulnerability scan. To add a new list of vulnerable credentials, click **Create New List**.

The minimum frequency of credential vulnerability scan that you can configure is 12 hours.

Step 9 For the scans that you enable in the **Security Sensor**, the relevant endpoints are scanned and if anomalies are detected in open ports or credential checks, the Trust Score for these endpoints is adjusted accordingly. In the **Endpoint Inventory** tab, where applicable, the **Trust Score** tab for an endpoint displays the list of unauthorized ports that are open on the endpoint, or weak usernames, or both.

View and Manage Trust Scores for Endpoints

Figure 29: Trust Score Dashlet in Cisco AI Endpoint Analytics Overview Tab



After Catalyst Center is upgraded and necessary Trust Score sources are enabled, the Cisco AI Endpoint Analytics **Overview** tab (main menu > **Policy** > **AI Endpoint Analytics**) displays the **Trust Scores** dashlet. This dashlet contains the following information:

- The total number of endpoints that have been assigned a Trust Score.
- A donut chart and a list of the number of endpoints with low, medium, and high trust scores.

To view the details of endpoints in a trust score category, click its endpoint count in the **Trust Scores** dashlet. The **Trust Score** view of the **Endpoint Inventory** tab is displayed with the appropriate filters applied.

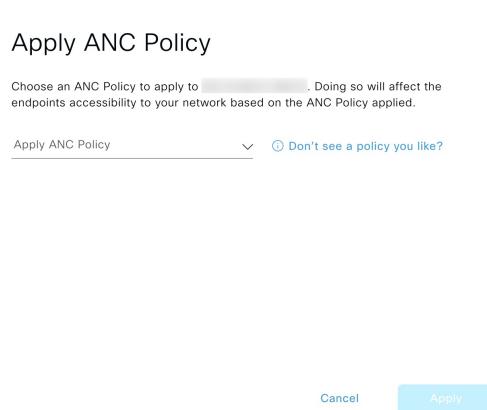
You can view endpoints with Trust Scores in two ways:

- In the **Trust Score** tab, choose the **Endpoints** tab to see all the endpoints with Trust Scores assigned.
- In the **Endpoint Inventory** tab, click **View endpoints in Trust Score View** from the caution message that is displayed, to see endpoints with Low and Medium scores.

You can perform the following actions on endpoints with Trust Scores:

- **Apply an ANC Policy**

View and Manage Trust Scores for Endpoints



Click the **Apply ANC Policy** button to choose an ANC policy to be applied to an endpoint. The endpoint's access to the network is modified accordingly. ANC policies are imported from Cisco ISE and displayed in the drop-down list in the pop-up window displayed.

- **Replace an ANC Policy**



Click **Change ANC Policy** button to replace an existing ANC policy of an endpoint with another ANC policy. From the pop-up window displayed, choose the new policy to be applied from the **Change ANC Policy** drop-down list.

- **Remove an ANC Policy**



Remove ANC Policy

Removing the ANC Policy will restore the endpoints connectivity back to its normal state. Do you want to remove?

[Cancel](#)

[Remove](#)

Click the **Remove ANC Policy** button to remove an applied ANC policy from an endpoint. In the pop-up window displayed, click **Remove**. This removes the remediation policy that was applied to the endpoint, and allows the endpoint to connect to the network normally.

- **Reset Trust Score**

Figure 30: Reset Trust Score for an Endpoint Without an ANC Policy



Reset Trust Score

By resetting, you are acknowledging the low trust score of the endpoint. We recommend leaving a description below of any actions you took to address the low trust score.

Enter Description

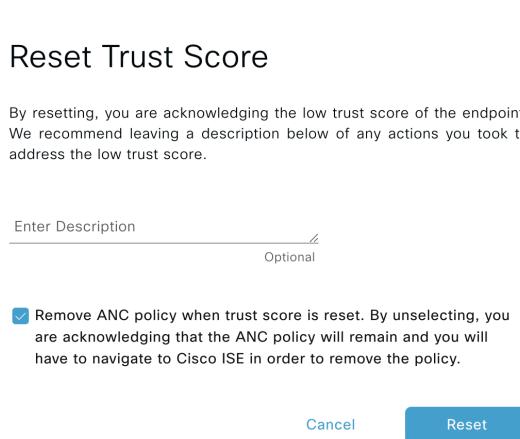
Optional

[Cancel](#)

[Reset](#)

View and Manage Trust Scores for Endpoints

Figure 31: Reset Trust Score for an Endpoint with an ANC Policy



Click **Reset Trust Score** button to remove an endpoint from the Trust Score inventory. In the pop-up window displayed, click **Reset**.

If you choose this option for an endpoint after applying an ANC policy, you will not see this endpoint in the Trust Score inventory again. In this case, to modify the ANC policy for such an endpoint, you must remove the policy from Cisco ISE instead.

If you reset the score for an endpoint without applying an ANC policy, you may see the endpoint in the Trust Score inventory again with the next automatic refresh of Trust Score data.

The buttons for each of the actions are displayed in two locations in the **Endpoint Inventory** tab. The actions can be performed on a single endpoint, or on multiple endpoints.

- **Manage Trust Score for Single Endpoint**

Figure 32: Trust Score Options for an Endpoint Without an ANC Policy

MAC Address	Trust Score	Date Trust Score Reported	Date ANC Policy
XXXXXXXXXXXXXX	4	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	7	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	7	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	1	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	1	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	4	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	1	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	7	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	4	Aug 05, 2020 03:07 PM	-
XXXXXXXXXXXXXX	7	Aug 05, 2020 03:07 PM	-

Figure 33: Trust Score Options for an Endpoint with an ANC Policy

The screenshot shows the Cisco DNA Center Endpoint Inventory page. At the top, there is a message: "AI Endpoint Analytics works for endpoints coming to Cisco DNA Center from ISE running one of (2.4.0 Telemetry Appliance running IOS-XE 17.3.1 or later)." Below this, there are tabs: Overview, Endpoint Inventory (which is selected), Profiling Rules, and Hierarchy. A filter bar is present with the text "Focus: Trust Score". The main table lists endpoints with columns: MAC Address, Trust Score, Date Trust Score Reported, and Date ANC Policy Applied. One row is highlighted with a blue border, corresponding to the MAC address XXXX-XXXX-XXXX. The details pane on the right shows the Trust Score tab selected, displaying the value "4", the date "Time ANC Policy Applied Aug 05, 2020 02:21 PM", and the policy name "ANC Policy DCS_SHUTDOWN". Below the details pane, there are buttons for "Reset Trust Score", "Remove ANC Policy", and "Change ANC Policy".

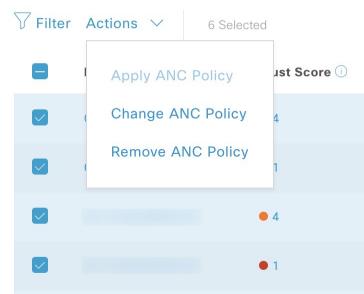
From the list of endpoints with a Trust Score, click the MAC Address of the endpoint you want to manage. In the endpoints details pane that is displayed, click the **Trust Score** tab.

Here, **Expected Endpoint Type** value is displayed. The **Applications Used** field lists the applications that are used by the endpoint.

This pane includes buttons to start the workflows of accepting and removing ANC policies, and to reset the Trust Score. Click the button for the intended task.

Alternatively, you can check the check box for an individual endpoint on the **Endpoint Inventory** window, click **Actions**, and choose the required option from the drop-down list.

- **Manage Trust Score for Multiple Endpoints**



In the **Endpoint Inventory** tab, check the check boxes for all the endpoints you must perform a specific action on. Click **Actions** and choose the required action from the drop-down list.

Control Endpoint Spoofing

Concurrent MAC address detection means that two endpoints with the same MAC address are detected accessing the network and generating traffic. It then becomes imperative to distinguish between the real endpoint and the spoofed endpoint and take the necessary remediation action for the spoofed endpoint.

The Control Endpoint Spoofing feature provides granular policy control by providing network information other than just the MAC address of an endpoint. Network information includes site information, network device IP address, network device port, first authorized timestamp, last authorized timestamp, and the duration for which the endpoint has been available in the network. You can choose to distinguish the entries by the MAC address as done traditionally, or by using both the MAC address and the network information provided. If you choose to distinguish by MAC address and connectivity (network information), a selection is made automatically to detect the spoofed endpoint. You can either go with the automatic selection or choose the one you feel is the spoofed endpoint, and apply the appropriate remediation action for that endpoint. The remediation actions available are the Adaptive Network Control (ANC) policies configured in Cisco ISE.

Because this is the granular way of applying the policy, you won't see a listing for this policy in **Operations > Adaptive Network Control > Endpoint Assignment**.

For endpoints without concurrent MAC address detection and only NAT mode detection, an ANC policy is applied as described in [View and Manage Trust Scores for Endpoints, on page 789](#). In such a scenario, the endpoint gets listed under **Endpoint Assignment** in Cisco ISE.

For endpoints with both concurrent MAC addresses and NAT mode detection, the precedence is given to granular policy control. So, when you click **Apply ANC Policy**, you get the new **Apply ANC Policy** window with two options, to distinguish the entries.

You can also choose to change the ANC policy for an endpoint at any point of time. While changing the ANC policy, you have an option to choose more than one entry for which the ANC policy can be applied.



Note If you chose **Shutdown** as the remediation action, and you want to change the action, the endpoint won't be brought back automatically after changing the action. You must manually turn on the interface in the switch to which the endpoint is connected.

An ANC policy can also be removed at any point of time.

Before you begin

The dynamic author must be configured in the network devices. We recommend that you provision the network devices with the AAA configuration from Catalyst Center.

-
- Step 1** From the Catalyst Center GUI, choose **Policy > AI Endpoint Analytics > Endpoint Inventory > View endpoints in trust score view**.
 - Step 2** Click the endpoint that you want to check and apply the ANC policy to.
 - Step 3** Choose **Trust Score > Concurrent MAC Address**.
 - Step 4** Click **Apply ANC Policy**.
 - Step 5** In the **Apply ANC Policy** window, choose **Based on MAC address** or **Based on MAC address and connectivity**.
 - Step 6** Choose the appropriate remediation action from the **Apply ANC Policy** drop-down list.
 - Step 7** Click **Apply ANC Policy**.

After completing this task, when you return to the **Trust Score** view for that endpoint, you can see the ANC policy name and the network device IP address to which the policy was applied, along with the time at which the ANC policy was applied.

To verify the configuration, in the Cisco ISE GUI, choose **Operation > RADIUS > Live logs**. You can filter the **Identity** column by endpoint MAC address.

An entry for the CoA action that was initiated from Cisco ISE for this endpoint is listed. If you check the details, the **CoA Reason** shows the ANC policy that was applied by you for the endpoint.

Profiling Rules

Profiling rules in Cisco AI Endpoint Analytics enable you to group endpoints with a combination of common attributes. These attributes allow endpoint identification by Endpoint Type, OS Type, Hardware model, and Hardware Manufacturer. The profiling rules help you administer and manage many endpoints with ease.

Cisco AI Endpoints Analytics receives profiling data from network devices through DPI, media protocols, medical industry protocols, and more. Profiling data from Cisco ISE is communicated through pxGrid. These profiling attributes are then available in the device dictionary for authoring profile rules.

You can view the profiling rules in the **Profiling Rules** tab of Cisco AI Endpoints Analytics. In the table that is displayed under this tab, click a **Rule Name** entry to view the assigned profiles and attributes used.

The profiling rules that are used to profile the endpoints in Cisco AI Endpoint Analytics are:

- System Rules
- Custom Rules
- Cisco AI Rules

Rule Prioritization

The profiling rules in Cisco AI Endpoint Analytics have an order of priority. Profiling rule execution follows this rule priority to profile endpoints with high fidelity.

As user inputs are primary in Cisco AI Endpoint Analytics, the priority of the profiling rules is as follows:

- Administrator-created static profiles, for example, profiles added using the **Register Endpoints** option.
- Administrator-created custom rules.
- Cisco-provided system rules that are available by default.
- Auto-generated rules through the machine learning-enabled Smart Grouping workflow.

To view the set rule priority, click **Rule Prioritization** in the **Profiling Rules** window.

A registered endpoint can be profiled by multiple Cisco AI Endpoint Analytics rules for different profiling labels. The following table shows the design of profiling rules for two endpoints.

Endpoint 1	Endpoint 2
Hardware Model profiled by System Rule	Hardware Model profiled by System Rule
OS Type profiled by Cisco AI Rule	Hardware Model profiled by Custom Rule
Hardware Manufacturer profiled by Custom Rule	Hardware Model profiled by Cisco AI Rule

For Endpoint 2, rule priority results in the precedence of the custom rule over the others. The Hardware Model label for Endpoint 2 is profiled by the custom rule.

For Endpoint 1, different rules define different profile labels, and each label is profiled accordingly.

Filter Profiling Rules

Step 1 In the **Profiling Rules** window, click **Filter**.

Step 2 Enter a name in the **Rule Name** field.

Step 3 Select values for endpoint attributes from the corresponding drop-down lists, to filter for a set of endpoints.

Step 4 Click **Apply**.

View Updated Profiling Rules

Step 1 Go to the **Endpoint Inventory** window.

Step 2 Click the check box adjacent to the MAC Address of the endpoint to view the profiling details of the endpoint.

Step 3 Click the information icon next to profile labels, and click the rule name to view the assigned profile and attributes details.

System Rules

Cisco AI Endpoint Analytics provides predefined rules called System rules for profiling endpoints. When Cisco AI Endpoint Analytics is deployed, it provides day-zero visibility into endpoints without any need to configure specific rules.

Newly onboarded endpoints are profiled using system rules by default.

Network devices are managed in Catalyst Center in the **Provision > Network Devices > Inventory** window.

These network devices are profiled by the system rules and are not visible in the Cisco AI Endpoint Analytics **Endpoint Inventory** window. However, you can view the endpoints profiled by custom rules because the custom rules are created with network device as **Device Type**.

Automatic System Rule Updates for Endpoint Profiling

The system rules that are used for endpoint profiling in Cisco AI Endpoint Analytics are regularly updated to enhance profiling accuracy. Schedule automatic updates to receive updates in endpoint profiling system rules from Cisco. Your Catalyst Center receives updates at the configured time, and the changes are applied

in Cisco AI Endpoint Analytics. In the **Profiling Rules** window (**Policy > AI Endpoint Analytics > Profiling Rules**), review the details of the changes in endpoint profiles, and accept or decline the system rule update.

If an endpoint's hardware model value changes due to an accepted system rule update, when you view the endpoint's details in the **Endpoint Inventory** tab, the **Hardware Model** field contains the name of the system rule update.

Before you begin

Configure and enable NBAR Cloud. See [Configure CBAR Cloud, on page 643](#).

To check the status of NBAR Cloud, choose **Policy > AI Endpoint Analytics > Overview**, and click **Configuration**.

Step 1 From the main menu, choose **System > Settings > Cisco Accounts > Profile Rule Settings**.

The **Enabled** toggle button in the **Schedule Automatic Updates** area is set to active by default.

Step 2 Click the buttons for the days of the week on which you want to schedule updates. You can choose multiple days. Then, use the **Time Slot** text fields to select the time for the update. It takes 30 minutes for the updates to be received by Catalyst Center. The second time slot area is not editable and displays the time when the scheduled update is expected to complete.

Step 3 When your Catalyst Center receives a system rule update, a notification is displayed in the **Profiling Rules** window (**Policy > AI Endpoint Analytics > Profiling Rules**). The following notification is displayed when you click **Expand** in the dialog box:

You are updated to the latest version *Name of Latest Version* and a recent Cisco profiling rule has changed the profiles of some endpoints. Review Update.

Click **Review Update**

Step 4 The **Endpoint Profile Update Review** dialog box is displayed. The dialog box contains information on the current stable update applied, the latest update received, and more. It also contains the following sections that you can click to view the related endpoint profile updates:

- a. **Major Updates**: Lists the endpoints whose profiles have had major changes, such as a Windows endpoint that is now recorded as a Linux endpoint.
- b. **Minor Updates**: Lists the endpoints whose profiles have had minor changes, such as an updated version of Windows OS.
- c. **Newly Profiled**: Lists the endpoints that were unprofiled previously and have now been assigned profile information.

Step 5 After you review the endpoint profile changes, to accept the profile update, click **Mark As Approved Version** in the **Endpoint Profile Update Review** dialog box. If you do not agree with the endpoint profile changes, click **Rollback**.

When you choose rollback, you must choose if you want to roll back to the last running version, or the last approved version, by clicking the corresponding option.

You can also perform the accept and rollback actions from the **AI Endpoint Analytics > Overview > Configuration** window.

Step 6 Click **X** to close the dialog box.

Custom Rules

In addition to the system rules, you can also create custom rules for profiling endpoints using a combination of endpoint attributes. Custom rules precede all the other endpoint profiling rules in Cisco AI Endpoint Analytics.

Logic and Conditions for Profiling Rules

You can create custom profiling rules in the **Endpoint Inventory** window. To create a custom profiling rule, you must create a logical condition based on endpoint attributes and values. These attributes are collected from network probe data and are different from the classification attributes available in the **Attribute Glossary** window.

A value is a user input that uniquely identifies the group of endpoints. The attributes and values create a regular expression with the help of the following operators.

Operators	Description
Contains	Attribute has the selected value.
Equals	Attribute is strictly mapped to the selected value.
Matches	Attribute should match the regular expression pattern of the selected value.
Starts With	Attribute should start with the selected value.



Note Contains, Equals, and Starts With are case-sensitive operators. For case-insensitive values, use the Matches operator.

These conditions can be further combined with the help of logic (**AND** and **OR**) to create a nested rule.

Create and Edit a Logical Condition

Follow the below instruction to create a logical condition.

Step 1 In the **Choose Attribute Conditions** window, check the check box adjacent to the **Attribute** that you want to update.

Step 2 Choose a option from the **Operator** drop-down lists.

Step 3 Enter the value in the **Value** field.

Step 4 Click **Next**.

Step 5 In the **Add Logic to Conditions** window that is displayed, drag and drop the **AND** logic or the **OR** logic between the conditions in order to create a logical sequence of conditions for a custom rule.

Note You can also add or edit an attribute condition in the **Add Logical Conditions** window using the vertical ellipsis next to a condition.

Step 6 Click **Next**.

Create a Custom Rule

- Step 1** In the **Endpoint Inventory** window, check the check box adjacent to the MAC address of the endpoints that you want to profile.
- Step 2** Click **Actions** and choose **Profile with Custom Rules**.
- Step 3** In the **Name Rule and Type** window that is displayed, in the **Rule Name** field, enter a name for the rule, and from the **Profile Label** drop-down list, choose a label.
- Depending on what you choose from the **Profile Label** drop-down list, a corresponding field, whose name is dynamically updated, is displayed. For example, if you choose **Endpoint Type**, the **Endpoint Type** field appears.
- Step 4** Enter a value in the new field that is displayed. As you start entering information, matching options are displayed. If an option matches your requirements, select the same. Otherwise, enter the complete type name.
- Step 5** Click **Next**.
- Step 6** In the **Choose Attribute Conditions** window that is displayed, create a logical condition.
- For more information, see [Logic and Conditions for Profiling Rules](#).
- Step 7** In the **Review Rule** window, review the list of endpoints that are going to be profiled with this custom rule.
- Step 8** Click **Next**.
- Step 9** Click **Profile**.

Edit a Custom Rule

- Step 1** In the **Profiling Rules** window, check the check box adjacent to the admin rule you want to edit.
- Step 2** Click **Actions** and select **Edit**.
- Step 3** In the **Edit** window that is displayed, in the **Rule Name** field, enter a name for the rule, and select or enter the profile details based on the **Profile Label** selected during the rule creation.
- Step 4** In the **Logic and Conditions** section, click on the vertical ellipsis and select **Edit** to update the logic and conditions for profiling rules. For more information, see [Logic and Conditions for Profiling Rules](#).
- Step 5** Click **Next**.
- Step 6** Click **Apply**.
After the existing rule is updated with new profiling details, the endpoints profiled with this rule are updated with new profiling details.

Delete a Custom Rule

- Step 1** In the **Profiling Rules** window, check the check box next to the rule that you want to delete.
- Step 2** Click **Actions** and choose **Delete**.
- The following message is displayed:

Do you really want to delete the selected Rule(s)?

Step 3

Click **Yes** to permanently delete the rule from Cisco AI Endpoint Analytics.

After the custom rule is deleted, the endpoints profiled with this rule are updated with system rules.

Export and Import Custom Profiling Rules Across Deployments Using APIs

Catalyst Center contains Cisco AI Endpoint Analytics APIs through which you can import, export, edit, and delete custom profiling rules.

To enable the Cisco AI Endpoint Analytics API bundle:

1. From the top-left corner, click the menu icon and choose **Platform > Manage > Bundles**.
2. Find the bundle named **AI Endpoint Analytics** and click **Enable**.
3. The value in the **Status** column changes from **Disabled** to **Active**, and the list of APIs is displayed. You can also view the expected request and response payloads for each API.
4. After you enable the API bundle, the Cisco AI Endpoint Analytics APIs are added to the Catalyst Center Developer Toolkit. You can then access the APIs from the **Developer Toolkit** window (**Platform > Developer Toolkit**).

From both the **Bundles** and **Developer Toolkit** windows, you can:

- Generate code preview to view the API code that you can use in a different tool to run the API.
- Click **Try It** to run the API from the Catalyst Center GUI. You will receive a JSON response that you can copy and paste into a text editor of your choice to continue working with.

Cisco AI Rules for Smart Grouping

The Cisco AI Endpoint Analytics' AI algorithm analyzes data about endpoint profiling labels and groups across deployments and provides you with smart profiling rules suggestions.

The **AI Proposal** dashlet in the Cisco AI Endpoint Analytics **Overview** tab displays the following rule suggestions based on the learnings from endpoint clusters:

- New profiling rules for unprofiled or unlabeled endpoints in your network. For more information, see [New Profiling Suggestions for Similar Endpoints in Your Network, on page 801](#)
- Modification suggestions for existing profiling rules in your network that are based on the endpoint profiling data changes that AI algorithm has learned across deployments. For more information, see [Smart Modification Suggestions for Your Endpoint Profiling Rules, on page 803](#).
- Deletion suggestions for profiling rule that contain an incorrect label that are based on the endpoint profiling data changes that AI algorithm has learned across deployments. When you accept a deletion rule, the incorrect profiling label is removed from the impacted endpoints. The profiling type value for the endpoints is then either empty or returns to a previously assigned label. For more information, see [Smart Suggestions to Delete Profiling Rules, on page 805](#).

You can also initiate the workflows to review and apply proposals for changes to endpoint profiling rules from the **Profiling Rules** tab of Cisco AI Endpoint Analytics. The **Profiling Rules** displays a dialog box with information alerts. In the information alert dialog box, click **Expand** to view the available proposals for

changes to endpoint profiling rules. Click **Review** next to the information alert that you want to examine to initiate the corresponding workflow.

Figure 34: Information Alerts in the Profiling Rules Tab

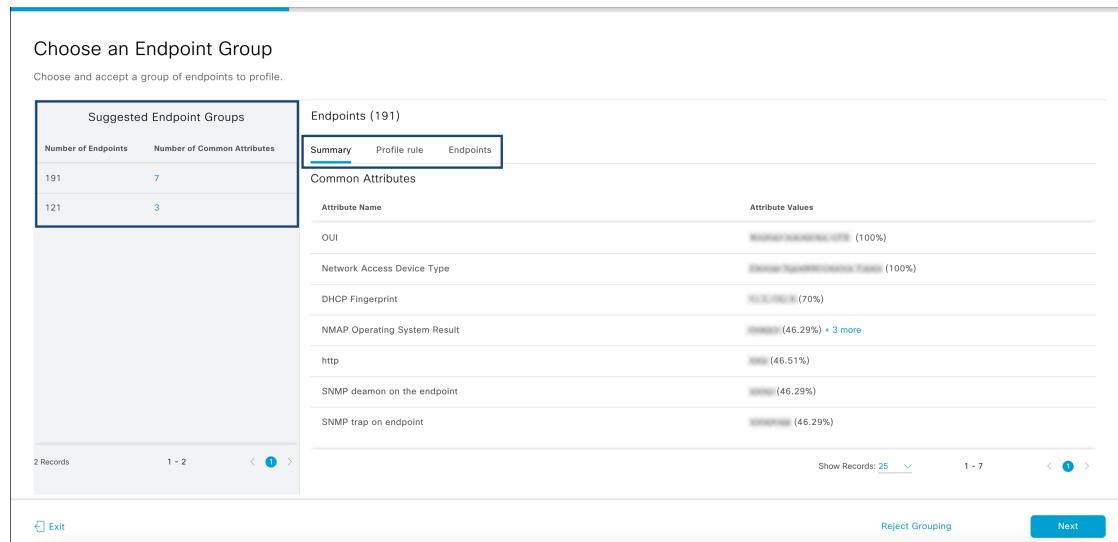


New Profiling Suggestions for Similar Endpoints in Your Network

Step 1 In the AI Proposals dashlet, click the **Review** button next to **New rule(s) for profiling endpoints that many be similar**. The **Smart Group Profile** workflow is launched.

Step 2 The **Choose an Endpoint Group** window that is displayed contains a list of new profiling rules suggestions in the left pane. Click an entry in the list to view the details of the profiling rule in the right pane.

Figure 35: Choose an Endpoint Group Window of the Smart Group Profile Workflow



The right pane contains the **Summary**, **Profile Rule**, and **Endpoints** tabs that provide a quick view of the details of the profiling rule that is suggested.

Step 3 Click **Next** to create the suggested profiling rule.

