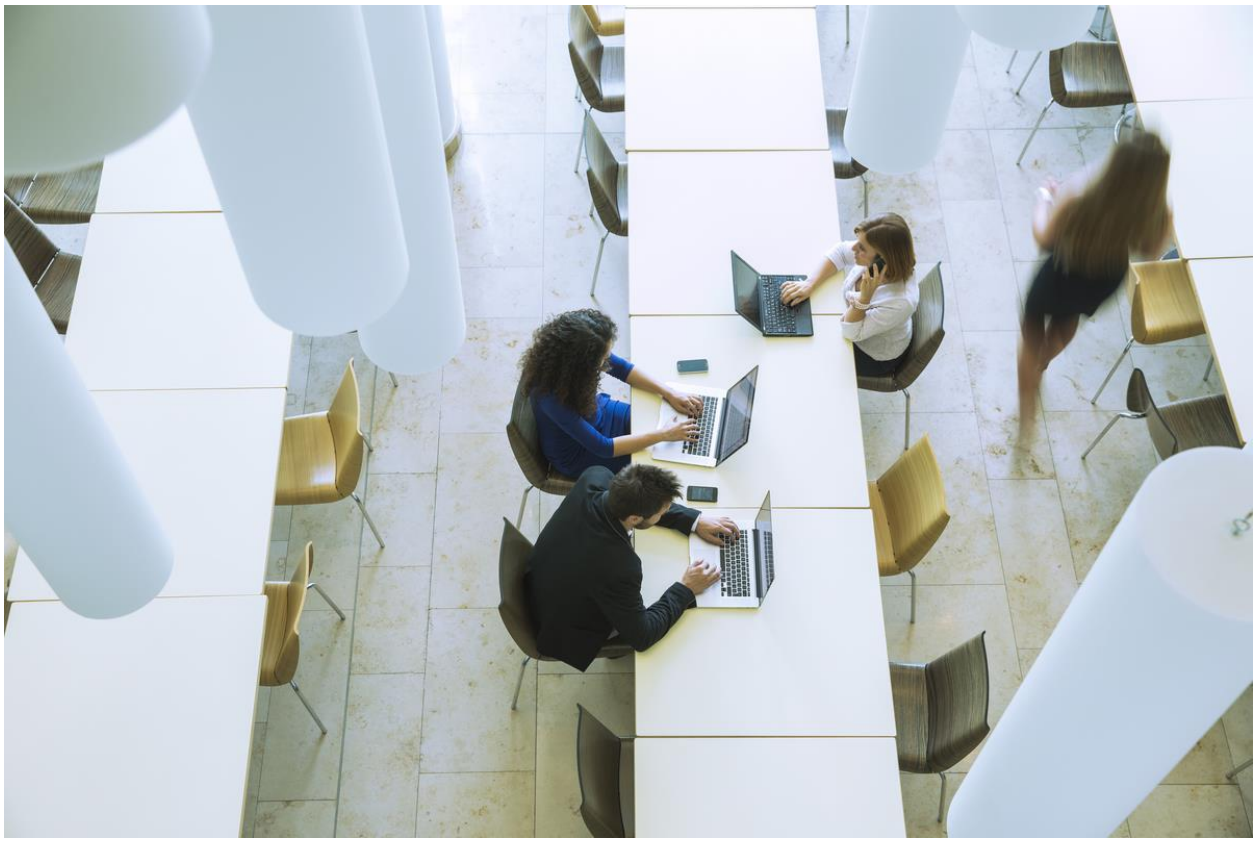


Enabling Cisco DNA Assurance on an existing network

Solutions adoption prescriptive reference—design guide

October, 2019