Step 4 In the **Name Profiling Rules and Labels** window that is displayed, in the **Rule Name** field, enter a name for the rule.

New Profiling Suggestions for Similar Endpoints in Your Network

Figure 36: Name Profiling Rules and Labels Window of the Smart Group Profile Workflow

Name Profiling Rules and Labels

For your selected group of endpoints, provide a name for the new profiling rule and fill in one or more of the profile labels. You will have an opportunity to review this information at the end of the workflow before pushing the changes.

Rule Name* This field is required

Endpoint Type Enter or select type

Hardware Manufacturer Cisco - Suggested Enter or select type

Hardware Model Cisco - Suggested Enter or select type

OS Type Enter or select type

[Exit](#) [Back](#) [Next](#)

Step 5 In one or more of the following fields, enter the required values. You must enter a value in at least one of the fields to proceed to the next step.

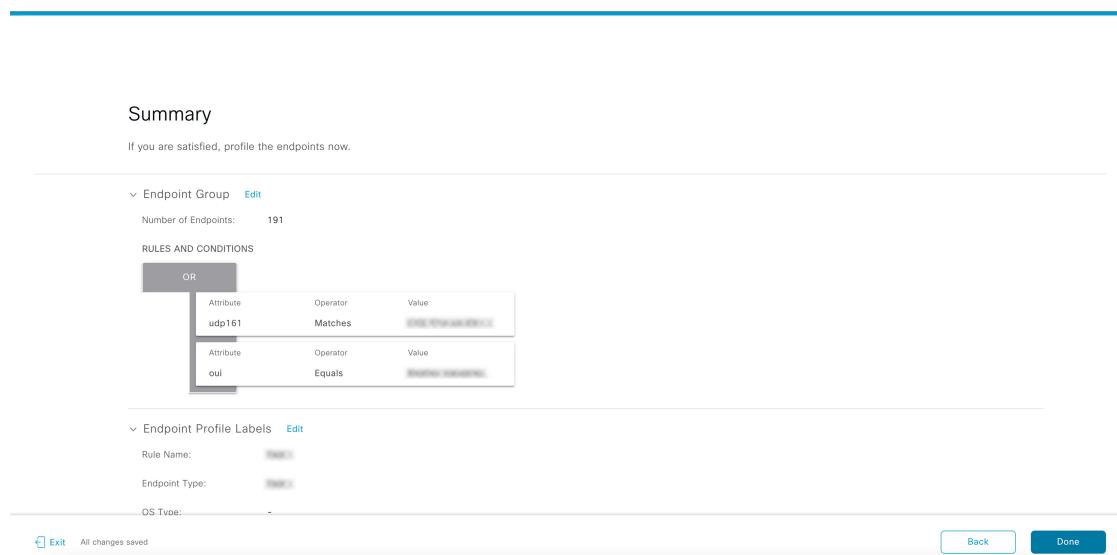
- **Endpoint Type**
- **Hardware Manufacturer**
- **Hardware Model**
- **OS Type**

If the AI algorithm identifies a profiling label for the endpoints, the label is displayed as a suggestion in the corresponding field. You can choose to proceed with the suggested label or select a different label.

Step 6 Click **Next** to continue.

Step 7 In the **Summary** window, review the details of profiling rule. To make any changes, click **Edit**.

Figure 37: Summary Window of the Smart Group Profile Workflow



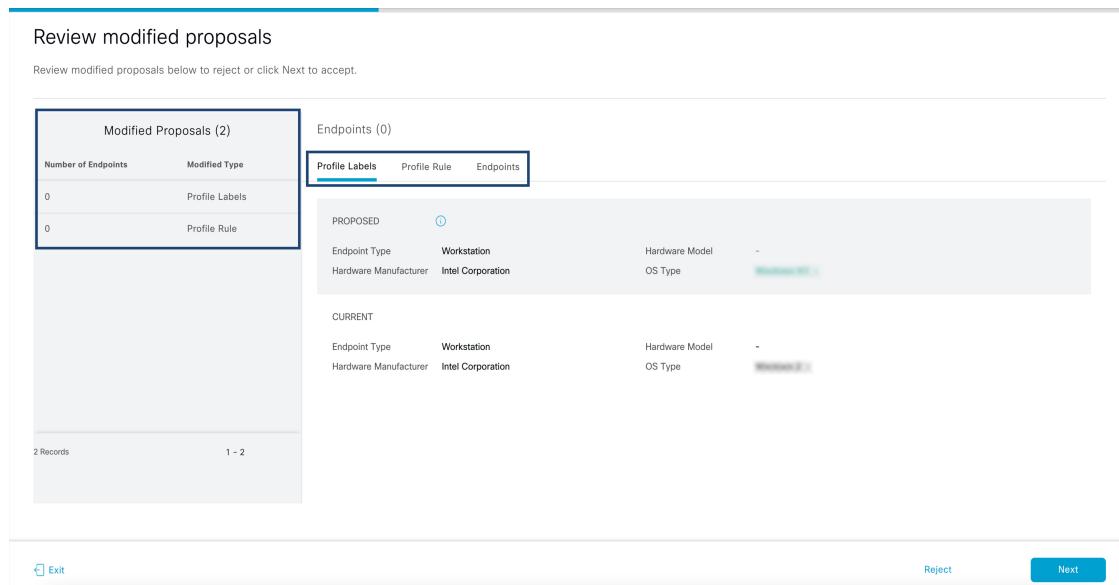
- Step 8** To create the profiling rule, click **Done**.

Smart Modification Suggestions for Your Endpoint Profiling Rules

- Step 1** In the AI Proposals dashlet, click the **Review** button next to **Modification proposal(s) for previously accepted rule(s)**. The **Smart Group Profile** workflow is launched.
- Step 2** The **Review modified proposals** window that is displayed contains a list of modification proposals for existing profiling rules. Click an entry in the list to view the details of the modification suggestion in the right pane.

Smart Modification Suggestions for Your Endpoint Profiling Rules

Figure 38: Review Modified Proposals Window of the Review AI Proposals Workflow



The right pane contains the **Profile Labels**, **Profile Rule**, and **Endpoints** tabs that provide a quick view of the details of the modified profiling rule that is suggested.

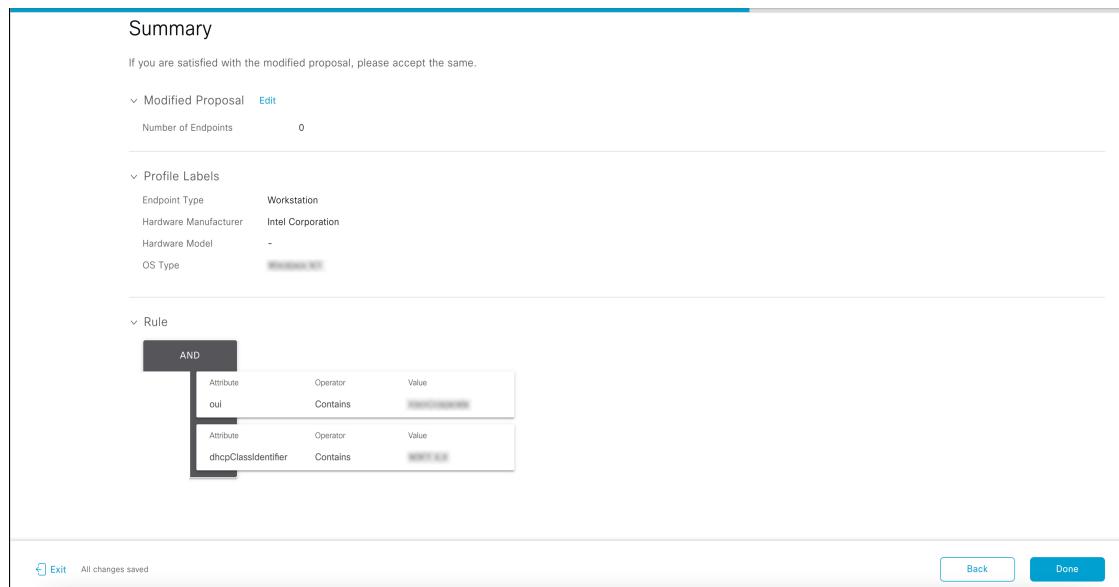
Step 3

Click **Next** to update the profiling rule as suggested.

Step 4

In the **Summary** window, review the details of profiling rule. To make any changes, click **Edit**.

Figure 39: Summary Window of the Review AI Proposals Workflow



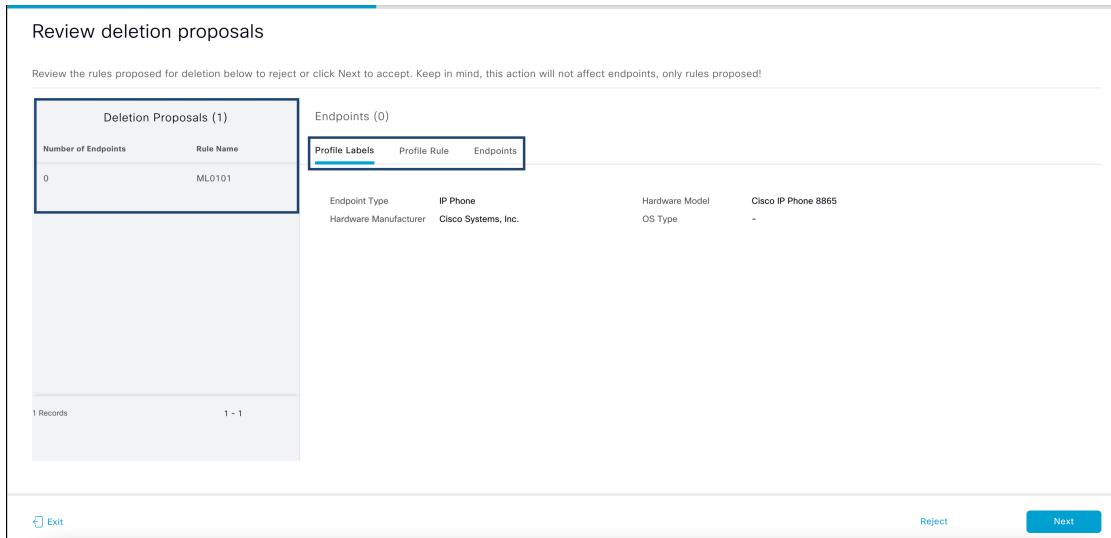
Step 5

To update the profiling rule, click **Done**.

Smart Suggestions to Delete Profiling Rules

- Step 1** In the AI Proposals dashlet, click the Review button next to Profiling Rules(s) is/are no longer needed. The Review AI Proposals workflow is launched.
- Step 2** The Review deletion proposals window that is displayed contains a list of deletion proposals for existing profiling rules. Click an entry in the list to view the details of the deletion suggestion in the right pane.

Figure 40: Review Deletion Proposals Window of the Review AI Proposals Workflow



The right pane contains the **Profile Labels**, **Profile Rule**, and **Endpoints** tabs that provide a quick view of the details of the modified profiling rule that is suggested.

- Step 3** Click Next to update the profiling rule as suggested.
Step 4 In the Summary window, review the details of profiling rule. To make any changes, click Edit.

Import Profiling Rules**Figure 41: Summary Window of the Review AI Proposals Workflow**

If you are satisfied with the deletion proposal, please accept the same.

Deletion Proposal [Edit](#)
Number of Endpoints 0

Profile Labels

Endpoint Type	IP Phone
Hardware Manufacturer	Cisco Systems, Inc.
Hardware Model	Cisco IP Phone 8865
OS Type	-

Rule

Attribute	Operator	Value
assetDeviceType	Contains	IOT

[Exit](#) All changes saved [Back](#) [Done](#)

- Step 5** Click **Done** to accept the deletion proposal.

Import Profiling Rules

You can migrate your custom profiling rules and Cisco AI rules by importing the .json files.

- Step 1** In the **Profiling Rule** window, click **Actions**

- Step 2** Choose **Import Profiling Rules**.

- Step 3** Click **Choose a file** and browse to the .json file in your system.

- Step 4** Click **Ok**.

Export Profiling Rules

You can export and back up custom rules and Cisco AI profiling rules from Cisco AI Endpoint Analytics. The **Export Profiling Rules** option exports all the available custom rules and Cisco AI profiling rules. You cannot selectively export rules.

- Step 1** In the **Profiling Rules** window, click **Actions**.

- Step 2** Choose **Export Profiling Rules**.

- Step 3** Click **Yes** to export all the custom and ML profiling rules. Click **No** to exit.

Note You can import the same file again into Cisco AI Endpoint Analytics.

Hierarchy

Cisco AI Endpoint Analytics hierarchy helps you create logical groupings of endpoints, based on the endpoint types. Creating categories and subcategories for the endpoints focuses on endpoint visibility and simplifies the authorization process.

You can create categories from the **All Endpoints** default parent category. The category details such as total number of endpoints, endpoint types, and subcategories are listed within individual boxes in the **Hierarchy** window.

You can create, edit, and delete the categories to reorder the hierarchy.

Create Category and Subcategory

-
- Step 1** In the **Hierarchy** window, click the horizontal ellipsis of the parent category.
 - Step 2** Click **Create Category**.
 - Step 3** Enter a category name.
 - Step 4** Click **Enter**.
-

What to do next

After you create a category, you can drag and drop endpoint types from the **Endpoint Type** window, or edit the category to add endpoints to it.

Edit a Category or Subcategory

-
- Step 1** In the **Hierarchy** window, click on the horizontal ellipsis of the category.
 - Step 2** Click **Edit**.
 - Step 3** In the **Edit** window that is displayed, enter the **Category Name**.
 - Step 4** Enter the **Parent Category** from the drop-down menu, if you want to reassign the category.
 - Step 5** Click the **Endpoint Type** tab.
 - Step 6** Click **Actions** and select **Add Endpoint Type**.
 - Step 7** Choose the endpoint type from the **Search Dropdown** list.
 - Step 8** Click **Save**.
-

What to do next

In the Endpoint Type window, you can filter the endpoint types as **All**, **Available**, and **Assigned**.

Delete Endpoint Types from Category

Step 1 In the **Hierarchy** window, click the horizontal ellipsis of the category that you want to delete.

Step 2 Click **Edit**.

Step 3 In the **Edit** window, click the **Endpoint Type** tab.

Step 4 Check the check box adjacent to the endpoint type that you want to delete.

Step 5 Click **Actions** and choose **Remove From Category**.

The following message displays:

Are you sure you want to delete this category?

Step 6 Click **Yes** to delete the endpoint from the category. Click **No** to exit.

Reassign Endpoint Types from Category

Step 1 In the **Hierarchy** window, click the horizontal ellipsis of the category.

Step 2 Click **Edit**.

Step 3 In the **Edit** window, click the **Endpoint Type** tab.

Step 4 Check the check box adjacent to the endpoint type that you want to reassign.

Step 5 Click **Actions** and choose **Re-assign to existing category** or **Re-assign to a new category**.

Option	Steps
Re-assign to existing category	<ul style="list-style-type: none"> a. In the Reassign window, choose an existing category from the Category drop down list. b. Click Save.
Re-assign to a new category	<ul style="list-style-type: none"> a. In the Reassign window, choose New Category from the Category drop down list. b. Choose a parent category from the Parent Category drop down list. c. Enter the category name in the New Category field. d. Click Save.

Delete a Category

Before you begin

Before you delete a parent category, check its subcategories. You can reassign the subcategories to another existing category or to a new category. Otherwise, all the subcategories are deleted along with the parent category. You can also reassign the subcategories while you are deleting a category.

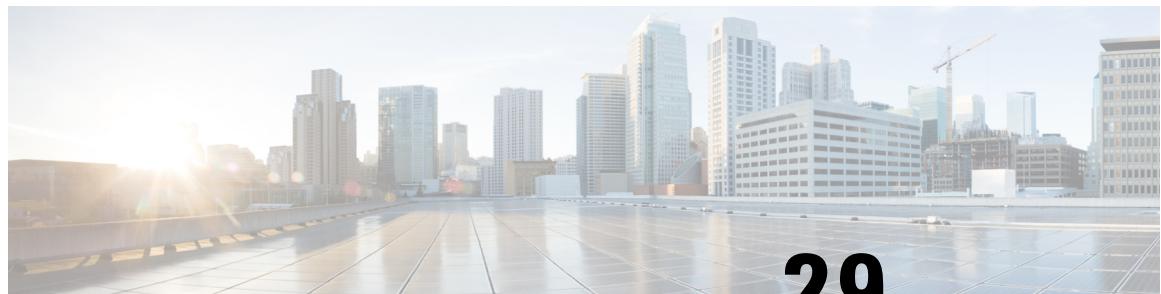
Step 1 In the **Hierarchy** window, click the horizontal ellipsis of the category.

Step 2 Click **Delete**.

If you are deleting a category that has subcategories assigned to it, the **Reassign Relationships** dialog box is displayed. Choose one of the following options:

Option	Condition	Steps
Reassign to an existing category	Reassign the subcategories to an existing category.	<ol style="list-style-type: none">Select a category from the Category drop-down list.Click Reassign. <p>The parent category is deleted and its subcategories will be reassigned to the selected category.</p>
Reassign to a new category	Reassign the subcategories to an existing category.	<ol style="list-style-type: none">Select a category from the Parent Category drop-down list.Enter the category name in the New Category field.Click Reassign. <p>The parent category is deleted and its subcategories are reassigned to the new category.</p>
Remove from category	Delete the subcategories along with the parent category.	Click Reassign . The parent category and its subcategories are deleted.

Delete a Category



CHAPTER 29

Troubleshoot Network Devices Using Network Reasoner

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Network Reasoner Overview

The Network Reasoner tool allows you to troubleshoot various issues on your network quickly. From the top-left corner, click the menu icon and choose **Tools > Network Reasoner** to launch the Network Reasoner dashboard. The Network Reasoner dashboard hosts separate workflows that you can use to proactively troubleshoot network issues. The dashboard provides a brief description of the workflows, the number of affected devices in the last 24 hours, and the impact of running a workflow on a network.



Note You must install the Machine Reasoning package to view the Network Reasoner feature under the **Tools** menu. For more information, see the *Cisco Catalyst Center Administrator Guide*.

Validate Cisco SD-Access Migration Using the MRE Workflow

The following Machine Reasoning Engine (MRE) workflows assist in planning your migration to Cisco SD-Access:

- SDA Hardware Readiness Check

Validate Cisco SD-Access Migration Using the MRE Workflow

- SDA Software Readiness Check
- Redundant Link Check
- L3 Access Check
- MTU Link Check
- SDA Health Check
- SDA Scale Limits Check

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 In the **Network Reasoner** dashboard, click the following workflows as required:

Workflow	Description	Action
SDA Hardware Readiness Check	Checks whether the hardware is ready for Cisco SD-Access migration.	<ol style="list-style-type: none"> Click SDA Hardware Readiness Check. Click Run Machine Reasoning.
SDA Software Readiness Check	Checks whether the software is ready for Cisco SD-Access migration.	<ol style="list-style-type: none"> Click SDA Software Readiness Check. Click Run Machine Reasoning.
Redundant Link Check	Checks whether any redundant uplinks are present in your device and if there are ways to increase availability by configuring redundant uplinks on the access switches.	<ol style="list-style-type: none"> Click Redundant Link Check. Select an appropriate device. Click Troubleshoot.
L3 Access Check	Checks whether your network has access switches that are running Layer 3 routing protocols to move to Cisco SD-Access with minimal design changes.	<ol style="list-style-type: none"> Click L3 Access Check. Select an appropriate device. Click Troubleshoot.
MTU Link Check	Checks whether the links between the main network devices and the access, core, and other switches are configured with the correct MTU.	<ol style="list-style-type: none"> Click MTU Link Check. Select an appropriate device. Click Troubleshoot.
SDA Health Check: Fabric Count	Checks the health of the Catalyst Center cluster to determine whether it is reaching any scale limit thresholds due to managing fabrics.	<ol style="list-style-type: none"> Click Fabric Count. Click Run Machine Reasoning.

Workflow	Description	Action
SDA Health Check: Fabric Data Collection	Collects show command outputs from network devices to troubleshoot issues in a fabric network.	<ol style="list-style-type: none"> Click Fabric Data Collection. Choose the devices and click Troubleshoot. After Machine Reasoning is completed, click View Details. In the Conclusions tab, click the link to download the output file. The output file is a bundle of text files containing all executed commands on the selected devices.
SDA Health Check: SDA Scale Limits Check	Checks whether the number of client endpoints, network devices, and configured fabrics in Catalyst Center are within the published SDA limits.	<ol style="list-style-type: none"> Click SDA Scale Limits Check. Click Run Machine Reasoning.
SDA Health Check: Client Count	Checks the health of the Catalyst Center cluster to determine whether it is reaching any scale limit thresholds due to managing clients.	<ol style="list-style-type: none"> Click Client Count. Click Run Machine Reasoning.
SDA Health Check: Device Count	Checks the health of the Catalyst Center cluster to determine whether it is reaching any scale limit thresholds due to managing network devices.	<ol style="list-style-type: none"> Click Device Count. Click Run Machine Reasoning.
SDA Health Check: LISP PubSub Session Check	Checks the LISP PubSub health on the fabric border device. If a PubSub session is down, troubleshoot to find the root cause.	<ol style="list-style-type: none"> Click LISP PubSub Session Check. Choose the devices and click Troubleshoot. After Machine Reasoning is completed, click View Details.
SDA Health Check: LISP Session Check	Checks the status of all LISP sessions on the chosen device. If a session is down, troubleshoot to find the root cause	<ol style="list-style-type: none"> Click LISP Session Check. Choose the devices and click Troubleshoot. After Machine Reasoning is completed, click View Details.

Troubleshoot High CPU Utilization

CPU utilization troubleshooting support is available only for the following network devices with software version 16.9.3 and later:

- Cisco Catalyst 9400 Series Switches

- Cisco Catalyst 9300 Series Switches
- Cisco Catalyst 3850 Series Switches
- Cisco Catalyst 3650 Series Switches

Before you begin

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
 - Create a user role with write permissions for Machine Reasoning under the **System** function. For more information, see Configure Role-Based Access Control in the [Cisco Catalyst Center Administrator Guide](#).
-

Step 1

From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2

Click the **CPU Utilization** tab.

The **CPU Utilization** window displays the filtered list of devices with high CPU utilization in the past 24 hours.

Click **All** to see the list of all devices from the inventory, and you can choose any device to run the workflow.

Step 3

Choose the device that you want to troubleshoot.

Click **Filter** and enter the devices by entering **Tag**, **Device Name**, **IP Address**, **Device Type**, **Site**, or **Reachability**.

Step 4

Click **Troubleshoot**.

In the **Reasoner Input** window, enter the **CPU Utilization Threshold** percentage that you want to check against.

Step 6

Click **Run Machine Reasoning**.

Note The following processes, if observed, are considered for detailed analysis:

- **MATM Process Group**: MATM RP Shim, NGWC Learning, and VMATM Callback
- **IOSXE Process Group**: IP Input, ARP Input, IOSXE-RP Punt Se, SISF Main Thread, DAI Packet, and ARP Snoop

In the **CPU Utilization** window, you can see the **Root Cause Analysis** of the high CPU utilization for the chosen device.

The **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process.

Step 7

(Optional) Click **Stop** to stop the ongoing reasoning activity.

Step 8

Click the **Conclusion** tab to see the processes that consume more CPU and the utilization percentage.

Step 9

Click **View Relevant Activities** for each process to view the **Activity Details** in the right pane.

Step 10

(Optional) Click **Run Again** to rerun the troubleshooting process for the same device.

Note The Machine Reasoning Engine (MRE) implements a system-terminate algorithm that detects and terminates network reasoner workflows when thresholds exceed a specified level, or when no events are received from the timeout request for inactivity.

Troubleshoot a Power Supply Failure

Power supply troubleshooting workflow support is available only for the following network devices with software version 16.6.1 and later:

- Cisco Catalyst 3650 Series Switches
- Cisco Catalyst 3850 Series Switches
- Cisco Catalyst 9300 Series Switches
- Cisco Catalyst 9400 Series Switches
- Cisco Catalyst 9500 Series Switches

Before you begin

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- Create a user role with write permissions for Machine Reasoning under the **System** function. For more information, see Configure Role-Based Access Control in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 Click the **Power Supply** tab.

The **Power Supply** window displays the filtered list of devices with power supply failures in the past 24 hours.

Click **All** to see the list of all devices in the inventory. You can choose any device to run the workflow.

Step 3 Choose the device that you want to troubleshoot.

Click **Filter** and filter the devices by entering **Tag**, **Device Name**, **IP Address**, **Device Type**, **Site**, or **Reachability**.

Step 4 Click **Troubleshoot**.

In the **Power Supply** window, you can see the **Root Cause Analysis** of the power supply failure for the chosen device.

The **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process.

Step 5 (Optional) Click **Stop** to stop the ongoing reasoning activity.

Step 6 Click the **Conclusion** tab to see the **Stack Identifier**, **Product ID**, **Serial Number**, and **Status** of the power supply for the chosen device and the suggested action.

Step 7 Click **View Relevant Activities** for each stack identifier to view the **Activity Details** in the right pane.

Step 8 (Optional) Click **Run Again** to rerun the troubleshooting process for the same device.

Note The Machine Reasoning Engine (MRE) implements a system-terminate algorithm that detects and terminates network reasoner workflows when thresholds exceed a specified level, or when no events are received from the timeout request for inactivity.

Troubleshoot a Downed Interface

Interface down troubleshooting workflow support is available only for the following network devices with software version 16.9.3, and later:

- Cisco Catalyst 3650 Series Switches
- Cisco Catalyst 3850 Series Switches
- Cisco Catalyst 9300 Series Switches
- Cisco Catalyst 9400 Series Switches
- Cisco Catalyst 9500 Series Switches

Before you begin

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- Create a user role with write permissions for Machine Reasoning under the **System** function. For more information, see Configure Role-Based Access Control in the [Cisco Catalyst Center Administrator Guide](#).

Step 1

From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2

Click the **Interface Down** tab.

The **Interface Down** window displays the filtered list of devices with an interface that went down in the past 24 hours.

Click **All** to see the list of all devices from the inventory, and you can choose any device to run the workflow.

Step 3

Choose the device that you want to troubleshoot.

Click **Filter** and enter the devices by entering **Tag**, **Device Name**, **IP Address**, **Device Type**, **Site**, or **Reachability**.

Step 4

Click **Troubleshoot**.

In the **Reasoner Input** window, enter the interface name that you suspect has issues.

Step 5

Click **Run Machine Reasoning**.

In the **Interface Down** window, you can see the **Root Cause Analysis** of the downed interface for the chosen device.

The **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process.

Step 7

(Optional) Click **Stop** to stop the ongoing reasoning activity.

Step 8

Click the **Conclusion** tab to see the potential root causes for the interface down issue and the suggested action.

Step 9

Click **View Relevant Activities** for each root cause analysis to view the **Activity Details** in the right pane.

Step 10

(Optional) Click **Run Again** to rerun the troubleshooting process for the same device.

Note The Machine Reasoning Engine (MRE) implements a system-terminate algorithm that detects and terminates network reasoner workflows when thresholds exceed a specified level, or when no events are received from the timeout request for inactivity.

Troubleshoot Network Connectivity

Only the following network devices running Cisco IOS-XE software version 16.9.3 or later support the network connectivity troubleshooting:

- Cisco Catalyst 9200 Series Switches
- Cisco Catalyst 9300 Series Switches
- Cisco Catalyst 9400 Series Switches
- Cisco Catalyst 9500 Series Switches
- Cisco Catalyst 9600 Series Switches

Use the following procedure to check the reachability of an endpoint from a device using IP address:

Before you begin

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- Create a user role with write permissions for Machine Reasoning under the **System** function. For more information, see Configure Role-Based Access Control in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 Click the **Network Connectivity** tab.

Step 3 You can view the device table with details, such as **Device Name**, **IP Address**, **Device Type**, **Site**, **Reachability**, **Role**, and **Platform**.

Step 4 Select a device and click **Troubleshoot**.

Step 5 In the **Destination IP address** field of the **Reasoner Inputs** window, enter a valid IP address and click **Run Machine Reasoning**.

Note Provide the Virtual Routing and Forwarding (VRF) name, if applicable.

Step 6 In the **Root Cause Analysis** window, under **Reasoning Activity**, you can view various workflows that are validated as a part of the troubleshooting process.

Step 7 In the **Conclusions** tab, you can view the status of the validation check and the suggested action.

Troubleshoot IP Connectivity of a Device

As ping is a simple command, IP connectivity troubleshooting support is available for all the network devices.

Before you begin

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).

- Create a user role with write permissions for Machine Reasoning under the **System** function. For more information, see Configure Role-Based Access Control in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 In the **Network Reasoner** dashboard, click **Ping Device**.

Step 3 In the **Devices** window, choose a device and click **Troubleshoot**.

Step 4 In the **Reasoner Inputs** window, enter **Target IP Address** and click **Run Machine Reasoning**.

Step 5 Click **View Details** to view the ping status.

Troubleshoot Wireless Clients Using the MRE Workflow

Use this procedure to troubleshoot wireless client issues using the MRE workflow.



Note

- Wireless client troubleshooting workflow support is available only for network devices with Cisco IOS-XE software version 17.3.4 and later.
- The MRE workflow doesn't support HA, which means that if a switchover occurs during the workflow, you must repeat the workflow.

Before you begin

Make sure that the Machine Reasoning Engine (MRE) knowledge base is updated with the latest knowledge packs. For more information, see the "Update the Machine Reasoning Knowledge Base" topic in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 Click the **Wireless Client Data Collection** tile.

The **Devices** window shows the filtered wireless controller devices.

Step 3 Choose the wireless controller that you want to troubleshoot and click **Troubleshoot**.

Step 4 In the **Reasoner Inputs** window, complete the following fields:

- **Troubleshoot Duration**
- **Client MAC Address**
- **PCAP Interface**: Click the drop-down arrow and choose an interface from the list. Use this option if packet capture is required.

Step 5 Click **Run Machine Reasoning**.

The **Wireless Client Data Collection** slide-in pane is displayed.

Step 6 In the **Root Cause Analysis** area, the **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process. Optionally, click **Stop** to stop the ongoing reasoning activity.

Step 7 Wait for the troubleshooting process to complete. After it completes, you can view the troubleshooting files under the **Conclusions** tab.

Step 8 (Optional) Click **Run Again** to rerun the troubleshooting process for the same device.

Step 9 (Optional) You can view the last troubleshooting files in the **Wireless Client Data Collection** slide-in pane when you start the Wireless Client troubleshooting workflow.

Troubleshoot Wireless APs Using the MRE Workflow

Use this procedure to troubleshoot wireless AP issues using the MRE workflow.



Note

- Wireless AP troubleshooting workflow support is available only for network devices with Cisco IOS-XE software version 17.3.4 and later.
- The MRE workflow doesn't support HA, which means that if a switchover occurs during the workflow, you must repeat the workflow.

Before you begin

Make sure that the MRE knowledge base is updated with the latest knowledge packs. For more information, see Update the Machine Reasoning Knowledge Base in the *Cisco Catalyst Center Administrator Guide*.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 Click the **Wireless AP Data Collection** tile.

Step 3 The **Devices** window shows the filtered wireless controller devices. Choose the wireless controller device that you want to troubleshoot for the AP and click **Troubleshoot**.

Step 4 In the **Reasoner Inputs** window, complete the following fields:

- **Troubleshoot Duration**
- **Two AP MAC Address**: Enter the AP MAC address for Ethernet and radio.
- If packet capture is required, use the following option:
 - **PCAP Interface**: Click the drop-down list to choose the interface.
- **AP IP Address**: Enter the AP IP address.
- **AP Name**

Step 5 Click **Run Machine Reasoning**.

The **Wireless AP Data Collection** slide-in pane appears.

Step 6 In the **Root Cause Analysis** area, the **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process. Optionally, click **Stop** to stop the ongoing reasoning activity.

Step 7 Wait for the troubleshooting process to complete. After it completes, you can view the troubleshooting files under the **Conclusions** tab.

- Step 8** (Optional) Click **Run Again** to rerun the troubleshooting process for the same device.
- Step 9** (Optional) You can view the last troubleshooting files in the **Wireless AP Data Collection** slide-in pane when you start the Wireless AP troubleshooting workflow.
-

Troubleshoot Unmonitored Devices Using the MRE Workflow

Use this procedure to troubleshoot unmonitored devices or devices that are not showing Assurance data. The Troubleshooting Unmonitored Devices workflow supports only switches, Cisco AireOS Wireless Controllers, and Cisco Catalyst 9800 Series Wireless Controllers.

Before you begin

Make sure that the Machine Reasoning Engine (MRE) knowledge base is updated with the latest knowledge packs. For more information, see the "Update the Machine Reasoning Knowledge Base" topic in the [Cisco Catalyst Center Administrator Guide](#).

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.
- Step 2** Click the **Assurance Telemetry Analysis** tile.
- Step 3** The **Devices** window shows the filtered unmonitored devices. Choose the device that you want to troubleshoot and click **Troubleshoot**.
- The **Assurance Telemetry Analysis** slide-in pane is displayed. In the **Root Cause Analysis** area, the **Reasoning Activity** tab shows the various parameters that are checked as part of the troubleshooting process.
- Step 4** Click **Stop** to stop the ongoing reasoning activity.
- After the troubleshooting is complete, the **Machine Reasoning Completed** dialog box is displayed.
- Step 5** Click **View Details**.
- Step 6** You can view the troubleshooting files under the **Conclusions** tab. The issue is highlighted with an icon (⚠), and the **Suggested Action** is displayed below the issue.
- You can troubleshoot the unmonitored device with the suggestions provided.
- Step 7** Click **Run Again** to rerun the troubleshooting process for the same device.
- Step 8** You can also troubleshoot the devices from the **Inventory** tab. Scroll down to view the **Health Score** column. Click **No Health** under the **Health Score** column and click **View Assurance Telemetry Analysis** to run the troubleshooting process.
-

Troubleshoot HA on Cisco Wireless Controller Using the MRE Workflow

The MRE workflow analyzes the HA health on Cisco Wireless Controllers by processing the command outputs. This workflow is supported on the Cisco Catalyst 9800 Series Wireless Controllers and Cisco Catalyst 9800-CL

Wireless Controllers for Cloud running Cisco IOS XE Release 17.1 or later. Use this procedure to troubleshoot HA issues on wireless controllers using the MRE workflow.

Before you begin

Ensure that the Machine Reasoning Engine (MRE) knowledge base is updated with the latest knowledge packs. For more information, see the "Update the Machine Reasoning Knowledge Base" topic in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Alternatively, you can troubleshoot the HA issues on wireless controllers from the **Provision > Inventory** window. If there is an HA issue on a wireless controller, a red link icon () is displayed next to the wireless controller. To troubleshoot the HA issues, click the red link icon, and then click **HA SSO Analysis**. Skip to [Step 5, on page 821](#).

Step 2 Click the **Catalyst 9800 Wireless Controller HA SSO Analysis** tile.

The **Devices** window displays the wireless controllers. If HA is configured on a wireless controller, Catalyst Center displays a link icon () next to the device name. A red link icon () indicates an HA issue on the wireless controller.

Step 3 From the left hierarchy tree, choose the required site.

Step 4 Click the radio button next to the device name that you want to troubleshoot, and then click **Troubleshoot**.

Optionally, to stop the ongoing reasoning activity, click **Stop**.

Step 5 After the troubleshooting is complete, the **Machine Reasoning Completed** dialog box opens. Click **View Details**.

Step 6 In the **Root Cause Analysis** area, the **Reasoning Activity** tab displays the parameters that are checked as part of the troubleshooting process. To view the details of an activity, click the corresponding activity tile.

The analysis uses the following parameters in the mentioned order:

Number	MRE Analysis Parameters	Description
1	Check Controller Manageability	<ul style="list-style-type: none"> Checks if the wireless controller is running Cisco IOS XE Release 17.1 or later. Checks if the wireless controller IP address is in reachable state. Checks the SNMP, CLI credentials, and NETCONF. Checks if the wireless controller is Cisco Catalyst 9800 Series Wireless Controllers or Cisco Catalyst 9800-CL Wireless Controllers for Cloud.
2	Evaluate Catalyst Center platform	Checks if all the services in the platform are a part of the Catalyst Center ISO.
3	Check HA is configured in Controller	Checks if the sensors on the active and standby wireless controller are operating in normal threshold range.
4	Check Primary device and Secondary device status in HA Pair	Checks if the HA configuration is completed on the wireless controllers.

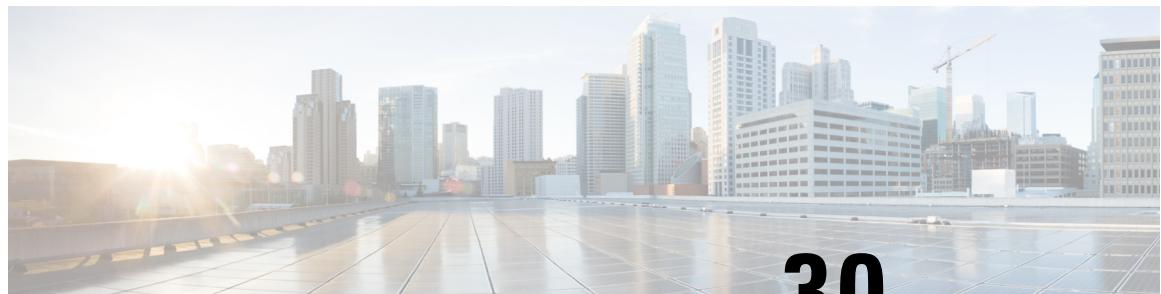
Number	MRE Analysis Parameters	Description
5	Show RP and RMI status	Checks the connectivity of the Redundancy Port (RP) link and Redundancy Management Interface (RMI) link between the active and standby wireless controllers running Cisco IOS XE Release 17.6 or later.
6	Check the HA Status	<ul style="list-style-type: none"> • Checks if the standby wireless controller is in HA removed state. • Checks if the standby wireless controller synchronization is in progress. • Checks if the power supply and RP network connectivity of the standby wireless controller are working as expected. • Checks if both active and standby wireless controllers are running the same image version.
7	Secondary device deletion check	<ul style="list-style-type: none"> • Checks if HA is configured successfully. • Checks if the standby wireless controller is in deleted state.

Step 7 The **Conclusions** tab displays the troubleshooting information. Catalyst Center highlights an issue with the  icon. It displays suggested action to resolve the issue in the **Suggested Action** area below the issue.

Step 8 (Optional) Click **Run Again** to rerun the troubleshooting process for the device.

What to do next

If your HA issue is not listed in the root cause or you need further assistance, contact Cisco Technical Assistance Center (TAC).



CHAPTER 30

Identify Network Bugs

- [Network Bug Identifier Tool Overview, on page 823](#)
- [Scan the Network for Bugs, on page 824](#)
- [Scan Catalyst Center for Bugs, on page 825](#)

Network Bug Identifier Tool Overview

The Catalyst Center network bug identifier tool allows you to scan the network for a selected set of defects or bugs that have been identified previously and are known to Cisco.

The Catalyst Center network bug identifier helps in identifying specific patterns in the device configuration or in the operational data of the device and matches them with known defects based on those patterns. This tool provides both bug-focused and device-focused views.

Catalyst Center collects network device configuration and operational data by running CLI commands on network devices, and then sends the information to the CX Cloud to be processed for exposure to potential security advisories or bugs. Catalyst Center invokes the following CLI commands for the network bug identifier tool:

- **show buffers summary**
- **show cef interfaces**
- **show clock**
- **show crypto eli all**
- **show crypto isakmp sa detail**
- **show eigrp service-family ipv4 neighbors**
- **show environment all**
- **show interfaces counters error**
- **show interfaces summary**
- **show inventory**
- **show ip interface brief**
- **show ip nat translations verbose**

Scan the Network for Bugs

- **show ip nbar protocol-discovery**
- **show ip nbar resources flow**
- **show ip nhrp**
- **show ip nhrp summary**
- **show ip route**
- **show ip ssh**
- **show ip vrf**
- **show logging**
- **show performance monitor cache detail**
- **show platform software route-map fp active map**
- **show pnp profile**
- **show redundancy**
- **show redundancy application group**
- **show running-config all**
- **show scp status**
- **show stackwise-virtual**
- **show startup-config**
- **show terminal**
- **show version**

Scan the Network for Bugs

The following procedure explains how to identify bugs using the network bug identifier tool.

Before you begin

- Install the Catalyst Center core package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Bug Identifier**.

Step 2 Click **Scan Network**.

Step 3 In the **Scan Network** window, choose whether you want to scan your system for bugs **Now** or schedule it for **Later**.

The dashboard progress indicator shows the list of devices scanned in batches of 10. When the scan is done, the **Network Bug Identifier** window appears.

Step 4 Use the top pane to view information about the results of the scan, rescan the network, and change scan settings, as follows:

Item	Description
Bug Summary	Number of Catastrophic , Severe , and Moderate bugs in your network.
Affected Devices	Number of the following device types that were scanned: <ul style="list-style-type: none"> • Routers • Switches and Hubs
Scan Mode	Method used to perform the scan: <ul style="list-style-type: none"> • Essential: Scan performed using the Cisco Network Reasoner Engine (NRE). • CX Cloud: Scan performed using the CX Cloud.
Re-scan Network	Click this button to scan your network again.
Settings	Click the Settings icon to do the following: <ul style="list-style-type: none"> • Enable or disable weekly scans. • Enable or disable the CX Cloud to scan your network.

Step 5 Click the **Bugs on Devices** tab to view information about the bug, such as **Bug ID**, **Name**, **Affected Devices**, **Severity**, **Affected Versions**, and **Workaround**.

Click any hyperlinked value to display more information about it.

Step 6 Click the **Devices** tab to view information about the devices, such as **Device Name**, **Image Version**, **IP Address**, **Device Type**, **Bugs**, **Scan Status**, **Scan Mode**, **Site**, and **Reachability**.

Click any hyperlinked value to display more information about it.

Step 7 From the **Devices** tab, click **Tag Device** to create, edit, or delete tags on the devices.

Scan Catalyst Center for Bugs

The **System Bug Identifier** tool provides an option to identify bugs in the Catalyst Center. The following procedure explains how to enable the **System Bug Identifier** tool:

Before you begin

- Install the Catalyst Center core package. For more information, see Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).

Scan Catalyst Center for Bugs

- Install the Machine Reasoning package. For more information, see Download and Install Packages and Updates in the *Cisco Catalyst Center Administrator Guide*.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Network Reasoner**.

Step 2 Select **System Bug Identifier**.

Step 3 Click **Scan System**.

Step 4 In the **Scan System** window, choose whether you want to scan your system for bugs **Now** or schedule it for **Later**.

Note Click the **here** link in the banner that appears at the top of the window, to create new trial that provides access to customized bug information based on device configuration.

Step 5 The **System Bug Identifier** window shows the **BUG SUMMARY** and the **Bugs Identified on Your System** table.

In addition to basic bug information, this window shows information, such as when the bug was first and last identified, the frequency that it was identified and affected versions.

Step 6 Click the **Bug ID**.

The **Bug Details** dialog box displays the details of the bug.

Step 7 Click the arrow next to **Bug ID** to go to the **Bug Search Tools** window, which shows more details about the bugs.



CHAPTER 31

Identify Network Security Advisories

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- [Prerequisites, on page 827](#)
- [View Security Advisories, on page 828](#)
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Security Advisories Overview

The Cisco Product Security Incident Response Team (PSIRT) responds to Cisco product security incidents, regulates the Security Vulnerability Policy, and recommends [Cisco Security Advisories and Alerts](#).

The Security Advisories tool uses these recommended advisories, scans the inventory within Catalyst Center, and finds the devices with known vulnerabilities.

Prerequisites

To use the Security Advisories tool, you must install the Machine Reasoning package. See *Download and Install Packages and Updates* in the [Cisco Catalyst Center Administrator Guide](#).

If you log in to Catalyst Center as an Observer, you cannot view the **Security Advisories** tool in the home page.

View Security Advisories

Step 1 From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.

Step 2 If you are launching the **Security Advisories** window for the first time, click **Scan Network**.

Catalyst Center uses the knowledge base to identify security issues and improve automated analysis. We recommend that you update the knowledge base on a regular basis to view the latest security advisories.

- From the top-left corner, click the menu icon and choose **System > Settings > Machine Reasoning Engine**.
- Either click **Import** or click **Download Latest** to download the latest available knowledge base. After the download, click **Import**.
- Click the **AUTO UPDATE** toggle button to subscribe to automatic updates.

Note Click the **here** link in the banner that appears at the top, to create new trial that provides access to customized field notices based on device configuration.

Step 3 The **ADVISORIES** area displays the distribution percentage of impact on the network, such as **Critical, High, Medium, Low, Informational, or Unknown**.

Step 4 Scans are performed on the devices based on the licenses associated against each device. In the **SCAN CRITERIA** area, you must follow the following order to match advisories against your devices:

- Software Version:** Scans are performed on devices based on the software version with **Essentials** license.
- Custom:** Scans are performed on devices based on the software version and the custom configuration entered for an advisory (if any) against the device running configuration with **Advantage** license.
- Advanced:** Scans are performed on devices based on the software version, configuration, and operations data on devices with **Cisco CX Cloud Success Track** entitlements.

The license entitlements are not enforced in trial period and all devices are scanned at the **Advanced** level.

Note

- The security advisories dashboard shows security advisories published by Cisco that may affect devices on your network based on the software image currently installed. A further analysis of the configuration, platform details, or other criteria is required to determine if a vulnerability is actually present.
- Security advisories scanning is only available for routers and switches that are running the minimum supported software version. For more information, see the [Catalyst Center Compatibility Matrix](#).
- The security advisories displayed are subject to the [Cisco Security Vulnerability Policy](#).

The following table describes the information that is available.

Column	Description
Advisory ID	ID of the security advisories found in the network. Click the ID to go to the respective advisory web page.
Advisory title	Name of the security vulnerability advisory applicable to the network devices.
CVSS score	Score evaluated based on the Common Vulnerability Scoring System (CVSS) model.
Impact	Impact of the vulnerability on the network.

Column	Description
CVE	Common Vulnerabilities and Exposures (CVE) identifier for the vulnerability.
Devices	The number of devices impacted by the vulnerability. Click the number to view the devices that may be vulnerable based on this specific advisory, and upgrade the devices as needed.
Match Type	Indicates whether the vulnerability was detected based on the Image Version match or the Configuration match.
Known since (days)	The number of days since the vulnerability was discovered.
Last updated	The date when the advisory was last updated.

- Step 5** The **FAILED DEVICES** area displays the information about the device scan scheduled for a later date and time.
- Note** The **FAILED DEVICES** area appears only when there is a failed device in a scan and system schedules a scan automatically.
- Step 6** In the **Advisories** table click **All** tab to list all the advisories.
- Step 7** In the **Advisories** table click **Affecting Devices** tab to view the advisories based on affecting devices. The **Devices** table list the devices based on **Device Name**, **Device Family**, **Device Series**, **IP Address**, **Advisories**, **Advisories (Suppressed)**, **Platform**, **Image Version**, **Scan Status**, **Scan Criteria**, **Site**, and **Reachability**.
- Step 8** Click the **Devices** tab to view the number of advisories applicable to each device.
- Click the number of advisories to view all that match the device.
 - Click the topology icon in the top-right corner to view the device topology. You can click a device in the topology to view all advisories that match the device.
- A lock icon next to the device indicates that there are one or more advisories applicable to the device.
- The **Fixed Version** column shows the version in which the advisories are fixed. You can remove the advisory on your device by upgrading to the version mentioned in this column.
- Step 9** Click **Re-scan Network** to run the scan the network again.
- To re-scan the network to identify security advisories based on automated config scan, see [Rescan the Network to Identify Security Advisories, on page 831](#).

Schedule a Security Advisories Scan

-
- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** Click **Scan Network**.
- The **Scan Network** window appears.
- Step 3** To scan the security advisories immediately, click the **Now** radio button and click **Start**.

- Step 4** To schedule the scan for a later date and time, click the **Later** radio button and specify the date and time.
- Step 5** Use the **Time Zone** drop-down list to schedule the scan according to a specific time zone.
- Step 6** Choose the recurrence option: **None** (the default), **Daily**, or **Weekly**.
- Step 7** In the **Run at Interval** field, enter the number of days or weeks for the recurrence of the scan.
- Step 8** (Optional) Check the **Set Schedule End** check box to schedule an end date and number of occurrences.
 - To schedule a scan end date, click the **End Date** radio button and define the date and time.
 - To define the number of scan occurrences, click the **End After** radio button.
- Step 9** Click **Schedule**.
- Step 10** From the top-left corner, click the menu icon and choose **Activities > Tasks** and confirm the schedule and recurrence of the scan.

**Note**

In Catalyst Center releases earlier than 2.1.1.x, you have the ability to opt in or out of telemetry that Cisco collects. When you opt in, we collect your cisco.com ID, system telemetry, feature usage telemetry, network device inventory, and license entitlement. Telemetry is not application or feature specific; the disclosure of telemetry is for all of Catalyst Center. In Catalyst Center 2.1.1.x and later, telemetry collection is mandatory. The telemetry is designed to help the development of features that you use. See the [Cisco Catalyst Center Data Sheet](#) for a more expansive list of data that we collect.

When a security advisory scan runs, the following telemetry data is collected:

- Whether automatic update of knowledge packages has been set up.
- Whether recurring scanning and recurring reports have been set up.
- The number of reports that have been run.
- The number of devices with a security advisory match based on software version and configuration.
- The number of thumbs up/thumbs down votes, per scan.
- The manual configurations entered as a search, and the associated advisory.
- The number of advisory matches by software version and configuration, including product family.
- The number of devices based on other categories (zero advisories, unknown, and unsupported).
- The number of successful, failed, and terminated scans.
- The average scan time.

CLI Commands Invoked for Security Advisories

Catalyst Center collects network device configuration and operational data by running CLI commands on network devices, and then sends the information to the CX Cloud to be processed for exposure to potential security advisories or bugs. Catalyst Center invokes the following CLI commands for security advisories:

- **show inventory**
- **show running-config**

- show version

Rescan the Network to Identify Security Advisories

The following procedure describes how to rescan the network to identify security advisories based on automated configuration scan.

Before you begin

You must enable the Cisco CX Cloud service. For more information, see **Update the Machine Reasoning Knowledge Base** in the *Cisco Catalyst Center Administrator Guide*.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Security Advisories > Advisories**.

Step 2 Click **Re-Scan Network** to start the network scan again.

Step 3 To rescan the security advisories immediately, click the **Now** radio button and click **Start**.

Step 4 To schedule the rescan for a later date and time, click the **Later** radio button and specify the details. For information, see [Schedule a Security Advisories Scan, on page 829](#).

In the **Device** table, the **Advisories** column is updated with the number of advisories.

- The Catalyst Center network rescan sends the running config of devices along with other details, such as platform details and the CX Cloud software version. The information is processed and sent back to Catalyst Center. The Machine Reasoning Engine (MRE) running on Catalyst Center maps the advisories against the devices provided by the Cisco CX Cloud.
- If Catalyst Center cannot determine the correct license level for a given device, the security advisory scan falls back to scan by software version.

Hide and Unhide Devices from an Advisory

Step 1 From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.

Step 2 If you are launching the **Security Advisories** page for the first time, click **Scan Network**.

Step 3 In the **Scan Network** window, choose **Now**, and then click **Start**.

Step 4 To hide the devices from an advisory, do the following:

- a) From the **Focus** drop-down list, choose **Advisories**.
- b) In the **Devices** column, click the devices count that corresponds to the advisory for which you want to hide the devices.

The **Active** tab shows the number of devices for which these advisories are issued.

- c) Choose the devices that you want to hide and click **Suppress Device**.

The hidden devices can be viewed in the **Suppressed** tab.

- d) Close the advisory window and view the change in the device count for this advisory.

Hide and Unhide Advisories from a Device

- Step 5** To restore the devices to an advisory, do the following:
- From the **Focus** drop-down list, choose **Advisories**.
 - In the **Devices** column, click the devices count that corresponds to the advisory for which you want to unhide the devices.
 - Click the **Suppressed** tab to view the hidden devices.
 - Choose the devices that you want to unhide and click **Mark as Active**.
- The restored devices can be viewed in the **Active** tab.
- Close the advisory window and view the change in the device count for this advisory.
-

Hide and Unhide Advisories from a Device

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** If you are launching the **Security Advisories** page for the first time, click **Scan Network**.
- Step 3** In the **Scan Network** window, choose **Now**, and then click **Start**.
- Step 4** To hide the advisories for a device, do the following:
- From the **Focus** drop-down list, choose **Devices**.
 - In the **Advisories** column, click the advisories count that corresponds to device for which you want to hide the advisories.
- The **Active** tab shows the number of advisories issued for this device.
- Choose the advisories that you want to hide and click **Suppress Advisory**.
- The hidden advisories can be viewed in the **Suppressed** tab.
- Close the device window and view the change in the advisory count for this device.
- Step 5** To restore the advisories for a device, do the following:
- From the **Focus** drop-down list, choose **Devices**.
 - In the **Advisories** column, click the advisories count that corresponds to the device for which you want to unhide the advisories.
 - Click the **Suppressed** tab to view the hidden advisories.
 - Choose the advisories that you want to unhide and click **Mark as Active**.
- The restored advisories can be viewed in the **Active** tab.
- Close the device window and view the change in the advisories count for this device.
-

Add Notification for a New Security Advisory KB

A security advisory Knowledge Bundle (KB) uses a Machine Reasoning Engine (MRE) to scan the network. You can configure Catalyst Center to notify you when a new security advisory KB is available. After you

enable notifications, Catalyst Center displays a visual notification and actionable alert whenever a new security advisory KB is available.

The following procedure explains how to add notifications for new security advisory KBs:

Before you begin

- You must install the Catalyst Center core package. See Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- You must install the Machine Reasoning (MRE) package. See Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- The following containers must be present in your system:
 - cnsr-reasoner
 - cloud connectivity/download

Step 1 Click the notification icon in the top-right corner of the Catalyst Center GUI. From the drop-down menu, select the gear icon to view the notification preferences.

Step 2 In the **My Profile and Settings** window, enable the security advisory notification by choosing the **Security Advisories** option.

Step 3 Click **Save**.

Step 4 In the **Machine Reasoning Engine** window, click the **Download Latest** link to download the latest knowledge bundle.

Step 5 Review and update the Knowledge Base settings.

Step 6 In the **Security Advisory Settings** section, choose the recurrence option: **None** (default), **Daily**, or **Weekly**.

Step 7 Choose **Notification Center > Go to Security Advisories** to view the Security Advisories tool window directly.

Step 8 Rescan the network with the newly downloaded security advisories. For more information, see [Schedule a Security Advisories Scan, on page 829](#).

View Security Advisories in the Inventory

The Catalyst Center security focus view lists the security advisories for your devices, based on the data retrieved from the previous security scan. The device data that you retrieve from the **Security Advisories** tool is displayed in the **Inventory** window.

Use the following procedure to view the security advisories:

Before you begin

- You must install the Catalyst Center core package. See Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).
- You must install the Machine Reasoning package. See Download and Install Packages and Updates in the [Cisco Catalyst Center Administrator Guide](#).

Add a Match Pattern

-
- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** Click **Scan Network**.
- Step 3** To scan the security advisories immediately, click the **Now** radio button and click **Start**.
- Step 4** From the top-left corner, click the menu icon and choose **Provision > Network Devices > Inventory**.
- Step 5** From the **FOCUS: Inventory** drop-down menu, choose **Security**.
The **Advisories** column is displayed in the **Inventory** table.
- Step 6** In the **Device Details** window, select a device and view the advisories data.
- Step 7** Click **Manage All** to navigate to the **Security Advisories** tool.
-

Add a Match Pattern

-
- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** If you are launching the **Security Advisories** page for the first time, click **Scan Network**.
- Step 3** In the **Scan Network** window, choose **Now**, and then click **Start**.
- Step 4** Choose an advisory and in the **Match Type** column, click **Add match pattern**.
- Step 5** In the **Add Configuration Match Pattern** window, enter the condition to match with devices in the **CONDITIONS** text box.
- Step 6** Click **Save**.
The match pattern is added to the advisory.
- Step 7** Click **Scan Network** to check the number of devices that match with the match pattern.
-

Define AND/OR for the Match Pattern

-
- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** If you are launching the **Security Advisories** page for the first time, click **Scan Network**.
- Step 3** In the **Scan Network** window, choose **Now**, and then click **Start**.
- Step 4** Choose an advisory and in the **Match Type** column, click **Add match pattern**.
- Step 5** In the **Add Configuration Match Pattern** window, do the following:
- In the **CONDITIONS** text box, enter a condition and then click the **Add** icon.
 - From the drop-down list, choose **AND** or **OR** and then enter the next condition.
 - If you want to delete a condition, click the **Remove** icon.
 - Click **Save**.
The match pattern is added to the advisory.

- Step 6** Click **Scan Network** to check the number of devices that match the match pattern.
-

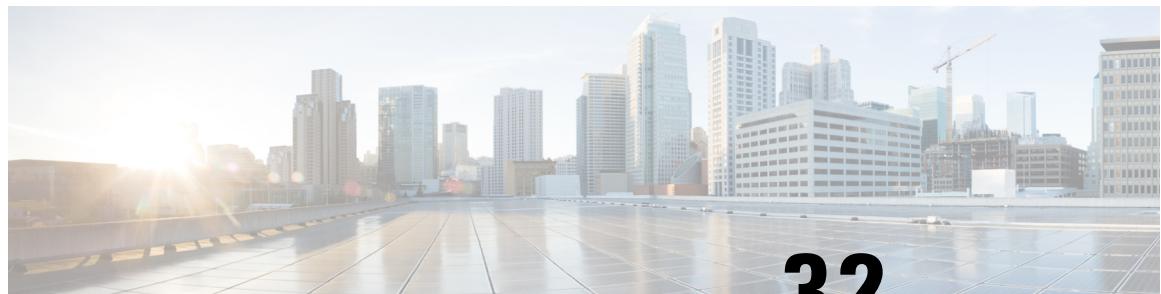
Edit the Match Pattern

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** If you are launching the **Security Advisories** page for the first time, click **Scan Network**.
- Step 3** In the **Scan Network** window, choose **Now**, and then click **Start**.
- Step 4** Choose an advisory that already has a match pattern and in the **Match Type** column, click **Edit match pattern**.
- Step 5** In the **Edit Configuration Match Pattern** window, enter the condition to match with devices in the **CONDITIONS** text box.
- Step 6** Click **Save**.
The match pattern is changed.
- Step 7** Click **Scan Network** to check the number of devices that match the match pattern.
-

Delete the Match Pattern

- Step 1** From the top-left corner, click the menu icon and choose **Tools > Security Advisories**.
- Step 2** If you are launching the **Security Advisories** page for the first time, click **Scan Network**.
- Step 3** In the **Scan Network** window, choose **Now**, and then click **Start**.
- Step 4** Choose an advisory that already has a match pattern and in the **Match Type** column, click **Edit match pattern**.
- Step 5** In the **Edit Configuration Match Pattern** window, click **Delete**.
The match pattern is deleted.
-

Delete the Match Pattern



CHAPTER 32

Identify Network Field Notices

- [Field Notices Identifier Tool Overview, on page 837](#)
- [View Field Notices, on page 837](#)

Field Notices Identifier Tool Overview

Field Notices are notifications that are published for significant issues, other than security vulnerability-related issues, that directly involve Cisco products and typically require an upgrade, workaround, or other customer action.

The Field Notices tool uses these notifications, scans the inventory within Catalyst Center, and finds the devices with these known issues.

View Field Notices

Field Notices are notifications for significant issues, other than security vulnerability-related issues, that directly involve Cisco products and typically require an upgrade, workaround, or other customer action.

Step 1 From the top-left corner, click the menu icon and choose **Tools > Field Notices**.

Step 2 If you are launching the **Field Notices** window for the first time, click **Scan Network**.

The **Scan Network** window appears.

Step 3 In **Scan Network** window, do the following:

- If required, edit the default Task Name.
- Select the **Now** radio button to scan network immediately or select **Later** radio button to scan the network for later time.

Note Click the **here** link in the banner that appears at the top, to create new trial that provides access to customized field notices based on device configuration.

Step 4 On completion of the scan, the **FIELD NOTICES** area displays the field notices for hardware and software issues. To view the list of devices and the issues identified for the devices, click the **Devices** tab and do the following:

- In the **SUMMARY** area, expand **Devices Family** and filter the device family that is, **Routers, Switches and Hubs, Unified AP, or Wireless Controller**.

View Field Notices

- b) Expand **Scan Status** and filter the devices based on **Success**, **Failed**, or **Not Scanned** status.

The **Devices** table displays the list of devices based on **Device Name**, **IP Address**, **Device Family**, **Site**, **Field Notices**, **Potential Field Notices**, **Scan Status**, **Last Scanned**, **Site**, and **Reachability**.

The **Field Notices** and **Potential Field Notices** columns display the number of field notices and potential field notices for the device.

- c) Click a number from the respective column to open a slide-in pane with additional details.
- d) In the slide-in pane, click the **Field Notices** or **Potential Field Notices** tab to view a table with additional information.

Note The **Reason** column is shown only for potential field notices.

- e) (Optional) Click the **Details** tab to view hardware, software details, and operational summary.

Step 5

Click the **Field Notices** tab and do the following:

- a) In the **SUMMARY** area, expand **Field Notice Type**.
- b) Choose the type **Hardware** or **Software**.

The **Field Notices** table is displayed with additional information.

- c) The **Affected Devices** column displays the number of affected devices. Click a number to open a slide-in pane with additional details.

The **Affected Device** table is displayed, which lists the devices based on **Device Name**, **IP Address**, **Reason**, and **Image Version**.

- d) The **Potentially Affected Devices** column displays the number of potentially affected devices. Click a number to open a slide-in pane with additional details.

The **Potentially Affected Devices** table is displayed, which lists the devices based on **Device Name**, **IP Address**, **Reason**, and **Image Version**.

Step 6

(Optional) Click **Re-scan Network** to run the network scan again.

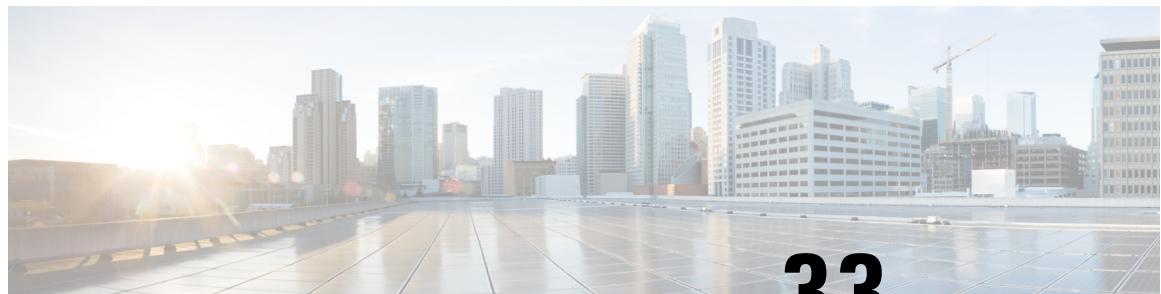
- a) In the **Scan Network** slide-in pane, choose whether you want to scan your system for field notices **Now** or **Later**, and click **Submit**.
- b) To view the progress, click the menu icon and choose **Activities** > **Tasks** and confirm the schedule and recurrence of the scan.



PART **VIII**

Manage Catalyst Center

- [Build and Deploy Workflows, on page 841](#)
- [Wireless Network Configuration Use Cases, on page 881](#)
- [Troubleshoot Catalyst Center Using Data Platform, on page 897](#)



CHAPTER 33

Build and Deploy Workflows

- Catalyst Center Workflow Navigation, on page 841
- Discover Devices, on page 841
- AP Refresh Workflow, on page 843
- Configure User-Defined Network, on page 846
- Enable Application Hosting on Switches, on page 849
- Enable IoT Services, on page 850
- AP Configuration in Catalyst Center, on page 851
- Learn Device Configurations from Devices with Pre-Existing Infrastructure, on page 864
- Replace Device, on page 868
- Create a Remote Support Authorization, on page 872
- Create an Event Notification, on page 873
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Catalyst Center Workflow Navigation

Catalyst Center workflows are similar to wizards. The workflows are embedded in the GUI to guide you through multistep tasks that would otherwise be too complex or advanced to complete. You can access many of them from various menu options or directly from the **Workflows** menu option.

Use these guidelines to help you navigate through the workflows:

- Follow the steps in the workflow and click **Next** to go to the next page.
 - When you hover your cursor near the top of each page in the workflow, a **Progress bar** displays, showing you the steps to complete the process and which step you are currently on.
 - Some workflows open a dialog box that you can click through to see a visual overview of the task. At any point in the task overview, you can click **Let's Do it** to jump directly to the beginning of the workflow.
- To skip the task overview in the future, check the **Don't show this to me again** check box.

Discover Devices

This workflow guides you from device discovery to network health.

Before you begin

- Your devices must have the required device configurations, as described in [Discovery Prerequisites, on page 44](#).
- Enable CDP on your network devices, if you want to use CDP discovery protocol.
- Enable LLDP on your network devices, if you want to use LLDP discovery protocol.
- Configure your network device's host IP address as the client IP address. (A host is an end-user device, such as a laptop computer or mobile device.)

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Discover Devices**.

Step 2 If a task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 3 In the **Discover Devices** window, complete the following fields:

- a) Enter a name for the discovery job.
- b) Under **Discovery Type**, choose the protocol used to discover devices and complete the corresponding fields, as follows:
 - **CDP**: Enter the **IP Address**, **CDP Level**, and **Subnet Filter**.
 - **IP Address Range**: Enter the **Starting IP Address** and **Ending IP Address**.
 - **LLDP**: Enter the **IP Address**, **LLDP Level**, and **Subnet Filter**.
- c) Choose the **Preferred Management IP Address**.

Step 4 In the **Provide Credentials** window, configure the discovery credentials and other settings as required.

Enter at least one CLI credential and one SNMP credential that Catalyst Center will configure for the devices it discovers. You can have a maximum of five global credentials and one task-specific credential for each type. For more details, see [Discovery Credentials, on page 45](#).

- a) In the left pane, click **CLI** to add CLI credentials.
- b) Expand **SNMP** to add SNMP credentials.
- c) Expand **Advanced Settings** and configure the following settings:
 - **Protocol Order**: Choose **SSH** or **Telnet**. If you choose both, you can specify the order in which they are used by dragging the protocols up or down.
 - **SNMP Polling Properties**: Use the global SNMP polling properties defined in the **Network Settings > Device Credentials** window or modify for this discovery instance.

Note You can configure other credentials such as, NETCONF and HTTP(S), if required.

Step 5 In the **Schedule Job** window, do the following:

- a) Click **Now** to start device discovery immediately or click **Later** to schedule device discovery at a specific time. If you choose the **Daily** or **Weekly** recurrence option, the **Discover new devices only** option is disabled.
- b) Click the toggle button to enable or disable the **Discover new devices only** option.
- c) Click the **Assign devices to an existing site** link.

The **Visibility and Control of Configurations** dialog box is displayed with information about the settings that will be enabled on the devices during site assignment. If Visibility of Configurations is enabled and a site is assigned during discovery, a configuration preview will not be generated.

During the discovery workflow, devices can be assigned to existing sites only, new site creation is not supported.

In the dialog box, choose any one of the following options:

- **Assign to site without Configuration Preview:** Use the **Search Hierarchy** search field or the filter icon to find a site, building, or area. For more details, see [Search the Network Hierarchy, on page 166](#).
- **Skip site assignment for now:** Use this option if you want the devices to be assigned to sites later from inventory.

Step 6 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 7 Click **Start Discovery**.

You can view the status of the task in the **Activities > Tasks** window.

What to do next

The **Device Discovery** window displays an option to view the discovered devices based on the site assignment. Use this option to view devices assigned to a site or a network or the unassigned devices in the inventory.

AP Refresh Workflow

The AP Refresh feature allows you to replace both provisioned and unprovisioned older AP models with newer AP models, using the Access Point Refresh workflow. You can use this procedure to replace old APs with new ones in Catalyst Center for the following use cases:

- Automation use case: Deployments where a wireless controller provisioned through Catalyst Center is used to provision your network. After AP refresh, the new AP is provisioned with the network intent configuration.
- Assurance use case: Deployments where Catalyst Center is used primarily for Assurance purposes, and provisioning and administration of wireless controllers and APs is done outside Catalyst Center. The new AP isn't provisioned after AP refresh and only the old configuration is copied to the new AP.

For device compatibility information, see the [Catalyst Center Compatibility Matrix](#).

Before you begin

- Ensure that the old AP is in the Unreachable state and assigned to a site.
- The new AP must not be assigned to any site.
- For the automation use case, the old AP site must be provisioned as a managed AP location for the wireless controller to which the new AP is associated.
- For the Assurance use case, the new AP must join the same wireless controller where the old AP was previously associated.

- For the automation use case, you must connect the new AP to a wireless controller. The new AP must either be available in the Catalyst Center inventory or be able to contact Catalyst Center through Plug and Play (PnP). It must be in the Reachable state.



Note Unprovisioned older AP models can't be refreshed through PnP. For unprovisioned older AP models, the new AP must be available in the inventory and connected to the same wireless controller.

- For the Assurance use case, you must connect the new AP to a wireless controller. The new AP must be available in the Catalyst Center inventory.

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Access Point Refresh**.

Note If an **Overview** window opens, click **Let's Do it** to start the workflow.

Step 2 In the **Before you begin** window, view the prerequisites for the AP refresh workflow.

Step 3 In the **Get started** window, enter a unique name for the task.

Step 4 In the **Select your scenario** window, click the radio button next to the required use case: **Automation Usecase** or **Assurance Usecase**

Step 5 In the **Select Access Points** window, do the following:

- In the left pane, check the check box next to the floor where you want to refresh the AP.
- In the right pane, check the check box next to the device name that you want to replace.

Step 6 In the **Assign New APs to Old APs** window, do the following:

- (Optional) To automatically detect the new APs using SwitchPort, click the corresponding toggle button.

Ensure that the Cisco Discovery Protocol (CDP) is enabled on the wireless controller or AP for automatic detection of new APs.

Note Automatic detection of the new AP using SwitchPort isn't supported when it's onboarded through PnP.

When you enable the automatic detection of new APs, this workflow performs the following:

- If the new AP is connected to the same switch port where the old AP is connected, the serial number of the new AP is automatically populated.
 - If the new AP isn't onboarded yet, the serial number of the new AP is detected after it's discovered. Alternatively, you can enter the serial number of the new AP.
- Select a method through which you want to provide new AP details:

- To add the new AP details using the GUI, click the edit icon () for the AP, and in the **Edit details** window, do the following:
 - (Optional) Update the new AP name.
 - (Optional) From the **Choose Platform ID** drop-down list, choose the platform of the new AP.
 - From the **Choose Serial Number** drop-down list, choose the serial number of the new AP.

If the new AP is already associated with a wireless controller and is available in the inventory, Catalyst Center displays the serial number of that AP as **Managed** in the **Choose Serial Number** drop-down list.

If the new AP has contacted Catalyst Center through PnP, Catalyst Center displays the serial number of that AP as **Unclaimed** in the **Choose Serial Number** drop-down list.

If the serial number of the new AP isn't available in the Inventory, the **Serial Number** drop-down list doesn't contain the serial number. To add a new serial number that isn't present in the inventory, from the **Choose Serial Number** drop-down list, enter the serial number and click +.

Note If you enable the automatic detection of new APs using SwitchPort, choosing the serial number is optional.

4. Click Save.

- To add the new AP details using a comma-separated value (CSV) file, do the following:
 1. Click **Download CSV**. The downloaded CSV template file contains the old AP details. Update the device name and add the serial number of the new AP.
 2. To import the CSV file, click **Upload CSV**.
 3. In the **Upload CSV** window, you can either drag and drop the CSV file into the drag-and-drop area or click **Choose a file**, browse to the location of the CSV file, and click **Open**.
Catalyst Center performs a validation check. If the uploaded CSV file doesn't meet the requirement, an error message is displayed. Click **View Details** to get more details about the error message.
 4. Click **Upload**.

Step 7 In the **Configuration to be copied from Old APs to New** window, view the configuration that will be copied from the old AP to the new AP.

Step 8 If Catalyst Center detects any errors or unresolved dependencies, the **Resolve Dependencies** window is displayed. You must resolve any errors and dependencies before proceeding, including the following:

- **Device EULA Acceptance:** Accept the device End-User License Agreement (EULA) by providing your Cisco.com credentials.
- **Update the Cisco Wireless Controller software image version:** You must resolve this dependency even though it doesn't stop you from proceeding with the AP refresh.
- **AP Connected SwitchPort:** You must resolve this dependency even though it doesn't stop you from proceeding with the AP refresh.

Step 9 In the **Schedule Access Point Refresh Task** window, click **Now** or **Run Later** to schedule the AP refresh task for a later date and time.

Step 10 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 11 In the **Track Replacement Status** window, monitor the AP replacement status:

- If the AP replacement succeeds, the **Replacement Status** shows **REPLACED**.
- If the AP replacement fails, the **Replacement Status** shows **Error**.

Note If the new AP isn't yet discovered in the inventory and the corresponding AP refresh entry is waiting for the new device to be connected, or if the PnP claim process is in progress, resynchronize the Cisco Wireless Controller.

Step 12 (Optional) In the **Track Replacement Status** window, do any of the following:

- To view the latest AP replacement status, click **Refresh Data**.
- To get more information about the AP replacement status, click **View Details**.
- To delete a replacement entry, under the **Actions** column, click the three blue dots and click **Delete**. In the **Warning** dialog box, click **Yes**.
- To download the provisioning summary to a CSV file that you can save locally, click **Export**.
- To download the provisioning status report, click **Download Report**.

Step 13 Click **Next** to view the refresh summary.

After a successful replacement, an AP refresh event is generated in Cisco Catalyst Assurance for the old and new APs.

Step 14 (Optional) View the AP refresh event under **Event Viewer** in the **AP View 360** window.

Catalyst Center automatically updates the new APs on the respective floor maps in the **Network Hierarchy** window.

Configure User-Defined Network

The following sections provide information about configuring the Cisco User-Defined Network service using workflows in Catalyst Center.

Overview of User-Defined Network Service

Home, consumer, and IoT devices on the network, such as printers, speakers, Apple TV, Google Chromecast, ring doorbells, smart bulbs, and so on, depend on the Simple Service Discovery Protocols (SSDP) such as Apple Bonjour, multicast DNS (mDNS), and Universal Plug and Play (UPnP) to provide the easy discovery and usage of devices.

The Cisco User-Defined Network service provides secure and remote onboarding of client devices in shared environments such as dormitory rooms, residence halls, class rooms, and auditoriums. With the User-Defined Network service, users can securely use SSDPs such as Apple Bonjour, mDNS protocols such as AirPlay, AirPrint, Screen Mirroring, Print, or UPnP protocol to interact and share with only their registered device in the shared environment.

The User-Defined Network service provides the following solution:

- Easy and secure onboarding of client devices.
- Automatic segmentation of client devices that belong to a particular user.
- Ability to invite other users to share their devices.

Prerequisites for Configuring the User-Defined Network Service

Before configuring the Cisco User-Defined Network service, the following prerequisites must be completed:

- Confirm that APs have joined the Cisco Wireless Controller.
- Discover Cisco Wireless Controllers and APs in your network using the **Discovery** functionality so that the discovered devices are listed in the **Inventory** window.
- Map the AAA server client endpoint with Cisco Identity Services Engine.
- Add the authentication tokens to Catalyst Center.
- Create nonfabric enterprise SSIDs or guest wireless SSIDs with any security, and map them to the network profile.
- Provision SSIDs.

Configure Cisco User-Defined Network

This procedure shows how to configure the Cisco User-Defined Network (UDN) using workflows.

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Configure Cisco UDN**.

Alternatively, you can configure the Cisco UDN from **Provision > Services > Cisco User Defined Network**.

Step 2 If a task overview window opens, click **Let's Do It** to go directly to the workflow.

a) Click **Click here**.

The **Cloud Authentication** window opens.

b) Hover over **Where did I get my token encryption key?** and click **Go to the Portal**.

The Cisco Cloud Services application opens in a new tab.

c) Log in to Cisco Cloud Services using your Cisco.com account ID and password.

The Cisco Cloud Services home window lists the subscribed offers for your region as a card.

Step 3 Generate an authentication token using the Cisco Cloud Services portal to allow Catalyst Center to connect with Cisco Cloud Services:

a) In the Cisco Cloud Services GUI, click the menu icon and choose **Applications > Product** to register Catalyst Center to your cloud subscription.

By default, the **ALL** tab opens and is highlighted with a blue tick mark. You can register either from the **ALL** tab or from the **Cisco DNA Center** tab.

Note Catalyst Center registration fails intermittently on the Cisco Cloud Services portal. This is an intermittent issue that occurs during every alternate deregistration due to communication failure from Cisco Cloud Services to Catalyst Center in all regions.

b) To register from the **ALL** tab:

• Click **Register**.

The **Register Product** slide-in pane appears.

- In the **Product Name** field, enter a name.
 - From the **Product Type** drop-down list, choose **Cisco DNA Center**.
 - Click **Register**.
 - The **OTP Generated** dialog box appears after successful registration of Catalyst Center. To copy the OTP, click **Copy**, and click **close**.
- c) Alternatively, to register from the **Cisco DNA Center** tab:
- Click **Register** to securely connect your products to the relevant cloud applications and services offered by Cisco and its partners.
- The **Register Product** slide-in pane appears.
- In the **Cisco DNA Center Name** field, enter the name of the on-premises Catalyst Center.
 - In the **OTP Generated** dialog box, click **Copy** to copy the OTP and click **close**.

Step 4

Navigate back to the **Cloud Authentication** window to establish the connection:

- a) In the Catalyst Center GUI, click the menu icon and choose **System > Settings > External Services > Cloud Authentication**.
- b) Click **Add OTP Key**.
- c) In the **OTP Code** field, paste the OTP that you generated and copied in the Cisco Cloud Services application, and click **Done**.
- d) In the **Success** dialog box, click **OK**.

Step 5

Verify whether the connection has been established between Catalyst Center and Cisco Cloud Services on the **Cisco Cloud Services > Applications > Products** window.

The **Registration Status** column shows the status as **Registered** after a successful registration.

Step 6

Enable sites and provision Cisco UDN services on your network:

- a) Navigate back to the **Welcome to Cisco User Defined Network** window in Catalyst Center.
- b) Click **Next**.
- c) In the **Select Sites** window, choose the sites where you want to enable the Cisco UDN service.
- d) In the **SSID(s)** window, do the following:
 - From the **SSID(s)** drop-down list, choose the SSIDs where you want to enable the Cisco UDN service.
 - To limit the unicast traffic for the selected SSID, turn on **Unicast Traffic Containment**.
 - Click **Apply Individually** to apply unicast traffic containment for a specific site.
 - Click **Apply to all** to apply the unicast traffic containment for all sites.
 - Click **Next**.

Step 7

In the **Scheduling** window, click **Now** or **Later** to indicate when you want to provision the Cisco UDN service. Then, click **Next**.

Step 8

In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

- a) Expand the **Connection Status** area to view the connection status between Catalyst Center and Cisco UDN Cloud.

A "Paired with Cisco Cloud Services" message appears after establishing a connection between Catalyst Center and Cisco UDN Cloud.

- b) Click **Configure**.

In the next window, a check mark is shown next to each step as it completes.

Enable Application Hosting on Switches

The following procedure shows how to enable docker applications such as ThousandEyes Enterprise Agent and iPerf in selected switches at a specific site.

Before you begin

- Complete the prerequisites. For more information, see [Prerequisites for Application Hosting, on page 661](#).
 - Add the application to Catalyst Center. For more information, see [Add an Application, on page 662](#).
 - Check the readiness of the switch to host the application. For more information, see [View Device Readiness to Host an Application, on page 662](#).
-

Step 1 From the top-left corner, click the menu icon and choose **Provision > Services > Application Hosting**.

Step 2 Choose the application and click **Install** at the bottom of the window.

Alternatively, you can also launch the workflow by choosing **Workflows > Enable Apps on Switches > Let's Do it**.

Note At the top of the workflow window, place your cursor on the blue progress bar and switch back to the previous step listed.

Step 3 In the **Select Site** window, navigate to the building where you want to enable the application.

Step 4 In the **Select App** window, click on the application you want to select.

Note You can access the **+ New App** link to add an application that is not present in Catalyst Center.

Step 5 In the **Select Switches** window, check the check box next to the device name for which you want to enable the application.

Note You can import or export devices in bulk by providing the details in the specified template in the **Select Switches** dialog box.

Step 6 Complete the following settings in the **Configuration App** window:

- **App Networking**

- **Device Network:** From the **Select Network** drop-down list, choose a VLAN to configure the application.

- **App IP address:** From the **Address Type** drop-down list, choose **Static** or **Dynamic**. If you choose **Static**, click the thumbnail icon and enter the **IP Address**, **Gateway**, **Prefix/Mask**, and **DNS** for the application.

- **Resource Allocation:** Check the **Allocate resources as asked by the app** or the **Allocate all resources available on the device** check box.

- **Custom Settings:** (Applicable only for Cisco package applications) Enter the configuration details for the attributes that are specified by the application.
- **App Data:** Browse and upload the application-specific files. To identify the required application-specific files, see the relevant application document.
- **Docker Runtime Options:** Enter the docker runtime options required by the application.

- Step 7** In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
The **Provisioning Task** window displays the task name that tracks the deployment of the application on the switches.
- Step 8** Review the automatically generated task name and click **Provision**.
- Step 9** In the **Track Provisioning Status** window, you can track the progress of the deployment.
- Step 10** Click **View Details** to view the provisioning status of the individual devices and failures, if any and click **Next**.
The application is enabled successfully.
The summary of the task result and the success/failure counts are displayed.
- Step 11** Click **Manage App**, where you can manage the lifecycle operations of the application to perform day-*n* tasks.
-

Enable IoT Services

The following sections provide information about enabling IoT technologies such as Bluetooth, Zigbee, and ESL on Cisco Catalyst 9100 Series Access Points using **Workflows** in Catalyst Center.

Enable IoT Services on Cisco Catalyst 9100 Series Access Points

This procedure shows how to enable IoT technologies such as Bluetooth, Zigbee, and ESL on selected Catalyst 9100 Series Access Points.

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Enable IOT Services**.
- Step 2** If a task overview window opens, click **Let's Do It** to go directly to the workflow.
- Step 3** In the **Select Site** window, navigate to the floor where you want to enable the IoT service, and click **Next**.
- Step 4** In the **Select the Application** window, select the SES-imagotag ESL Connector application to enable IoT in your network, and click **Next**.

Note To add an application that is not present in the Catalyst Center, see [Add an Application](#).

The **Select Access Points** window shows all the APs available on the particular floor.

- Step 5** In the **Select Access Points** window, check the check box adjacent to the **Device Name** where you want to install the IoT connector application, and click **Next**.
- Step 6** In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
- Step 7** The **Provisioning Task** window, which displays the task name created to track deployment of any application on APs, is displayed. Review the auto-generated task name and click **Provision**.

- Step 8** In the **Track Provisioning Status** window, you can track the progress of the deployment. Click **View Details** to view the provisioning status and click **Next**.
- Step 9** The **Done! Task Completed** window appears. Click **Manage IoT Application** to perform day-n tasks.

Manage IoT Applications

This procedure shows how to manage IoT applications.

Before you begin

You must have enabled IoT services on Cisco Catalyst 9000 Series Access Points.

- Step 1** After enabling IoT services, click **Manage IoT Application** in the **Done! Task Completed** window.
- Step 2** Check the check box next to the **Hostname** and perform the following tasks:
- To start the application, from the **Actions** drop-down list, choose **Start App**.
 - To stop the application, from the **Actions** drop-down list, choose **Stop App**.
 - To edit the application configuration, from the **Actions** drop-down list, choose **Edit App Config**.
 - To upgrade the application, from the **Actions** drop-down list, choose **Upgrade App**.
 - To uninstall the application from the selected AP, from the **Actions** drop-down list, choose **Uninstall App**.
- Step 3** Click the AP name to view details, such as the AP name, status, IP address, and health.
- Step 4** Click **Tech Support logs** to collect Application Hosting logs.
-

AP Configuration in Catalyst Center

The **Configure Access Points** workflow allows you to configure and deploy AP-level parameters, such as the AP location, admin status, mode, and so on. You can also configure radio-level parameters, such as the radio power level, channel settings, and so on.

Configure APs

This procedure shows how to configure AP and radio parameters in Catalyst Center.

The following settings configured using the **Configure Access Points** workflow aren't overwritten when the wireless controller or APs are reprovisioned:

- Admin status for radios (only applicable for Cisco AireOS Wireless Controllers)
- AP primary controller
- AP secondary controller



Note The AP configuration is generated from the information available in the Catalyst Center inventory. To ensure the latest configuration is generated, complete an inventory sync on the controller.

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Configure Access Points**.
If the **Configure Your Access Points** dialog box displays, click **Let's Do It** to go directly to the workflow.
- Step 2** In the **Get Started** window, enter a unique name for the workflow in the **Task Name** field and click **Next**.
- Step 3** In the **How do you want to configure APs?** window, do the following:
- Click the **Configure AP And Radio Parameters** radio button.
 - Check the check box next to the tasks that you want to perform:
 - **Modify AP Name**
 - **Configure AP Parameters**
 - **Configure 5 GHz Radio Parameters**
 - **Configure 2.4 GHz Radio Parameters**
 - **Configure 6 GHz Radio Parameters**
 - **Configure Dual-Band (XOR) Radio Parameters**
 - **Configure Tri-Radio Parameters**
 - **Create Template**
- Note** Based on the check boxes that you check, Catalyst Center displays the corresponding subsequent configuration steps.
- Click **Next**.
- Step 4** In the **Select Access Points** window, do the following:
- Click one of the following tabs:
 - **Assigned APs**: Lists the APs that are assigned to a site.
 - **Unassigned APs**: Lists the APs that are not assigned to any site.
 - If you chose the **Assigned APs** tab, navigate to the site where you want to apply AP-related configurations.
The right pane lists all the APs available in the selected site.
- Note** You can select up to 2000 sites in this window.
- If you chose the **Unassigned APs** tab, check the **Unassigned Devices** check box.
The right pane lists all the APs that are not assigned to any site.
 - Check the check boxes next to the AP names that you want to configure.
- We recommend that you select a maximum of 2000 APs in this window.

To filter APs based on specific details, click the search icon and choose from the filter options: **Quick Filters**, **Advanced Filters**, or **Recent Filters**. Choose the required option in the filter and click **Apply**.

To edit or customize the **Access Points** table, click the gear icon in the top-right corner of the table and do the following:

- To define the **Table Density**, click **Table Appearance**.
- To select the columns that you want to display in the table, click **Edit Table Columns**.
- To customize your current view, click **Edit Custom Views**.
- Click **Apply** to save the changes or click **Reset All Settings** to apply the default settings for the table.

e) Click **Next**.

Step 5

(Optional) In the **Modify AP Name** window, modify one or more AP names using one of the following methods:

- **Create a New Naming Convention**: Click this radio button, enter a name based on your naming convention, and click **Apply Pattern**. The **Access Points** table shows the new AP names based on the naming pattern that you entered.
- **Upload a CSV file**: Click this radio button, download the sample CSV template file, and add your AP names to it. Then, upload the CSV file either by dragging and dropping it into the drop area or by clicking **Choose a file** and browsing to select it.

Step 6

(Optional) In the **Configure AP Parameters** window, configure the AP parameters.

- **Admin Status**: To disable the admin status, check this check box and click **Disable**.
- **AP Mode**: Check this check box and choose the AP mode from the **Select AP Mode** drop-down list. Valid modes are **Local/Flexconnect**, **Monitor**, **Sniffer**, and **Bridge/Flex+Bridge**.

Note When you change the AP mode from **Monitor** or **Sniffer** to **Local/Flexconnect**, Catalyst Center uses the following settings:

If **FlexConnect Local Switching** is enabled on any associated SSID, Catalyst Center sets **FlexConnect** mode on the AP. Otherwise, it sets **Local** mode on the AP.

For unassigned APs or APs that are assigned but not provisioned, Catalyst Center sets **FlexConnect** mode on the AP as follows:

- For Cisco AireOS Wireless Controller: If **FlexConnect Local Switching** is enabled on any associated SSID in the AP group where the AP is present.
- For Cisco Catalyst 9800 Series Wireless Controller: If **Local site** is disabled on the current associated site tag of the AP.

- **AP Location**: Check this check box to enter the AP location details in the **Enter Location** field.

To use the currently assigned site as the AP location, check the **Use currently assigned site location** check box. If you check this check box, the **Enter Location** field is disabled. You can view the AP location that is being configured for each AP by clicking **Click here to see location details** before pushing this change to the device.

Note If you check the **Use currently assigned site location** check box, for APs that are not assigned to any site, Catalyst Center doesn't configure the AP location.

- **AP LED Status**: To disable the APs LED status, check this check box and click **Disable**.

- **LED Brightness Level:** Check this check box and choose the brightness level from the **LED Brightness Level**.
- **AP Failover Priority:** Check this check box and, from the **AP Failover Priority** drop-down list, choose one of the following failover priorities:
 - **Low** (Default): Level 1 priority, which is the lowest priority level.
 - **Medium**: Level 2 priority.
 - **High**: Level 3 priority.
 - **Critical**: Level 4 priority, which is the highest priority level.

- **High Availability:** Check this check box and configure the primary, secondary, and tertiary controller name and the IP address for the AP.

If you choose **Inherit from site / Clear** for the primary and secondary controllers:

- For the APs that are in Provisioned state, the controllers that are configured as primary and secondary for the floor where the AP is assigned are configured as the primary and secondary controllers on the AP.
- For the APs that are not in Provisioned state, the current primary and secondary controller configuration is cleared from the AP.

For the tertiary controller, only the **Clear** option is available.

- Note**
- If AP fallback is disabled on the controller, the AP doesn't join the newly configured primary, secondary, and tertiary controller.
 - If the AP is a ROW AP, ensure that you have added support for the country of operation to the country list on the controller. You must configure at least one site from the country of operation as the managed AP location for the controller.

- **CleanAir Pro / CleanAir / Spectrum Intelligence:** To disable the CleanAir spectrum intelligence for 2.4-GHz, 5-GHz, or 6-GHz radio band, check the corresponding check box, and click **Disable**.

- Note**
- You can configure CleanAir spectrum intelligence only on CleanAir spectrum intelligence-capable APs that are in the **Local/FlexConnect** or **Monitor** modes. If CleanAir spectrum intelligence is disabled on the 802.11a network, the operational status is down for the AP.

- Note**
- The **AP Height** parameter is no longer available in the **Configure Access Points** workflow. You can configure the AP height in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 7

- (Optional) In the **Configure 5 GHz Radio Parameters** window, configure the 5-GHz radio parameters.
- To view the list of applicable APs for the 5-GHz radio parameter configuration, click **View Devices**. Catalyst Center displays the **View Devices** option only when APs that support 5-GHz radio parameters are available.
 - Configure the following 802.11 a/n/ac/ax parameters:
 - **Admin Status:** To disable the admin status, check this check box and click **Disable**.
 - **Power Assignment:** To choose a custom power value, check this check box and click **Custom**. Choose the power level from the **Select Custom Power** drop-down list.

- **Channel Assignment:** To choose custom channel numbers, check this check box and click **Custom**. Choose a custom channel number from the **Select Custom Channel** drop-down list.
- **Channel Width:** To choose channel width, check this check box and choose the channel bandwidth.
- **Antenna Gain:** To choose an antenna, check this check box and choose an antenna from the **Select Antenna** drop-down list. If you choose **Other** as the antenna, enter the antenna gain value in the **Antenna Gain (in dBi) (for Antenna-Other)** field. Enter a number to specify the ability of an external antenna to direct or focus radio energy over a region. High-gain antennas have a more focused radiation pattern in a specific direction. The antenna gain value range is from 0 through 40.

Note The selected antenna name isn't reflected in wireless maps.

- **Antenna Cable:** To choose an antenna cable, check this check box and choose the antenna cable from the **Select Antenna Cable** drop-down list. If you choose **Other** as the antenna cable, enter the cable loss value in the **Cable Loss (in dB) (for Cable-Other)** field. The cable loss value is from 0 through 40.

Note The **Azimuth** and **Elevation** parameters are no longer available in the **Configure Access Points** workflow. You can configure these parameters in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 8 (Optional) In the **Configure 2.4 GHz Radio Parameters** window, configure the 2.4-GHz radio parameters.

- To view the list of applicable APs for the 2.4-GHz radio parameter configuration, click **View Devices**.

Catalyst Center displays the **View Devices** option only when APs that support 2.4-GHz radio parameters are available.

- Configure the following 802.11 b/g/n parameters:

- **Admin Status:** To disable the admin status, check this check box and click **Disable**.
- **Power Assignment:** To choose a custom power value, check this check box and click **Custom**. Choose the power level from the **Select Custom Power** drop-down list.
- **Channel Assignment:** To choose custom channel numbers, check this check box and click **Custom**. Choose a custom channel number from the **Select Custom Channel** drop-down list.
- **Antenna Gain:** To choose an antenna, check this check box and choose an antenna from the **Select Antenna** drop-down list. If you choose **Other** as the antenna, enter the antenna gain value in the **Antenna Gain (in dBi) (for Antenna-Other)** field. Enter a number to specify the ability of an external antenna to direct or focus radio energy over a region. High-gain antennas have a more focused radiation pattern in a specific direction. The antenna gain value range is from 0 through 40.

Note The selected antenna name isn't reflected in wireless maps.

- **Antenna Cable:** To choose an antenna cable, check this check box and choose the antenna cable from the **Select Antenna Cable** drop-down list. If you choose **Other** as the antenna cable, enter the cable loss value in the **Cable Loss (in dB) (for Cable-Other)** field. The cable loss value is from 0 through 40.

Note The **Azimuth** and **Elevation** parameters are no longer available in the **Configure Access Points** workflow. You can configure these parameters in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 9 (Optional) In the **Configure 6 GHz Radio Parameters** window, configure the 6-GHz radio parameters.

- a) To view the list of applicable APs for the 6-GHz radio parameter configuration, click **View Devices**. Catalyst Center displays the **View Devices** option only when APs that support 6-GHz radio parameters are available.
- b) Configure the following parameters:
 - **Admin Status**: To disable the admin status, check this check box and click **Disable**.
 - **Radio Role Assignment**: To choose a radio role, check this check box and click **Auto**, **Client-Serving**, or **Monitor**.
 - **Power Assignment**: To choose a custom power value, check this check box and click **Custom**. Choose the power level from the **Select Custom Power** drop-down list.
 - **Channel Assignment**: To choose a custom channel number, check this check box and click **Custom**. Choose a custom channel number from the **Select Custom Channel** drop-down list.
 - **Channel Width**: To choose channel width, check this check box and choose the channel bandwidth.

Note

The **Azimuth** and **Elevation** parameters are no longer available in the **Configure Access Points** workflow. You can configure these parameters in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 10

(Optional) In the **Configure Dual-Band (XOR) Radio Parameters** window, configure the dual-band (XOR) radio parameters.

- a) To view the list of applicable APs for the dual-band (XOR) radio parameter configuration, click **View Devices**. Catalyst Center displays the **View Devices** option only when APs that support dual-band (XOR) parameters are available.

You can configure dual-band (XOR) radio parameters on the following APs:

- Cisco Aironet 2800 Series Access Points
- Cisco Aironet 3800 Series Access Points
- Cisco Aironet 4800 Series Access Points
- Cisco Catalyst 9120 Series Access Points
- Cisco Catalyst 9166 Series Access Points

Note

Cisco Catalyst 9166 Series Access Point supports dual-band (XOR) between 5-GHz and 6-GHz radio modes. The other APs support dual-band (XOR) between 2.4-GHz and 5-GHz radio modes.

- b) Configure the following parameters:

- **Admin Status**: To disable the admin status, check this check box and click **Disable**.
- **Radio Role Assignment**: To choose a radio role, check this check box and click **Auto**, **Client-Serving**, or **Monitor**. Click the required option for radio band.
- **Power Assignment**: To choose a custom power value, check this check box and click **Custom**. Choose the power level from the **Select Custom Power** drop-down list.
- **Channel Assignment**: To choose a custom channel number, check this check box and click **Custom**. Choose a custom channel number from the **Select Custom Channel** drop-down list.

- **Channel Width:** To choose channel width, check this check box and choose the channel bandwidth.

Note If the dual radio mode is enabled on a dual-band (XOR)-capable AP, its slot 2 can't be in the **Client-Serving** radio role with the 160 MHz channel width.

- **Antenna Gain:** To choose an antenna, check this check box and choose an antenna from the **Select Antenna** drop-down list. If you choose **Other** as the antenna, enter the antenna gain value in the **Antenna Gain (in dBi) (for Antenna-Other)** field. Enter a number to specify the ability of an external antenna to direct or focus radio energy over a region. High-gain antennas have a more focused radiation pattern in a specific direction. The antenna gain value range is from 0 through 40.

Note The selected antenna name isn't reflected in wireless maps.

- **Antenna Cable:** To choose an antenna cable, check this check box and choose the antenna cable from the **Select Antenna Cable** drop-down list. If you choose **Other** as the antenna cable, enter the cable loss value in the **Cable Loss (in dBi) (for Cable-Other)** field. The cable loss value is from 0 through 40.

Note The **Azimuth** and **Elevation** parameters are no longer available in the **Configure Access Points** workflow. You can configure these parameters in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 11 (Optional) In the **Configure Tri-Radio Parameters** window, configure the tri-radio parameters.

- To view the list of applicable APs for the tri-radio parameter configuration, click **View Devices**.

Note

- Catalyst Center displays the **View Devices** option only when APs that support tri-radio parameters are available.
- Catalyst Center doesn't support tri-radio parameter configuration for APs that are in **Monitor** or **Sniffer** modes.

You can configure tri-radio parameters for the following APs:

- Cisco Catalyst 9124AXE Series Access Points
- Cisco Catalyst 9130AXI Series Access Points
- Cisco Catalyst 9130AXE Series Access Points

- Configure the following parameters:

- **Dual Radio Mode:** To choose the dual radio mode, check this check box and click **Auto**, **Enable**, or **Disable**.
- Note** When you enable dual radio mode, global tri-radio mode is enabled on the corresponding wireless controllers.
- **Radio Role Assignment:** To choose a radio role, check this check box and click **Auto**, **Client-Serving**, or **Monitor**.
- **Admin Status:** To disable the admin status, check this check box and click **Disable**.
- **Power Assignment:** To choose a custom power value, check this check box and click **Custom**. Choose the power level from the **Select Custom Power** drop-down list.
- **Channel Assignment:** To choose custom channel numbers, check this check box and click **Custom**. Choose a custom channel number from the **Select Custom Channel** drop-down list.

- **Channel Width:** To choose channel width, check this check box and choose the channel width.

Note Catalyst Center enables this parameter when you choose the **Custom** option for **Channel Assignment**.

- **Antenna Gain:** To choose an antenna, check this check box and choose an antenna from the **Select Antenna** drop-down list. If you choose **Other** as the antenna, enter the antenna gain value in the **Antenna Gain (in dBi) (for Antenna-Other)** field. Enter a number to specify the ability of an external antenna to direct or focus radio energy over a region. High-gain antennas have a more focused radiation pattern in a specific direction. The antenna gain value range is from 0 through 40.

Note The selected antenna name isn't reflected in wireless maps.

- **Antenna Cable:** To choose an antenna cable, check this check box and choose the antenna cable from the **Select Antenna Cable** drop-down list. If you choose **Other** as the antenna cable, enter the cable loss value in the **Cable Loss (in dBi) (for Cable-Other)** field. The cable loss value is from 0 through 40.

Note The **Azimuth** and **Elevation** parameters are no longer available in the **Configure Access Points** workflow. You can configure these parameters in the **Design > Network Hierarchy** window. For more information, see [Edit an AP, on page 189](#).

Step 12 (Optional) In the **Save As Reusable Template** window, choose one of the following options:

- To save as a new template, click **Create** and enter a name for the template in the **Template Name** field. By default, the **Template Name** field is autofilled with the workflow name. You can use the same name or change as required.
- If you want to skip the template creation, click **Do Not Save**.

Note The maximum number of templates supported is 500.

Step 13 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 14 In the **Schedule Provision** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 15 If necessary, update the task name in the **Task Name** field.

Step 16 Click **Configure**.

Note If you choose to save this configured workflow as a new template, it's created when you click **Configure**.

Step 17 On the **Performing Initial Checks** window, ensure the following issues display successful validations so that you can continue with your current deployment:

- Pending Operations: Because you can run multiple simultaneous AP configuration tasks without conflicting with your current deployment, this precheck displays a successful validation.

- Device Compliance: This precheck is unsupported in this workflow. So, this precheck displays a successful validation so that you can continue with your current deployment.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 18 (Optional) If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

When the device configurations are deployed, they are pushed to all the devices even if they aren't previewed on all the devices.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Schedule Recurring Events for APs

This procedure shows how to schedule recurring events for AP and radio parameters in Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Configure Access Points**.

If the **Configure Your Access Points** dialog box displays, click **Let's Do It** to go directly to the workflow.

Step 2 In the **Get Started** window, enter a unique name for the task in the **Task Name** field.

Step 3 In the **How do you want to configure APs?** window, click the **Schedule Recurring Events For AP And Radio Parameters** radio button.

Schedule Recurring Events for APs

- Step 4** In the **Select Access Points** window, do the following:
- Navigate to the site where you want to apply AP-related configurations.
- The right pane lists all the APs available in the selected site.
- Check the check boxes next to the names of the APs that you want to configure.
- Step 5** In the **Select AP and Radio Parameters** window, choose the AP and radio parameters that you want to configure. Catalyst Center applies certain settings to only one of the AP slots, as follows:
- **5 GHz Admin Status:** Applied to slot 1 of the AP.
 - **2.4 GHz Admin Status:** Applied to slot 0 of the AP.
 - **6 GHz Admin Status:** Applied to slot 3 of the 6 GHz-capable Cisco Catalyst 9136 Series APs and slot 2 of the 6 GHz-capable Cisco Catalyst 9164 Series APs.
 - **Dual-Band (XOR) Admin Status:** Applied to slot 0 of the following dual-band (XOR)-capable APs:
 - Cisco Aironet 2800 Series Access Points
 - Cisco Aironet 3800 Series Access Points
 - Cisco Aironet 4800 Series Access Points
 - Cisco Catalyst 9120 Series Access Points
- Applied to slot 2 of the dual-band (XOR)-capable Cisco Catalyst 9166 Series APs.
- **Tri-Radio Admin Status:** Applied to slot 2 of the tri-radio-capable APs with dual radio mode enabled.
- To disable the configuration of a parameter, check the corresponding check box and click **Disable**.
- Step 6** In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)
- Step 7** In the **Schedule Provision** window, depending on the Visibility and Control of Configurations settings, choose an available option:
- **Now:** Immediately deploy the configurations.
 - **Later:** Schedule the date and time and define the time zone of the deployment.
- For more information about the recurrence settings, see the following table.

Recurrence Setting	Description
None	Runs once and doesn't repeat.
Hourly	Catalyst Center runs the AP configuration task at every specified hour interval. In the Run at Interval (Hours) field, specify the interval, in number of hours, to repeat the task. The valid range is from 1 to 48.
Daily	Runs the AP configuration task at every specified day interval. In the Run at Interval (Days) field, specify the interval, in number of days, to repeat the task. The valid range is from 1 to 14.
Weekly	Runs the AP configuration task at every specified week interval. In the Run at Interval (Weeks) field, specify the interval, in weeks, to repeat the task. The valid range is from 1 to 52.

Recurrence Setting	Description
Set Schedule End	<p>If you choose Hourly, Daily, or Weekly, check the Set Schedule End check box to complete the recurrence end settings:</p> <ul style="list-style-type: none"> • To specify an end date, click End Date and specify the end date. <p>Note Catalyst Center allows a maximum end date of 3 years from the start date.</p> <ul style="list-style-type: none"> • To end the recurring event after a specified number of occurrences, click End After and specify the number of occurrences. <p>Note Catalyst Center allows a minimum value of 2.</p>

- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 8 If necessary, update the task name in the **Task Name** field.

Step 9 Click **Configure**.

Step 10 On the **Performing Initial Checks** window, ensure the following issues display successful validations so that you can continue with your current deployment:

- Pending Operations: Because you can run multiple simultaneous AP configuration tasks without conflicting with your current deployment, this precheck displays a successful validation.
- Device Compliance: This precheck is unsupported in this workflow. So, this precheck displays a successful validation so that you can continue with your current deployment.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 11 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
- b. On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

c. Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

- Note** You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

When the device configurations are deployed, they are pushed to all the devices even if they aren't previewed on all the devices.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Configure APs Using Existing Templates

This procedure shows how to configure AP and radio parameters in Catalyst Center using an existing template.

Before you begin

Ensure that AP configuration templates are available. To create a new template, choose the **Create Template** option in the **Configure AP And Radio Parameters** workflow. For more information, see [Configure APs, on page 851](#).

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Configure Access Points**.
If the **Configure Your Access Points** dialog box displays, click **Let's Do It** to go directly to the workflow.
- Step 2** In the **Get Started** window, enter a unique name for the workflow in the **Task Name** field and click **Next**.
- Step 3** In the **How do you want to configure APs?** window, do the following:
- a) Click the **Configure AP Parameters Using Existing Templates** radio button.
A list of templates is displayed.
 - b) (Optional) To view the configurations in a template, click the template name.
 - c) Check the check box next to the template name that you want.
You can choose only one template at a time.
 - d) Click **Next**.
- Step 4** In the **Select Access Points** window, do the following:
- a) Navigate to the site where you want to apply AP-related configurations.
The right pane lists all the APs available in the selected site.
 - b) Check the check boxes next to the AP names that you want to configure.
 - c) Click **Next**.
- Step 5** Based on the configuration settings in the selected template, Catalyst Center displays the corresponding subsequent configuration windows. Each of the following configuration windows displays the preconfigured settings as per the

template. You can choose to continue with existing configurations or reconfigure as required. For more information on configuring the AP and radio parameters, see [Configure APs, on page 851](#).

Note In the **Modify AP Name** window, the list of APs displayed is based on the APs selected in the previous step (**Select Access Points** window) and not as per the template settings.

- **Modify AP Name**
- **Configure AP Parameters**
- **Configure 5 GHz Radio Parameters**
- **Configure 2.4 GHz Radio Parameters**
- **Configure 6 GHz Radio Parameters**
- **Configure Dual-Band (XOR) Radio Parameters**
- **Configure Tri-Radio Parameters**

Step 6 (Optional) In the **Save As Reusable Template** window, choose one of the following options to save the configuration changes as a template, or click **Do Not Save** if you don't want to save the changes at this point:

- To save as a new template, click **Create** and enter a name in the **Template Name** field.
- To update the existing template, click **Update**.

Step 7 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 8 In the **Schedule Provision** window, depending on the Visibility and Control of Configurations settings, choose an available option:

- **Now**: Immediately deploy the configurations.
- **Later**: Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview**: Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

Step 9 If necessary, update the task name in the **Task Name** field.

Step 10 Click **Configure**.

Step 11 On the **Performing Initial Checks** window, ensure the following issues display successful validations so that you can continue with your current deployment:

- Pending Operations: Because you can run multiple simultaneous AP configuration tasks without conflicting with your current deployment, this precheck displays a successful validation.
- Device Compliance: This precheck is unsupported in this workflow. So, this precheck displays a successful validation so that you can continue with your current deployment.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

Step 12 If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:

- On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.

- On the **Preview Configuration** window, review the device configurations.

For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Do one of the following:

- When you're ready, click **Deploy** or **Submit for Approval**.
- If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

When the device configurations are deployed, they are pushed to all the devices even if they aren't previewed on all the devices.

- In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

- Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

Learn Device Configurations from Devices with Pre-Existing Infrastructure

The following procedure shows how to learn configuration from devices with pre-existing infrastructure using Catalyst Center.

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Learn Device Configuration > Let's Do it** to launch the workflow.

Note At the top of the workflow window, place your cursor over the blue progress bar to see the current step you are on and also to switch back to any of the previous steps.

Step 2 In the **Select a WLC to Learn Configuration** window, click on the wireless controller whose configurations have not been learned by Catalyst Center and click **Next**.

Step 3 In the **Site Assignment** window, select sites that aren't associated with the existing wireless network profiles for wireless controllers and APs.

Note While you can learn device configuration without site assignment, we recommend that you assign sites, which is required to manage the same wireless controller from Catalyst Center.

- a) To assign a site to a wireless controller, click **Assign Site** next to the **Device Name**.
 - In the **Assign Site** window, navigate to the building that you want to associate and click **Save**.
- b) To assign sites to an AP, check the check box next to the AP name in the **Unified APs** table and click **Assign Site**.
 - In the **Assign Site** window, navigate to the floor and click **Save**.
- c) Click **Next**.

Step 4

In the **Learned Network Settings** window, review the following learned network settings.

These settings are saved to the physical location of the device. The network servers that are displayed in this window are saved at the site level.

- Enter the **Shared Secret** for AAA servers.

- **System Settings**

- To save a AAA server as a Cisco ISE server, click the **Cisco ISE Server** toggle button and enter the **Username**, **Password**, and **FQDN** details.

Note If the Cisco ISE server is already present on Catalyst Center, you cannot save a AAA server as a Cisco ISE server.

After configuring a AAA server as a Cisco ISE server, the certificate from the Cisco ISE server is automatically accepted to establish the trust.

- Click the **Virtual IP Address(es)** toggle button to enter the load balancer IP address.

• **AAA Server:** Shows the network servers configured on Catalyst Center. These network servers are prepopulated.

- You can customize **Network** or **Client/Endpoint** for the AAA server. The servers and protocols are chosen by default.
- From the drop-down list, choose **IP Address (Primary)** and **IP Address (Secondary)**. These servers are saved at the global level.

• **DHCP Server:** Shows all the DHCP servers available on the device.

• **NTP Server:** Shows all the NTP servers available on the device.

- Click **Next**.

Step 5

In the **Assign Sites to Configurations Learned** window, you can view the following learned configurations if the configuration is available on the device. The configurations that aren't assigned to sites are ignored.

- Flex Override
- AAA Server
- VLAN Entry
- Mesh Configuration

- Enable Remote Teleworker

Step 6 In the **Learned Wireless Configuration** window, review the configurations learned from the wireless controller. The wireless configurations that appear in this window are saved at the global level.

- The **Supported** tab shows the list of learned configurations, such as **SSID**, **RF Profiles**, **Interfaces**, **Interface Groups**, **aWIPS** and **Forensic Capture Enablement**, **Pre Auth ACLs**, and **VLAN**.
 - By default, the NAC configuration enabled SSIDs are learned as guest SSID. Click the **Edit** icon next to the **SSID Type** in the **SSIDs** table to change the SSID type from Guest to Enterprise.
 - To ignore the configuration, check the check box next to the learned configuration, and click **Ignore Config** in the corresponding table.
 - To relearn an ignored SSID, RF profile, interface, or interface group, select it and click **Relearn Config** in the corresponding table.
- The **Unsupported** tab shows the configurations that are not learned, such as **SSIDs**, **RF Profiles**, **Interfaces**, **Pre Auth ACLs**, and **Interface Groups**. You can address these unsupported or unknown configurations and use CLI templates.

Step 7 In the **Assign Sites to Learned SSIDs** window, review and resolve any multiple WLAN profile conflicts.

- The SSIDs that are saved at the global level and learned with multiple WLAN profiles are listed. You can assign a WLAN profile from each SSID to global and another profile to a particular site to resolve the conflict.
- (Optional) To assign a WLAN profile to a site, click **Assign Site** in the corresponding SSID row.
 - In the **Assign Site** window, choose a site and click **Save**

Note Only the sites that do not have any wireless configurations or profiles that are associated to them can be overwritten. If there is no fresh site, exit from the current workflow, create a new site, and then restart the workflow.

Step 8 In the **Resolve Configuration Conflicts** window, review and resolve the available conflicts.

Configurations learned from the device and the configurations saved at the global level are shown.

Choose a configuration set to resolve the conflict:

- **Use DNAC Configuration**: To save configurations at the global level.
 - **Use Device Configuration**: To learn configurations from the device.
- Selecting device configuration overwrites the configurations saved at the global level.
- **Use Custom Configuration**: To customize the configurations by choosing the required **Wireless Interface**.

Step 9 In the **Model Configs Learned** window, review the model configuration.

The model configurations are a set of model-based, discoverable, and customizable configuration capabilities that can be deployed on network devices. Model configurations can be deployed on various hardware platforms and software types. Catalyst Center discovers and learns model configs from device-specific configurations such as CLI. The learned model configs are saved in designs that can be attached to network profiles.

Expand and review the following wireless model config design types:

- AAA Radius Attributes Configuration
- Advanced SSID Configuration
- CleanAir Configuration
- Dot11ax Configuration
- Event Driven RRM Configuration
- Global IPv6 Configuration
- Multicast Configuration
- RRM General Configuration

If you want to ignore any configuration from each model configuration design type, select the configuration in the corresponding table and click **Ignore Config**. To relearn the ignored configuration, select the ignored configuration and click **Relearn Config**.

Step 10 In the **CLI Templates Learned** window, review the CLI templates and use these templates to address the unknown or unsupported configurations.

- All the ignored WLAN configs are chosen by default. Click **Ignore Template** to restrict the template from addressing the configs. Click **Relearn Template** to address the configs.
- All the unknown or unsupported configs are chosen by default. Click **Ignore Template** to restrict the template from addressing the configs. Click **Relearn Template** to address the configs.

Step 11 In the **Network Profiles** window, review the learned network profile configuration. Based on the configurations learned, Catalyst Center creates the network profile. You can either use the learned network profile or create a new network profile. The SSIDs are learned and grouped while creating network profile.

For Cisco AireOS Wireless Controllers, the Flex group and AP groups are mapped to the network profile. Depending on the AP site assignment, the network profile is assigned to the appropriate site.

For Cisco Catalyst 9800 Series Wireless Controllers, the site tag, policy tag, and site hierarchy that is mapped to the network profile is displayed.

- Based on the AP site assignment configuration, network profile is assigned to the appropriate site. Click **Sites Assigned** to view details on the site assigned to the network profile.
- To create a new network profile, click **Create New Profile**.

The **New Profile** window appears.

- In the **Network Profile Name** field, enter a name for the network profile.
 - From the **SSIDs** table, check the check box next to the **Network Name** to select the SSID.
 - Click **Save**.
- (Optional) Review the template details and edit if you want to make any changes.
- To assign a site to a network profile, click **Assign Site**. In the **Assign Site** window, choose a site and click **Save**.
- Click **Sites Assigned** to view the sites assigned to this profile.

- To attach a template to a network profile, click **Assign Template**. In the **Assign Template** window, choose templates from the **Select Templates** drop-down list for each device in the existing deployment and click **Save**.

Click **View Templates** to view the templates assigned to the profile.

- To ignore a network profile, click **Ignore Profile** and click **Continue**.

If a profile is marked as ignored, all the profile attributes of that profile are removed. This cannot be undone by relearning the profile. To relearn an ignored profile, click **Relearn Profile**.

- To add a site tag to a network profile, click **Add** in the **Site Tag** table. In the **Add Site Tag** window, choose a site tag from the **Select Site Tag** drop-down list, choose a site from the hierarchy, and click **Save**.

Step 12 (Optional) In the **Network Profile - Model Configurations** window, associate model configurations learned by Catalyst Center into the network profiles.

- Click **Add**.
- In the **Add Model Configs to Network Profile** window, do the following:
 - Expand the model config design that you want to add.
 - Choose the design. For **Advanced SSID Configuration**, for each design, choose SSIDs from the drop-down list in the **Applicable SSID** column.
 - Click **Apply**.
- To delete a model config added to the network profile, choose the model config and click **Delete**.
- Click **Next**.

Step 13 In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.

Step 14 Click **Save**.

The network configurations are created at the global and site level appropriately.

Step 15 From the top-left corner, click the menu icon and choose **Design > Network Settings**.

- In the **Network** tab, you can view all the network configurations learned from devices.
- In the **Wireless** tab, you can view all the wireless configurations learned from devices.

The learned configurations are pushed to devices when the devices are provisioned.

Replace Device

This procedure explains how to replace a faulty device.

For Cisco switch stacks (hardware stacking), you don't need to follow a separate procedure in Catalyst Center for member switch replacement, which is handled by the active switch. The member switch is replaced by the active switch by providing the software image and configuration. Full stack replacement is handled by Catalyst Center.



Note You can also replace a faulty device from the **Inventory** window. For more details, see [Replace a Faulty Device, on page 138](#).

Before you begin

- The software image version of the faulty device must be imported in the image repository before marking the device for replacement.
- The faulty device must be in an unreachable state.
- The faulty device must be assigned to a user-defined site, if the replacement device onboards to Catalyst Center through Plug and Play (PnP).
- The replacement device must not be in a provisioning state while triggering the RMA workflow.
- For switch stacks replacement, the number of stacks for the faulty and replacement device must be the same.

Step 1

From the top-left corner, click the menu icon and choose **Workflows > Replace Device**.

Step 2

If a task overview window opens, click **Let's Do it** to go directly to the workflow.

Step 3

In the **Get started** window, enter a unique **Task Name** for your workflow.

Step 4

In the **Choose Device Type** window, choose the type of faulty device that you want to replace.

Step 5

In the **Choose Site** window, choose the site in which you have the faulty device.

Step 6

In the **Choose Faulty Device** window, choose one faulty device that you want to replace.

Step 7

In the **Choose Faulty Device** window, if you don't find the faulty device, do the following:

- a) Click **Add Faulty Device**.
- b) Choose the faulty device and click **Next**.
- c) In the **Mark for Replacement** window, click **Mark**.

Step 8

In the **Choose Replacement Device** window, choose a replacement device from the **Unclaimed** tab or the **Managed** tab.

The **Unclaimed** tab shows the devices that are onboarded through PnP. The **Managed** tab shows the devices that are onboarded either through Inventory or the discovery process.

Step 9

(Optional) If the replacement device is not yet onboarded, do the following:

- a) In the **Choose Replacement Device** window, click **Add Device**.
- b) In the **Add New Device** window, enter the serial number of the device and click **Add New Device**.

Alternatively, do the following:

- a) In the **Choose Replacement Device** window, click **Sync with Smart Account**.
- b) In the **Sync with Smart Account** window, click **Sync**.

Step 10

In the **Schedule Replacement** window, depending on the Visibility and Control of Configurations settings, choose an available option.

- To schedule the replacement immediately, click **Now**.

- To schedule the replacement for a later date and time, click **Later**, and define the date, time, and time zone of the deployment.
- To preview the configurations, click **Generate configuration preview**.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** options are dimmed (unavailable). For more information, see [Visibility and Control of Device Configurations, on page 132](#).

Step 11 Edit the default **Task Name**, if required.

Step 12 Do one of the following:

- If you have chosen **Now** or **Later**, click **Apply**.
- If you have chosen **Generate configuration preview**, click **Preview**.

Step 13 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

Step 14 If you chose **Generate configuration preview**, in the **Preview Configuration** window, depending on the Visibility and Control of Configurations settings, do the following:

a. Review the device configurations.

b. When you're ready, click **Deploy** or **Submit for Approval**. If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

c. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.

d. Click **Submit**.

When the configurations are successfully submitted, a success message is displayed.

If you previewed and scheduled the task for deployment, you can view the task on the **Tasks** window.

If you submitted the configurations for ITSM approval, you can view the work item's status on the **Tasks** window. If it's not approved, you must resubmit the work item for ITSM approval. When it's approved, it will deploy at the scheduled time, which you can view on the **Tasks** window.

Step 15 If you didn't choose to generate a configuration preview in the preceding steps, do the following:

- Click **Review** to view the chosen device type, faulty device details, and replacement device details.
- In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

- c. Under **Replacement Device**, click **View** to view the configuration of the replacement device.
- d. Click **Replace**.
- e. Click **Monitor Replacement Status** to go to the **Mark for Replacement** view in the **Provision** window.
- f. Click **Replace Status** to view the status of the RMA workflow progress, as follows:
 - Running readiness checks for device replacement.
 - Claim the (PnP) replacement device.
 - Distribute and activate the software image to the replacement device.
 - Deploy licenses.
 - Provision VLAN configurations.
 - Provision startup configurations.
 - Reload the replacement device.
 - Check for reachability of the replacement device.
 - Deploy SNMPv3 credentials to the replacement device.
 - Synchronize the replacement device.
 - Remove the faulty device from CSSM.
 - Add the replacement device to CSSM.
 - Revoke and create the PKI certificate.
 - Update Cisco ISE.
 - Delete the faulty device.

After the workflow is completed, the **Replace Status** is updated to **Replaced**.

Step 16 If an error message appears, click the error link. Click **Retry** to retrigger the workflow with the same set of faulty and replacement devices.

Note The main inventory window displays the details of the new replacement device that has replaced the faulty device.

Step 17 (Optional) You can exit the workflow at any stage and resume it later. The Exit option is shown at the bottom-left corner in all the windows. To exit the workflow and resume it later, do the following:

- a) Click **Exit**.
- b) In the confirmation window, click **Exit**.

A workflow **In Progress** card with the task name is created.

- c) To resume the workflow from where you left, click the **In Progress** card.
 - If a device has an **In progress** card and you try to replace the same device from the **Inventory > Marked for Replacement** window, a confirmation message with the serial number and task name of **In progress** appears. Click **Yes** to resume the workflow or **Cancel** to start a new workflow.

- If you click the **In progress** card for a device that is unmarked for replacement, a **Warning message** appears. Click **Yes** and choose a different faulty device to start a new workflow. If you click **Cancel**, the workflow is canceled.

Create a Remote Support Authorization

The following procedure describes how to create a remote support authorization.



Note The Catalyst Center remote support authorization is supported only with RADKit version 1.2.1 and later.

Before you begin

You must create the SSH credentials before completing a remote support authorization. To create SSH credentials, see [Configure SSH Credentials](#).

Step 1 From the top-left corner, click the menu icon and choose **Workflows > Create a Remote Support Authorization**.

Step 2 If a task overview window is displayed, click **Let's Do It** to go directly to the workflow.

Step 3 In the **Access Permission Agreement** window, do the following:

- a) Check the **I agree to provide access to network devices** check box to provide access to network devices.
- b) Check the **I agree to provide access to Catalyst Center** check box to allow a Cisco specialist to access your Catalyst Center setup using SSH credentials.

Note You can revoke the authorization at any time before it expires. To revoke the authorization, see [View the Remote Support Authorization Dashboard](#).

Step 4 Click **Next Step**.

Step 5 In the **Set up the Authorization** window, complete the following fields:

- **Cisco Specialist Email Address**
- **Existing Case Number(s)**
- **Access Justification**

Step 6 Click **Next Step**.

Step 7 In the **Schedule the Access** window, click **Now** or **Later** to indicate when you want to allow the Cisco specialist to access Catalyst Center.

Step 8 Click **Next Step**.

Step 9 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 10 Click **Create**.

The **Done! Authorization is created** window is displayed.

- Step 11** Click **View All Authorizations** to navigate to the **Remote Support Authorization** window. For information, see [View the Remote Support Authorization Dashboard](#).

Create an Event Notification

Catalyst Center event notification allows you to associate multiple channels inside one notification that delivers the details of selected events that occur at multiple points.

- Step 1** From the top-left corner, click the menu icon and choose **Workflows > Create a New Notification**.
- Step 2** If a task overview window opens, click **Let's Do It** to go directly to the workflow.
- Step 3** In the **Select Channels** window, choose the notification channels.
- The supported channels are **REST**, **PAGERDUTY**, **SNMP**, **SYSLOG**, **WEBEX**, **EMAIL**, and custom channels. Assurance events do not support SNMP.
- Step 4** In the **Select Site and Events** window, from the **Select a site** drop-down list, choose a specific site for which you want to be notified for the selected events.
- Note** You can choose multiple sites at a time.
- Step 5** Click either the plus icon next to an event, or click **Add All** to add all the events to the respective notification.
- Step 6** To remove an event from the notification, click either the cross icon next to the event that you want to remove, or click **Remove All** to remove all the event from the event list.
- Note**
- When you choose a notification channel, a table in the **Select Site and Events** window lists the number of events supported by the chosen notification channel.
 - When you choose more than one notification channel, a table in the **Select Site and Events** window lists the number of supported events that are common in the chosen notification channels.
- Step 7** In the **Configure Notification** window, configure the following values:
- a. If you choose an **EMAIL** notification channel, configure the following in the **Email Settings** window:
 1. Click the link to access the Email GUI window and configure a new email server.

Note

- Notification type can be set for either **REST** API endpoint (webhook), **PAGERDUTY**, **SNMP**, **SYSLOG**, **WEBEX**, and **EMAIL**. If you choose **EMAIL**, but have not yet configured the email settings, you are prompted to access the GUI window where you can perform this task. Email settings are configured in the **Email** tab.

(Optional) To access the **Email** tab, click the menu icon and choose **System > Settings > External Services**.

Expand **External Services**, choose **Destinations**, and click the **Email** tab.

- Up to 20 email addresses per endpoint can be configured to receive email notifications. To add multiple email addresses, you need to add each email address separately and press **Enter** (on your keyboard) after each addition. Catalyst Center validates the email addresses and notifies you if the syntax is incorrect.
- If you need to configure more than 20 email addresses per endpoint, you can use a group email alias.
- When using email destinations for event subscriptions, the emails that are sent show events with a UTC timestamp.

2. Click either **Select Existing Instance** to use the existing email instance or **Create New Instance** to create a new email instance.
3. If you click **Select Existing Instance**, from the **Select Instance** drop-down list, choose an email instance.
4. Enter the email addresses in the **From** and **To** fields and a subject for the **Subject** header in the email.

- b.** If you choose a **SYSLOG** notification, configure the following values in the **Syslog Settings** window:

1. Click the link to access the Syslog GUI window and configure a new syslog endpoint (syslog server hostname and port number).

Note

- Notification type can be set for either **REST** API endpoint (webhook), **PAGERDUTY**, **SNMP**, **SYSLOG**, **WEBEX**, and **EMAIL**. If you choose **SYSLOG**, but have not yet configured the syslog server settings, you are prompted to access the GUI window where you can perform this task. Syslog server settings are configured in the **Syslog** tab.

(Optional) To access the **Syslog** tab, click the menu icon and choose **System > Settings > External Services**.

Expand **External Services**, choose **Destinations**, and click the **Syslog** tab.

2. In the **Protocol** field, enter either TCP or UDP.
3. In the **Port** field, enter the port number of the syslog server.
4. In the **Hostname/IP** field, enter the hostname or IP address of the syslog server.
5. From the **Select Instance** drop-down list, choose the syslog instance.

- c.** If you choose a **REST** notification, configure the following values in the **REST Settings** window:

- Click the link to access the REST Webhook GUI window and configure a new webhook endpoint.

Note Notification type can be set for either **REST** API endpoint (webhook), **PAGERDUTY**, **SNMP**, **SYSLOG**, **WEBEX**, and **EMAIL**. If you select **REST**, but have not yet configured the webhook settings, you are prompted to access the GUI window where you can perform this task. Webhook settings are configured in the **Webhook** tab.

(Optional) To access the **Webhook** tab, click the menu icon and choose **System > Settings > External Services**.

Expand **External Services**, choose **Destinations**, and click the **Webhook** tab.

- From the **Webhook Instance** drop-down list, choose a notification endpoint and URL.
- In the **URL** field, enter the URL address of the REST API endpoint that the event will be sent to.

Trust certificate: Whether a trust certificate is required for REST API endpoint notification.

Method: Either the PUT or POST method.

- **Basic:** Authentication where the client sends HTTP requests with the word *Basic* in the authorization header, followed by a space and a base64-encoded string *username:password*. If you choose **Basic** in the GUI, the **Headers** field is automatically populated with the **Authorization** value.
- **Token:** Authentication where users are authenticated using a security token provided by the server. If you choose **Token**, the **Headers** field is automatically populated with the **X-Auth-Token** value.
- **No Authentication:** No authentication needed.
- **Headers:** The **Header Name** and **Header Value**.

Note The **Headers** fields may be automatically populated depending on your Authentication selection.

d. If you choose **SNMP** notification channel, configure the following values in the **SNMP Settings** window:

1. Click the link to access the SNMP GUI window and configure a new SNMP endpoint.

Note Notification type can be set for either **REST** API endpoint (webhook), **PAGERDUTY**, **SNMP**, **SYSLOG**, **WEBEX**, and **EMAIL**. If you select **SNMP**, but have not yet configured the SNMP settings, you are prompted to access the GUI window where you can perform this task. SNMP settings are configured in the **SNMP** tab.

(Optional) To access the **SNMP** tab, click the menu icon and choose **System > Settings > External Services**.

Expand **External Services**, choose **Destinations**, and click the **SNMP** tab.

The SNMP trap notification is only available for a system hardware event. When the health state of hardware components changes, a system hardware event triggers notifications to subscribers. Hardware components monitored for changes include CPU, memory, disk, NIC, fan, power supply, and RAID controller.

2. From the **SNMP Instance** drop-down list, choose the notification endpoint.
3. **Create a new endpoint:** Enter a new endpoint name and description.
4. In the **Hostname/IP Address** field, enter the hostname or IP address for the SNMP trap receiver (server).
5. In the **Port** field, enter the port number for the SNMP trap receiver (server).

- e. If you choose **PAGERDUTY** notification channel, configure the following in the **PAGERDUTY settings** window:
 - 1. In the **SERVICE CONFIGURATION** area, click either **Select Existing Instance** to use the existing PagerDuty instance or **Create New Instance** to create a new PagerDuty instance.
 - 2. From the **Select Instance** drop-down list, choose a PagerDuty instance.
 - 3. In the **PagerDuty Events API URL** field, enter a PagerDuty event API URL.
 - 4. In the **PagerDuty Integration Key** field, enter a PagerDuty integration key.
- f. If you choose **WEBEX** notification channel, configure the following values in the **WEBEX Settings** window:
 - 1. From the **Select Instance** drop-down list, choose a Webex instance.
 - 2. In the **Webex URL** field, enter the Webex URL.
 - 3. In the **Webex Room ID** field, enter the Webex room ID.
 - 4. In the **Webex Bot Access Token** field, enter the Webex bot access token.

Step 8 Click **Save**.

In the **Name and Description** window, do the following:

- a) In the **Name** field, enter a unique name for the notification.
- b) In the **Description** box, enter a description of the notification.

Step 9 In the **Summary** window, review the configuration settings. (To make any changes, click **Edit**.)

Step 10 Click **Finish**.

The **Done! Your new notification is complete** window appears.

Configure Remote LAN

Remote LAN (RLAN) allows you to configure RLAN ports on APs for Cisco Wireless Controller. Wireless controller authenticates the wired clients and allows them to connect to the network.

Catalyst Center supports RLAN configuration only on Cisco Catalyst 9800 Series Wireless Controller. You can configure RLAN for nonfabric sites on wireless controllers that run Cisco IOS XE Release 16.12 or later. You can configure RLAN for fabric sites on wireless controllers that run Cisco IOS XE Release 17.7 or later.



Note Catalyst Center doesn't support RLAN configuration on Cisco AireOS Wireless Controllers.

This section provides information about how to configure RLAN ports.

Before you begin

- Ensure that you have provisioned a Cisco Wireless Controller and at least one AP for the site.

To configure RLAN ports for fabric sites:

- Ensure that you have provisioned the required fabric site.
- Ensure that you have created IP pools and Security Group Tags (SGT).

Step 1

From the top-left corner, click the menu icon and choose **Workflows > Configure RLAN**.

Step 2

If a task overview window appears, click **Let's Do It** to go directly to the workflow.

Step 3

In the **Get Started** window, enter a unique name for the task.

Step 4

In the **Select Floor** window, navigate to the floor where you want to configure RLAN ports.

The right pane shows the summary for the selected floor. Catalyst Center configures RLAN for all the APs provisioned on the selected floor.

Step 5

In the **Remote LAN Configuration** window, do the following:

- Choose the required RLAN port from the **Port 1**, **Port 2**, and **Port 3** options.

If the AP has a single RLAN port, Catalyst Center ignores the **Port 2** and **Port 3** configurations for the AP.

- Click the **Enable RLAN** toggle button to enable or disable RLAN.

- In the **Connectivity Settings** area, click the **Fabric** toggle button to configure RLAN ports for a fabric or nonfabric site.

Note After you configure the connectivity settings for fabric or nonfabric, you can't modify the option later.

If you enable the **Fabric** toggle button, do the following:

- In the **IP Address Pool** field, enter the IP address.
- (Optional) From the **Scalable Group Tag** drop-down list, choose the required option.

If you disable the **Fabric** toggle button, do the following:

- From the **Select Switching** drop-down list, choose the required option.
- In the **VLAN** field, enter the VLAN number. The valid range for VLAN is from 1 through 4096.

- In the **Security Settings** area, do the following:

- In the **Maximum End Points** field, enter the number of endpoints. The valid range is from 0 through 10000.

Note This field configures the client connections per RLAN. 0 indicates unlimited client connections.

- In the **Timeout Period (in seconds)** field, enter the timeout period, in seconds. The valid range for timeout is from 0 through 86400.

- (Optional) From the **Layer 2** drop-down list, choose the required option.

- (Optional) To enable MAC filtering, check the **MAC Filtering** check box.

- (Optional) From the **Fallback Authentication** drop-down list, choose the required option.

Note Fallback mechanism is supported on both fabric and nonfabric sites on Cisco Catalyst 9800 Series Wireless Controllers that run Cisco IOS XE Release 17.8 or later.

- (Optional) From the **Layer 3** drop-down list, choose the required option.

- (Optional) From the **Select a AAA Server Group** drop-down list, choose an AAA server group.

This drop-down list provides the list of AAA server groups configured as part of WLAN provisioning on the primary controller. If you don't choose an AAA server group, Catalyst Center configures the default method under the RLAN profile for the selected security settings.

- e) (Optional) In the **Point over Ethernet Settings** area, use the **PoE** toggle button to enable or disable the Point over Ethernet (PoE).

Note Catalyst Center enables PoE only on APs with PoE-capable ports.

- Step 6** In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
Step 7 In the **Schedule Task** window, based on the Visibility of Configurations settings, choose an available option.

- **Now:** Immediately deploy the configurations.
- **Later:** Schedule the date and time and define the time zone of the deployment.
- **Generate configuration preview:** Review the configurations before deploying them.

If only visibility is enabled or both visibility and control are enabled, **Generate configuration preview** is chosen by default, and **Now** and **Later** are dimmed (unavailable). For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).

- Step 8** Click **Apply**.
Step 9 On the **Performing Initial Checks** window, address the following issues to continue with your current deployment:

- Pending Operations: Wait for all pending operations to deploy or discard them.
- Device Compliance: Fix, acknowledge, or ignore all issues.
If you ignore any noncompliant devices, this activity is captured on the **Audit Logs** window.
- After addressing all the issues, click **Recheck** in the bottom-right corner of the window and make sure that all the validations are successful.

For more information, see [Network Provisioning Prechecks, on page 137](#).

If you chose **Now** or **Later**, click **Submit**, and the device configurations will deploy at the scheduled time. You can view the task on the **Tasks** window.

- Step 10** If you chose **Generate configuration preview**, depending on the Visibility and Control of Configurations settings, do the following:
- a. On the **Preparing Devices and Configuration Models** window, wait for the system to prepare the devices and generate the device configurations. This can take some time, so you can click **Exit and Preview Later**. To view the work item later, go to the **Tasks** window.
 - b. On the **Preview Configuration** window, review the device configurations.
For more information, see [Visibility and Control of Wireless Device Configurations, on page 470](#).
 - c. Do one of the following:
 - When you're ready, click **Deploy** or **Submit for Approval**.
 - If you're not ready to deploy the configurations or submit them for ITSM approval, click **Exit and Preview Later**. Later, go to the **Tasks** window, open the work item, and click **Deploy** or **Submit for Approval**.

Note You can submit the device configurations for ITSM approval and deploy them without previewing all the configurations.

- d. In the slide-in pane, indicate when you want to deploy the configuration, choose a time zone, and if visibility and control are enabled, add notes for the IT administrator.
- e. Click **Submit**.

You can check the work item's approval status or the task's deployment status on the **Tasks** window. If the work item isn't approved, you need to resubmit the work item for ITSM approval. When it's approved, it's deployed at the scheduled time.

What to do next

You can view the status of the RLAN configuration in the **Activities > Tasks** window.

If you have provisioned a secondary wireless controller, reprovision the secondary wireless controller from the **Provision > Inventory** window.



CHAPTER 34

Wireless Network Configuration Use Cases

- [Wireless Network Configuration Use Case, on page 881](#)
- [High Availability Use Cases, on page 881](#)
- [Wireless Mobility Use Cases, on page 884](#)
- [AP Management Use Cases, on page 890](#)
- [Wireless Controller Migration Use Case, on page 895](#)

Wireless Network Configuration Use Case

The following use cases help you understand the wireless network configuration.

High Availability Use Cases

The following topics help you understand the high availability (HA) use cases for wireless networks.

Configure Cisco Wireless Controller HA

Cisco Wireless Controller HA allows you to use a wireless controller as a backup for a primary wireless controller. The active wireless controller handles all the APs, client traffic, and shares the AP and client database with the standby wireless controller. If there is a failover, the standby wireless controller takes over immediately, resulting in zero client service downtime and zero SSID outage.

Before you begin

- Ensure that both the wireless controllers are of the same form factors.
- Ensure that both the wireless controllers are running the same software version.
- Wireless controller HA supports a maximum redundancy port link latency of 80 ms round-trip time (RTT), minimum bandwidth of 60 Mbps, and minimum maximum transmission unit (MTU) of 1500.
- Ensure that you connect the redundancy ports of both the wireless controllers physically or through a Layer 2 virtual network. If you connect redundancy ports through a Layer 2 virtual network, ensure that the link latency, bandwidth, and MTU requirements are met.

Configure Cisco Wireless Controller HA

- For the Cisco Catalyst 9800-CL Wireless Controllers running on ESXi, KVM, and Hyper-V, ensure that the redundancy port connects to the same vswitch.

-
- Step 1** Ensure that you have the wireless controller in your inventory. For more information, see [About Inventory, on page 62](#) and [Add a Network Device, on page 87](#).
- If the wireless controller isn't available in the inventory, use the Discovery feature to discover it. For more information, see [Discover Your Network, on page 43](#).
- Step 2** Ensure that both the wireless controllers are in the **Managed** state in the inventory. For more information, see [Display Information About Your Inventory, on page 63](#).
- Step 3** Use the **show redundancy** command to verify that the operating redundancy mode is **Non-redundant** on both the wireless controllers.
- Step 4** From the top-left corner, click the menu icon and choose **Provision > Inventory**.
- Step 5** Check the check box next to the required wireless controller, and then click **Actions > Provision > Configure WLC HA**.
- Step 6** Enter the **Redundancy Management IP** and the **Peer Redundancy Management IP** addresses.
- You must configure the IP addresses used for redundancy management IP and peer redundancy management IP in the same subnet as the management interface of the wireless controller. Ensure that these IP addresses are unused IP addresses within that subnet range.
- Step 7** Enter the **Netmask**.
- Step 8** From the **Select Secondary WLC** drop-down list, choose the secondary wireless controller.
- Step 9** Since the Cisco Catalyst 9800-CL Wireless Controller doesn't have a dedicated redundancy port, choose the interface that will be used for the redundancy port.
- Note** Appliance-based Cisco Catalyst 9800 Series Wireless Controllers have dedicated redundancy ports, and redundancy port interface selection isn't necessary for these devices.
- Step 10** Click **Configure HA**.

What to do next

To verify the status of HA, use the **show redundancy** command. Following is a sample output of this command:

```

cat_9800-1 #show redundancy
Redundant System Information :
-----
Available system uptime = 5 minutes
Switchovers system experienced = 0
    Standby Failures = 0
Last switchover reason = none

Hardware Mode = Duplex
Configured Redundancy Mode = sso
Operating Redundancy Mode = sso
Maintenance Mode = Disabled
Communications = Up

Current Processor Information :
-----
Active Location = slot 1
Current Software state = ACTIVE
Uptime in current state = 5 minutes
Image Version = Cisco IOS Software [Bengaluru], C9800-CL Software (C9800-CL-K9_IOSXE), Version 17.6.3, RELEASE SOFTWARE (fc4)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2022 by Cisco Systems, Inc.
Compiled Wed Mar 23 23:13 by
Configuration register = 0x2102
Recovery mode = Not Applicable

Peer Processor Information :
-----
Standby Location = slot 2
Current Software state = STANDBY HOT
Uptime in current state = 3 minutes
Image Version = Cisco IOS Software [Bengaluru], C9800-CL Software (C9800-CL-K9_IOSXE), Version 17.6.3, RELEASE SOFTWARE (fc4)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2022 by Cisco Systems, Inc.
Compiled Wed Mar 23 23:13 by
    BOOT =
    CONFIG_FILE =
Configuration register = 0x2102

```

To verify the **Priority** of the primary wireless controller, use the **show chassis** command. The **Priority** of the primary wireless controller is changed to 2 to ensure that its role is **Active**. Following is a sample output of this command:

```

cat_9800-1 #show chassis
Chassis/Stack Mac Address : 000c.2972.9b46 - Local Mac Address
Mac persistency wait time: Indefinite
          H/W   Current
Chassis#  Role    Mac Address      Priority Version State           IP
-----
*1       Active   000c.2972.9b46    2      V02     Ready        172.16.0.2
2       Standby  0050.56ae.a54f    1      V02     Ready        172.16.0.3

```

Configure Cisco Wireless Controller N+1 HA

Cisco Wireless Controller N+1 HA allows you to use a wireless controller as a backup for multiple primary wireless controllers. Catalyst Center doesn't support stateful switchover for N+1 HA and each wireless controller must be managed separately.



Note

- Catalyst Center supports N+1 HA configurations for primary and secondary wireless controllers. Catalyst Center doesn't support tertiary wireless controller configurations.
- If you edit the primary wireless controller configuration, reprovision the secondary wireless controller manually with the updated configurations.

Step 1

Ensure that you have the wireless controller in your inventory. For more information, see [About Inventory, on page 62](#) and [Add a Network Device, on page 87](#).

If the wireless controller isn't available in the inventory, use the Discovery feature to discover it. For more information, see [Discover Your Network, on page 43](#).

- Step 2** Ensure that both the wireless controllers are in the **Managed** state in the inventory. For more information, see [Display Information About Your Inventory, on page 63](#).
- Step 3** Create enterprise and guest wireless SSIDs. For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) and [Create SSIDs for a Guest Wireless Network, on page 264](#).
- Step 4** If you created a wireless network profile during SSID creation, assign it to the primary wireless controller-managed site. From the top-left corner, click the menu icon and choose **Design > Network Profiles**, and then click the corresponding **Assign Site** option for the wireless network profile.
- Step 5** Provision the primary wireless controller. Choose the role as **Active Main WLC**. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- Step 6** Provision the secondary wireless controller. Choose the role as **Active Main WLC** and choose the secondary managed AP location same as the managed AP location for the primary wireless controller. For more information, see [Provision a Cisco AireOS Controller, on page 478](#) and [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#).
- Step 7** Provision the APs. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).
-

Wireless Mobility Use Cases

The following topics help you understand the mobility configuration use cases for wireless networks.

Configure Wireless Mobility

Mobility configuration in Catalyst Center allows you to establish a tunnel between Cisco Wireless Controllers in a network allowing them to communicate with each other and dynamically share information. The mobility tunnel enables seamless roaming of clients within a wireless network. This procedure describes the steps to configure a mobility tunnel between wireless controllers for the following use cases:

- Two newly added wireless controllers with the same mobility group: The two wireless controllers are newly added to Catalyst Center and are not yet provisioned.
- Two existing wireless controllers with the same mobility group: The wireless controllers are already added and provisioned on Catalyst Center and have the same mobility group name.
- Two existing wireless controllers with different mobility group: The wireless controllers are already added and provisioned on Catalyst Center and have different mobility group name.
- Two existing wireless controllers with a third wireless controller: Adding a new wireless controller to an existing mobility group between two wireless controllers.

Before you begin

- Ensure that you have the Cisco Wireless Controllers in your inventory and they are in **Managed** state. For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).
 - For more information on wireless mobility configuration, see [Mobility Configuration Overview, on page 507](#).
-

- Step 1** For newly added wireless controllers with the same mobility group, do the following:

- a) Run the **show wireless mobility summary** command to verify that there's no existing mobility tunnel between the controllers.
- b) Choose one of the wireless controllers and configure the mobility group, adding the other wireless controller as the peer. For more information, see [Configure Mobility Group, on page 509](#).
- c) Verify the configurations before provisioning.
- d) Provision the wireless controller.

Note You don't have to provision the second wireless controller. Adding it as a peer for the first wireless controller automatically provisions it with the same mobility group name and peer configurations.

Step 2

For two existing wireless controllers with same mobility group, do the following:

- a) Verify that the wireless controllers have the same mobility group name configured. For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).
- b) Choose one of the wireless controllers and configure the mobility group, adding the other wireless controller as the peer. For more information, see [Configure Mobility Group, on page 509](#).
- c) Verify the configurations before provisioning.
- d) Provision the wireless controller.

Note You don't have to provision the second wireless controller. Adding it as a peer for the first wireless controller automatically provisions it with the same mobility group name and peer configurations.

Step 3

For two existing wireless controllers with different mobility group, do the following:

- a) Verify that the wireless controllers have the mobility group name configured. For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).
- b) Choose one of the wireless controllers and configure the mobility group, adding the other wireless controller as the peer. For more information, see [Configure Mobility Group, on page 509](#).
- c) Verify the configurations before provisioning.
- d) Provision the wireless controller.

Note You don't have to provision the second wireless controller. Adding it as a peer for the first wireless controller automatically provisions it with the same mobility group name and peer configurations.

Step 4

For adding a new wireless controller to an existing mobility group between two wireless controllers, do the following:

- a) Verify that the existing wireless controllers have the mobility tunnel established between them by checking the mobility group name and the mobility peer information in the **Mobility** tab. For more information, see [About Inventory, on page 62](#) and [Display Information About Your Inventory, on page 63](#).
- b) Choose the newly added wireless controller and configure the mobility group, adding the other two existing wireless controllers as peers. For more information, see [Configure Mobility Group, on page 509](#).
- c) Verify the configurations before provisioning.
- d) Provision the wireless controller.

Note You don't have to provision the existing two wireless controllers. Adding them as a peer for the newly added wireless controller automatically provisions it with the same mobility group name and peer configurations.

Configure Anchor/Foreign Wireless Mobility

What to do next

After provisioning, run the **show wireless mobility summary** command on each of the controllers to verify the mobility tunnel status. Following is a sample output of the command:

WLC1#show wireless mobility summary						
Mobility Summary						
Wireless Management VLAN: 1						
Wireless Management IP Address: 172.16.0.5						
Wireless Management IPv6 Address:						
Mobility Control Message DSCP Value: 48						
Mobility High Cipher Suite:						
Mobility Supported Ciphers: TLS_ECDHE_RSA_AES128_GCM_SHA256, TLS_RSA_AES256_GCM_SHA384, TLS_RSA_AES128_CBC_SHA						
Mobility Keepalive Interval/Count: 15/3						
Mobility Group Name: mobility						
Mobility Multicast IP address: 0.0.0.0						
Mobility Multicast IPv6 address: ::						
Mobility MAC Address: 00le.7a61.09ff						
Mobility Domain Identifier: 0x62ab						
Controllers configured in the Mobility Domain:						
IP	MTU	Public IP	MAC Address	Group Name	Multicast IPv4	Multicast IPv6
172.16.0.5 N/A		N/A	00le.7a61.09ff	mobility1	0.0.0.0	::
172.16.0.5 1385		172.16.0.6	00le.bd0a.c2ff	mobility1	0.0.0.0	::
WLC1#						
WLC2#show wireless mobility summary						
Mobility Summary						
Wireless Management VLAN: 2						
Wireless Management IP Address: 172.16.0.6						
Wireless Management IPv6 Address:						
Mobility Control Message DSCP Value: 48						
Mobility High Cipher Suite:						
Mobility Supported Ciphers: TLS_ECDHE_RSA_AES128_GCM_SHA256, TLS_RSA_AES256_GCM_SHA384, TLS_RSA_AES128_CBC_SHA						
Mobility Keepalive Interval/Count: 15/3						
Mobility Group Name: mobility1						
Mobility Multicast IP address: 0.0.0.0						
Mobility MAC Address: 00le.bd0a.c2ff						
Mobility Domain Identifier: 0xf2ab						
Controllers configured in the Mobility Domain:						
IP	MAC Address	Public IP	Group Name	Multicast IPv4	Multicast IPv6	MTU
172.16.0.6 N/A		N/A	00le.bd0a.c2ff	mobility1	0.0.0.0	::
172.16.0.5 1385		172.16.0.5	00le.7a61.09ff	mobility1	0.0.0.0	::
WLC2#						

Configure Anchor/Foreign Wireless Mobility

The anchor/foreign wireless configuration on Catalyst Center allows you to establish wireless mobility between Cisco Wireless Controllers on different wireless networks. In an anchor/foreign setup, the foreign wireless controller encapsulates the client L3 traffic in the mobility tunnel and forwards it to the anchor wireless controller. The anchor wireless controller decapsulates the tunnel and switches the client traffic. This procedure describes the steps to configure anchor/foreign wireless mobility for the following use cases:

- Configuring two newly added wireless controllers - one anchor and one foreign wireless controller.
- Configuring three newly added wireless controllers - one anchor and two foreign wireless controllers.
- Configuring three newly added wireless controllers - one foreign and two anchor wireless controllers.
- Deleting the anchor/foreign setup.

Before you begin

- Ensure that you have the Cisco Wireless Controllers in your inventory and they are in **Managed** state. For more information, see [About Inventory](#), on page 62 and [Display Information About Your Inventory](#), on page 63.
- Use the **show wireless mobility summary** command to verify that there's no existing mobility tunnel between the wireless controllers.

Step 1 Create an SSID for the wireless network and associate it with a new wireless network profile. For more information, see [Create SSIDs for an Enterprise Wireless Network, on page 253](#) or [Create SSIDs for a Guest Wireless Network, on page 264](#).

In the **Associate SSID to Profile** step, choose the **Add Profile** option and configure as below:

- **Profile Name:** Enter a name for the profile.
- **Fabric:** Choose **No**.
- **Do you need Anchor for this SSID?**: Choose **Yes**.

Step 2 For a scenario with one anchor and one foreign wireless controller, do the following:

a) Assign the newly created wireless profile to the site managed by the foreign wireless controller.

To assign a site:

- From the top-left corner, click the menu icon and choose **Design > Network Profiles**
- Choose the profile and click **Assign Site**. For information on creating sites, see [Create, Edit and Delete a Site, on page 167](#).

b) Provision the anchor wireless controller.

- Choose the wireless controller role as **Anchor WLC** and select the anchor **Managed AP location(s)**.
- Configure the interface details.
- Configure other advance settings, if required, and deploy.

For more information on provisioning wireless controllers, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) or [Provision a Cisco AireOS Controller, on page 478](#).

c) Provision the foreign wireless controller.

- Choose the wireless controller role as **Active Main WLC** and select the **Managed AP location(s)**.
- Configure other advance settings, if required, and deploy.

For more information on provisioning wireless controllers, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) or [Provision a Cisco AireOS Controller, on page 478](#).

d) Provision the APs under the wireless controllers.

Ensure that APs have the correct SSID. For more information on AP provisioning, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

Step 3 For a scenario with one anchor and two foreign wireless controllers, do the following:

a) Assign the newly created wireless profile to the sites managed by the foreign wireless controllers.

- From the top-left corner, click the menu icon and choose **Design > Network Profiles**
- Choose the profile and click **Assign Site**. For information on creating sites, see [Create, Edit and Delete a Site, on page 167](#).

b) Provision the anchor wireless controller.

Configure Anchor/Foreign Wireless Mobility

- Choose the wireless controller role as **Anchor WLC** and select the **Managed AP location(s)** (select both foreign sites).
- Configure the interface details.
- Configure other advance settings, if required, and deploy.

For more information on provisioning wireless controllers, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) or [Provision a Cisco AireOS Controller, on page 478](#).

c) Provision the foreign wireless controllers.

- Choose the wireless controller role as **Active Main WLC** and select the **Managed AP location(s)**.
- Configure other advance settings, if required, and deploy.

For more information on provisioning wireless controllers, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) or [Provision a Cisco AireOS Controller, on page 478](#).

d) Provision the APs under the wireless controllers.

Ensure that APs have the correct SSID. For more information on AP provisioning, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

Step 4

For a scenario with one foreign and two anchor wireless controllers, do the following:

- Assign the newly created wireless profile to the sites managed by both wireless controllers (foreign and anchor).
 - From the top-left corner, click the menu icon and choose **Design > Network Profiles**
 - Choose the profile and click **Assign Site**. For information on creating sites, see [Create, Edit and Delete a Site, on page 167](#).
- Provision the foreign wireless controller.
 - Choose the wireless controller role as **Active Main WLC** and select the **Managed AP location(s)** (select both foreign and anchor sites).
 - Configure other advance settings, if required, and deploy.
- Provision the anchor wireless controllers.
 - Choose the wireless controller role as **Anchor WLC** and select the **Managed AP location(s)**.
 - Configure the interface details.
 - Configure other advance settings, if required, and deploy.

For more information on provisioning wireless controllers, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) or [Provision a Cisco AireOS Controller, on page 478](#).

d) Provision the APs under the wireless controllers.

Ensure that APs have the correct SSID. For more information on AP provisioning, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).

What to do next

After provisioning, Catalyst Center automatically creates a mobility tunnel between the anchor and foreign wireless controllers. Use the **show wireless mobility summary** command on each of the controllers to verify the mobility tunnel status. Following is a sample output of the command:

```
#WLCC#show wireless mobility summary
Mobility Summary
Wireless Management VLAN: 1
Wireless Management IP Address:172.16.0.7
Wireless Management IPv6 Address:
Mobility Control Message DSCP Value: 48
Mobility High Cipher : False
Mobility DHSS Enabled Ciphers: TLS_ECDHE_RSA_AES128_GCM_SHA256, TLS_RSA_AES256_GCM_SHA384, TLS_RSA_AES128_CBC_SHA
Mobility DHSS Inactive Interval/Count: 10/3
Mobility Group Name: default
Mobility Multicast Ipv4 address: 0.0.0.0
Mobility Multicast Ipv6 address:::
Mobility MAC Address: 00le.bd0a.c2ff
Mobility Domain Identifier: 0x34ac

Controllers configured in the Mobility Domain:
IP          Public IP          MAC Address        Group Name      Multicast IPv4      Multicast IPv6      Status
-----+-----+-----+-----+-----+-----+-----+
172.16.0.7   N/A           00le.bd0a.c2ff    default        0.0.0.0          :::                N/A
172.16.0.8   172.16.0.8     00le.e657.ddff    default        0.0.0.0          :::                Up
-----+-----+-----+-----+-----+-----+-----+
```

```
#WLCC-Anchor#show wireless mobility summary
Mobility Summary
Wireless Management VLAN: 1
Wireless Management IP Address:172.16.0.8
Wireless Management IPv6 Address:
Mobility Control Message DSCP Value: 48
Mobility High Cipher : False
Mobility DHSS Enabled Ciphers: TLS_ECDHE_RSA_AES128_GCM_SHA256, TLS_RSA_AES256_GCM_SHA384, TLS_RSA_AES128_CBC_SHA
Mobility DHSS Inactive Interval/Count: 10/3
Mobility Group Name: default
Mobility Multicast Ipv4 address: 0.0.0.0
Mobility Multicast Ipv6 address:::
Mobility MAC Address: 00le.e657.ddff
Mobility Domain Identifier: 0x34ac

Controllers configured in the Mobility Domain:
IP          Public IP          MAC Address        Group Name      Multicast IPv4      Multicast IPv6      Status
-----+-----+-----+-----+-----+-----+-----+
172.16.0.8   N/A           00le.e657.ddff    default        0.0.0.0          :::                N/A
172.16.0.7   172.16.0.7     00le.bd0a.c2ff    default        0.0.0.0          :::                Up
-----+-----+-----+-----+-----+-----+-----+
```

Verify the following mobility configurations on the wireless controllers:

- Both wireless controllers have the same WLAN and policy profile.
- The policy tag is created on foreign wireless controller and mapped to the AP.
- The VLAN interface is created for the anchor wireless controller and is mapped to the policy profile.

Delete the anchor/foreign setup

To delete the anchor/foreign setup, do the following:

1. Ensure that the mobility tunnel between the anchor and foreign wireless controllers is in *up* state.
2. Delete the SSID that was created for the wireless network.
 - a. From the top-left corner, click the menu icon and choose **Design > Network Settings**
 - b. Click the **Wireless** tab.
 - c. From the left hierarchy tree, choose **Global**.
 - d. In the **SSID** table, choose the SSID and click **Delete**.
3. Provision the foreign wireless controllers.

In the provision **Summary** window, ensure that the SSID details are removed.

After provisioning, Catalyst Center automatically deletes the mobility tunnel between the anchor and foreign wireless controllers and the WLAN and policy profile is deleted on all the wireless controllers.

AP Management Use Cases

The following topics help you understand the AP management use cases for wireless networks.

AP Configuration

You can do the following for APs in Catalyst Center:

- Configure AP-level parameters and radio-level parameters for APs.
- Schedule recurring events for APs.
- Configure APs using existing templates.

For more information, see [AP Configuration in Catalyst Center, on page 851](#).

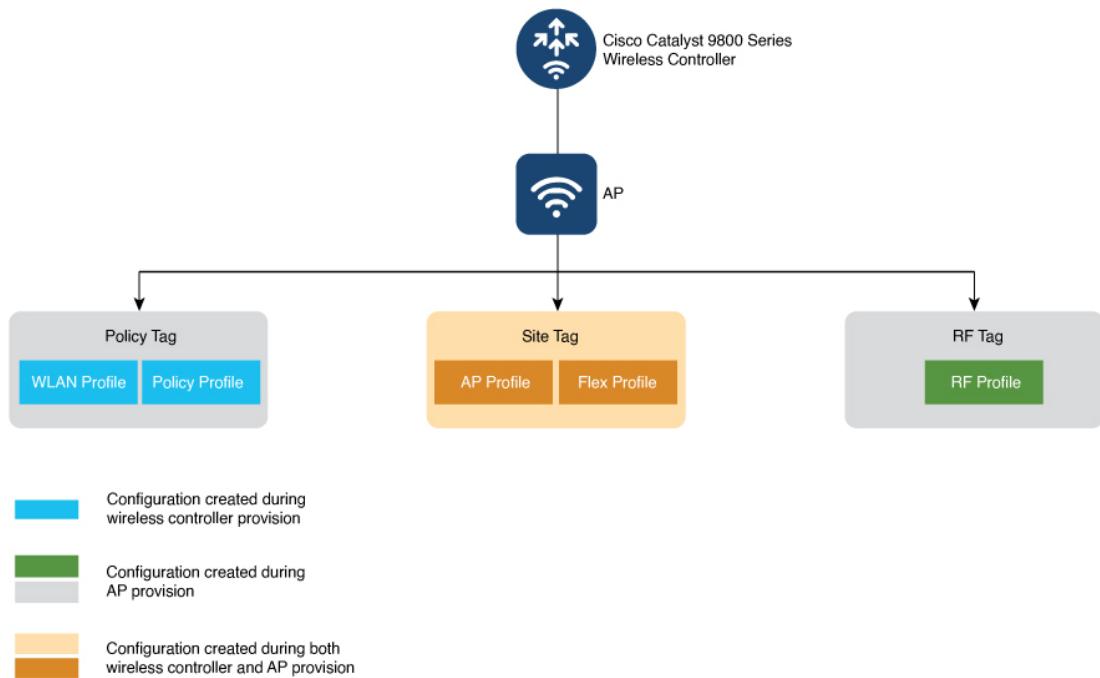
AP Refresh

You can replace old AP models with new AP models using Catalyst Center. You can replace both provisioned and unprovisioned old APs with new ones in Catalyst Center. For more information, see [AP Refresh Workflow, on page 843](#).

Skip AP Provision During Wireless Controller Provisioning

Catalyst Center uses policy tags, site tags, and RF tags to push the wireless network configurations to individual APs through Cisco Catalyst 9800 Series Wireless Controllers.

The following figure shows how Catalyst Center processes the tags.



For information about the tags on the wireless controller, see [Understand Catalyst 9800 Wireless Controllers Configuration Model](#).

By default, when you provision a wireless controller, Catalyst Center also provisions the associated APs. Based on the available number of devices, provisioning all the APs associated with the wireless controller may take several minutes.

If you modify any configuration that needs wireless controller reprovisioning but doesn't need an AP reprovision (for example, if you add a new building to an existing area), you can use the **Skip AP Provision** option to avoid the longer processing time while reprovisioning the wireless controller.

For the first-time provisioning, Catalyst Center doesn't reuse the existing tags. Both custom and Catalyst Center-generated site tags, policy tags, and RF tags are configured only during the AP provisioning. For more information about the tag and flex profile configurations, see [Overview of AP Groups, Flex Groups, Site Tags, and Policy Tags](#), on page 343.

If there are no provisioned APs on a floor, tags aren't configured on the floor during the wireless controller reprovisioning. Reprovisioning the wireless controller also updates any RF profile changes. If you check the **Skip AP Provision** check box during the wireless controller reprovisioning, Catalyst Center doesn't reprovision the existing APs and the APs managed by the wireless controller. However, the newly added APs are provisioned.

The following table lists the tags and the associated tag information during wireless controller and APs reprovisioning:

Configure ROW APs

Tag	Design Window	Wireless Controller Provision (with the Skip AP Provision Unchecked)	AP Provision
Policy tag	Design > Network Settings > Wireless > SSIDs	WLAN profile, policy profile, and policy tags are configured. Tags for the AP zone are created.	Policy tags with the required profiles are configured.
Site tag	AP profile: Design > Network Settings > Wireless > AP Profiles Custom site tag and flex profile: Design > Network Profiles > Add Profile > Wireless > Advanced Settings > Provision Group	Custom and autogenerated site tag, flex profile, and AP profile are configured.	Custom and autogenerated site tag, flex profile, and AP profile are configured.
RF tag	Design > Network Settings > Wireless > RF Profiles	No change	RF Tag and RF profiles are configured.

For flex profiles, intent configurations defined in the model configuration with **IP Overlap** enabled and native VLAN configurations are created during wireless controller provisioning. The other flex profile configurations are created during AP provisioning.

Configure ROW APs

Use this procedure to configure the Rest of World (ROW) domain APs.

Step 1 Create an AP profile with the necessary country code and configure custom site tags. For more information, see [Configure Additional Settings for an AP Profile for Cisco IOS XE Devices](#), on page 315 and [Add AP Groups, Flex Groups, Site Tags, and Policy Tags to a Network Profile](#), on page 353.

Note If you don't create an AP profile, Catalyst Center automatically generates the AP profile with the country code of the selected site and site tags for the ROW AP during AP provisioning or AP PnP onboarding.

Step 2 Add support for the country of operation to the country list on the wireless controller. You must configure at least one site from the country of operation as the managed AP location for the wireless controller. For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller](#), on page 516.

Step 3 If the wireless controller is not already provisioned with the configurations in [Step 1](#), on page 892 and [Step 2](#), on page 892, provision the wireless controller. For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller](#), on page 516.

Step 4 Configure the AP parameters. For more information, see [Configure APs](#), on page 851.

Step 5 Provision the AP. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning](#), on page 486.

Note Onboarding a ROW AP to a site with existing APs may disrupt the services of the existing APs for a brief period.

What to do next

To verify the AP configuration, use the **show ap summary** command. Following is a sample output of this command.

C9800LC-94#show ap summary Number of APs: 4									
CC = Country Code RD = Regulatory Domain									
AP Name	Slots	AP Model	Ethernet MAC	Radio MAC	CC	RD	IP Address	State	Location
AP68-C9138I-8D48	3	C9138AXI-B	3c41.	1416.	IN	-B		Registered	Texas
C9138AXI-5A40	3	C9138AXI-D	548a.	48Bb.	IN	-D		Registered	DEFAULT
C9136I-E1F4	4	C9136I-ROW	4891.	6cd6.	IN	-RW		Registered	DEFAULT
C9115AXI-4AD4	2	C9115AXI-D	6c41.	a4b4.	IN	-D		Registered	DEFAULT

This command displays the country code (CC) and regulatory domain (RD) for the APs. For ROW APs, the regulatory domain is **-RW**.



- Note** For a ROW AP, if the country code in the command output is --, it indicates that the country code is not available for the AP. The operational status of all the radios for the ROW APs without a country code is **down**. You must provision the ROW AP to configure the country code for the ROW AP.

Configure Wireless Mesh Network

In a Cisco wireless mesh network architecture, APs operate in one of the following ways:

- Root APs (RAP): Connected to the wired network.
- Mesh APs (MAP): Communicates with other MAPs and RAPs using wireless connections.

The workflow for configuring a wireless mesh network involves the following main steps:

1. Wireless controller provisioning: Configure a mesh profile, configure the AP authorization list and provision the wireless controller.
2. AP configuration: Configure AP in bridge mode and deploy.
3. AP provisioning: Configure the mesh role for AP (RAP or MAP) and provision the AP.

Before you begin

All APs are configured and shipped as MAPs. To use the AP as a RAP, you must reconfigure it as a RAP during AP provisioning. A mesh network must contain at least one RAP. For more information on Cisco Wireless Controller configuration and AP configuration for wireless mesh networks, see [About Wireless Mesh Networks, on page 328](#).

-
- Step 1** In the Catalyst Center device inventory (**Provision > Inventory**), ensure that the wireless controllers and APs are in managed state and assigned to the respective sites.
- Step 2** Create an AP profile with mesh settings. For more information, see [Configure Mesh Settings for an AP Profile for Cisco IOS XE Devices, on page 313](#) and [Configure Mesh Settings for an AP Profile for Cisco AireOS Devices, on page 317](#).
- Step 3** Add the AP Ethernet MAC address to the AP authorization list. For more information, see [Create an AP Authorization List, on page 305](#).

- Step 4** Provision the Cisco Wireless Controller. For more information, see [Provision a Cisco Catalyst 9800 Series Wireless Controller, on page 516](#) and [Provision a Cisco AireOS Controller, on page 478](#).
- In the provision configuration window, select the **AP Authorization List** defined in Step 3 and choose the option for authorizing only the mesh access points.
- Step 5** (Optional) In the **Configure Access Points** workflow, select the APs and change the AP mode to **Bridge/Flex+Bridge** mode if they are in **Local/Flexconnect** mode. For more information, see [Configure APs, on page 851](#).
- Step 6** Provision the APs. For more information, see [Provision a Cisco AP—Day 1 AP Provisioning, on page 486](#).
- For RAPs, choose the **Mesh Role** as **RAP (Root AP)**.
 - For MAPs, choose the **Mesh Role** as **MAP (Mesh AP)**.

What to do next

You can verify the mesh configurations on the Cisco Wireless Controller using the following commands:

- AP Ethernet MAC address: **show run | inc username**.
- AP mesh role (MAP/RAP) after provisioning: **show wireless mesh ap summary**.
- Site tag details: **show wireless tag site detailed <site tag name>**.
- AP profile: **show run | section ap profile**.
- Wireless mesh configurations:
 - **show wireless profile mesh summary**
 - **show wireless profile mesh detailed <mesh profile name>**

AP Migration from a Wireless Controller to Another Wireless Controller

You can migrate APs from one wireless controller to another wireless controller with the same floors in the network hierarchy. For more information, see [Migrate APs from a Wireless Controller to Another Wireless Controller, on page 488](#).

AP Replacement Using RMA Workflow

You can replace a faulty access point in the network using the Catalyst Center Return Material Authorization (RMA) feature. The RMA workflow lets you replace failed devices quickly, thus improving productivity and reducing operational expense. For wireless APs, the replacement device is assigned to the same site, provisioned with primary wireless controller, RF profile, and AP group settings, and placed on the same floor map location in Catalyst Center as the failed AP.

For more information, see [Replace a Faulty Access Point, on page 142](#).

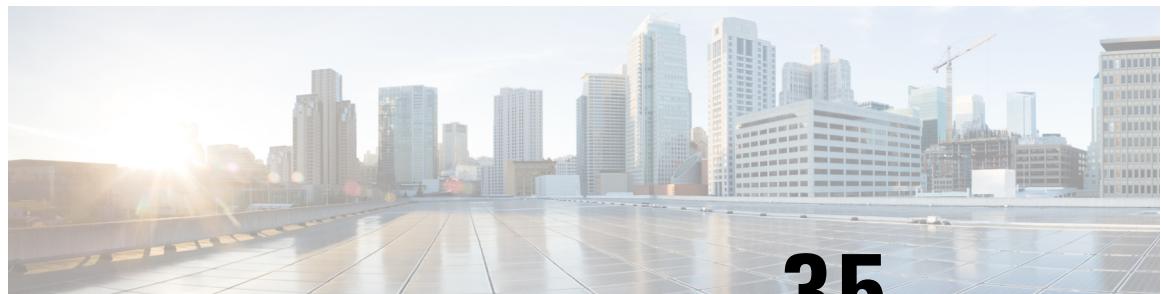
Wireless Controller Migration Use Case

The following topic helps you understand the migration use case for Cisco Wireless Controllers.

Migrate Cisco AireOS Wireless Controller to Cisco Catalyst 9800 Series Wireless Controller

You can migrate from Cisco AireOS Wireless Controller to Cisco Catalyst 9800 Series Wireless Controller using the **Learn Device Configurations** workflow on Catalyst Center. Migration is achieved by using the workflow to learn the device configurations from the wireless controller to be migrated and provisioning the new wireless controller with the learned configurations.

For more information, see [Migrate Cisco AireOS Controller to Cisco Catalyst 9800 Series Wireless Controller Using Catalyst Center, on page 523](#).



CHAPTER 35

Troubleshoot Catalyst Center Using Data Platform

- [About Data Platform, on page 897](#)
- [Troubleshoot Using the Analytics Ops Center, on page 898](#)
- [View or Update Collector Configuration Information, on page 899](#)
- [View Data Retention Settings, on page 900](#)
- [View Pipeline Status, on page 901](#)

About Data Platform

Data Platform provides tools that can help you monitor and troubleshoot Catalyst Center applications. **Data Platform** displays synthesized data from various inputs to help you identify patterns, trends, and problem areas in your network. For example, if something goes wrong in your network, you can quickly get answers to questions such as whether a pipeline is in an error state and what is the real-time traffic flow in a particular area. The main areas of Data Platform are:

- **Analytics Ops Center:** Provides a graphical representation of how data is streamed through collectors and pipelines and provides Grafana dashboards, which can help you identify patterns, trends, and problem areas in your network. See [Troubleshoot Using the Analytics Ops Center, on page 898](#).
- **Collectors:** Collects a variety of network telemetry and contextual data in real time. As data is ingested, Catalyst Center correlates and analysis the data. You can view the status of collectors and quickly identify any problem areas. See [View or Update Collector Configuration Information, on page 899](#).
- **Store Settings:** Allows you to view how long data is stored for an application. See [View Data Retention Settings, on page 900](#).
- **Pipelines:** Allows Catalyst Center applications to process streaming data. A data pipeline encapsulates an entire series of computations that accepts input data from external sources, transforms that data to provide useful intelligence, and produces output data. You can view the status of pipelines and quickly identify any problem areas. See [View Pipeline Status, on page 901](#).
- **Task Managers:** Allows you to view the list of Task Managers along with details such as Last Heart Beat, All Slots, and Free Slots. You can export the details as a CSV file.

Troubleshoot Using the Analytics Ops Center

The Analytics Ops Center provides a graphical representation of how data is streamed through collectors and pipelines, and provides Grafana dashboards, which can help you identify patterns, trends, and problem areas in your network, such as:

- Missing data in Assurance.
- An inaccurate health score.
- Devices that appear as monitored under Inventory but unmonitored under Assurance.

Step 1 From the top-left corner, click the menu icon and choose **System > Data Platform**.

Step 2 Click **Analytics Ops Center**.

A list of applications is displayed.

Step 3 Click the application name for which you want to view metrics; for example, **Assurance**.

A graphical representation of all existing collectors and pipelines in the application appears. CPU or throughput values corresponding to each pipeline are also provided.

The current health status of each component is indicated by its color:

- Red: error
- Yellow: warning
- Gray: normal operation

Step 4 To view historical data of pipelines, click **Timeline & Events**.

A timeline bar providing data for the time interval appears. You can also:

- Move the timeline slider to view data for a specific time.
- Hover your cursor over an event in the timeline bar to display additional details or a group of events that occurred at the same time.
- Click an event to display the Analytics Ops Center visualization at that particular time.

Step 5 To view additional details to help you troubleshoot an issue and determine the cause of an error or warning, click a collector name.

A slide-in pane appears with the following tabs:

- **Metrics**: Provides a selection of available metrics gathered during the last 30 minutes. It displays summary information indicating the component status, start and stop time, and error exceptions. You can also choose a different time interval.
- **Grafana**: Displays a dashboard associated with the respective component for deeper debugging.

Step 6 To view whether data is flowing through a specific pipeline, click a pipeline stream.

A slide-in pane appears with graphs. The graphs display whether the application is receiving data from the underlying pipelines. The graph information is based on the time interval you select from the drop-down list in the slide-in pane. Options are **Last 30 Min**, **Last Hour**, **Last 2 Hours**, and **Last 6 Hours**. The default is **Last 30 Min**.

Step 7 If a pipeline is not flowing at normal levels, hover your cursor over the stream to display the lag metrics.

Step 8 To view detailed information for a specific pipeline, click a pipeline name.

The appropriate *Pipeline* page displays with the following tabs:

Note Make sure to click the **Exceptions** tab to determine if any exceptions occurred in the pipeline. Under normal working conditions, this tab displays **null**.

- **Metrics**: Displays metrics, updated every 30 minutes in a graph.
- **Summary**: Displays summary information such as stats, run-time, and manifest.
- **Exceptions**: Displays any exceptions that occurred on the pipeline.
- **Stages**: Displays the pipeline stages.

Step 9 To change the metrics displayed on the Analytics Ops Center page, click **Key Metrics**, select up to two metrics, and then click **Apply**.

By default, Catalyst Center displays CPU and Throughput metrics.

Step 10 To view metrics for a particular flow, do the following:

- a) Click **View Flow Details**.
- b) Select three connected components (collector, pipeline, and store) by clicking the tilde (~) on the component's top-left corner.
- c) Click **View Flow**.
Catalyst Center displays the metrics associated with that specific flow.

View or Update Collector Configuration Information

Collectors collect a variety of network telemetry and contextual data in real time. As data is ingested, Catalyst Center correlates and analyzes the data. You can view the status of collectors and quickly identify any problem areas.

Step 1 From the top-left corner, click the menu icon and choose **System > Data Platform**.

Step 2 Click **Collectors**. The colored dot next to each collector indicates its overall status.

Step 3 To view additional details, click a collector name.

The appropriate *Collector* page appears. By default, Catalyst Center displays the **Configurations** tab which displays the list of current configurations.

Step 4 To view, update, or delete a configuration, click a specific configuration name.

Step 5 To add a new configuration, click **+ Add** in the **Configurations** tab.

Step 6 In the slide-in pane, enter the required information for the configuration.

View Data Retention Settings

Step 7 (Optional) For some collectors, such as the wireless collector, you can check the **Anonymize** check box to scramble the hostname and user ID in the **Client Health** window with a one-way hash that cannot be decrypted.

Important If you want to anonymize your data, make sure that you check the **Anonymize** check box before you discover devices with the **Discovery** tool. If you anonymize the data after you discover devices, the new data coming into the system is anonymized, but the existing data is not anonymized.

Step 8 Click **Save Configuration**.

Step 9 To view configured instances, click the **Instances** tab.

Step 10 To view summary information and metrics, choose an instance from the list.

Step 11 (Optional) If Catalyst Center integrates with Cisco Connected Mobile Experience (CMX), you have the option of anonymizing data on the CMX side. Do the following:

- Using an SSH client, log in to Cisco CMX as the cmxadmin CLI user.
- Change to the root user.
- Go to /opt/cmx/etc/node.conf and under [location], add **user_options**. For example:

```
[location]
...
user_options=-Dhideusername=true
```

- On the Cisco CMX CLI, enter the following commands:

```
cmxctl agent restart
cmxctl location restart
```

View Data Retention Settings

You can view how long data is stored for an application.

Step 1 From the top-left corner, click the menu icon and choose **System > Data Platform**.

Step 2 Click **Store Settings**.

Step 3 To view a list of historical purge jobs that have completed, click **Data Purge Schedule**.

The **HISTORY** table lists the name of the purge job, the result, time, and other data. You can sort, filter, and export data in the table.

Step 4 To view the current data retention and purge settings, click **Data Retention & Purge Configuration**. The following is displayed:

- **Document Store**: Settings for all time-based data, such as the maximum size and the low and high watermark threshold.
- **Metric Graph Store**: Settings for all time-based graphical data, such as the maximum size and the low and high watermark threshold.

View Pipeline Status

Data pipelines allow Catalyst Center applications to process streaming data. A data pipeline encapsulates an entire series of computations that accepts input data from external sources, transforms that data to provide useful intelligence, and produces output data. You can view the status of pipelines and quickly identify any problem areas.

Step 1 From the top-left corner, click the menu icon and choose **System > Data Platform**.

Step 2 Click **Pipelines**.

Step 3 To view whether the application is receiving data from the underlying pipelines, click a pipeline name.

The appropriate *Pipeline* page displays with the following tabs:

Note Make sure to click the **Exceptions** tab to determine if any exceptions have occurred in the pipeline. Under normal working conditions, this tab displays **null**.

- **Metrics**: Displays metrics, updated every 30 minutes in a graph.
 - **Summary**: Displays summary information such as stats, run-time, and manifest.
 - **Exceptions**: Displays any exceptions that have occurred on the pipeline.
 - **Stages**: Displays the pipeline stages.
-

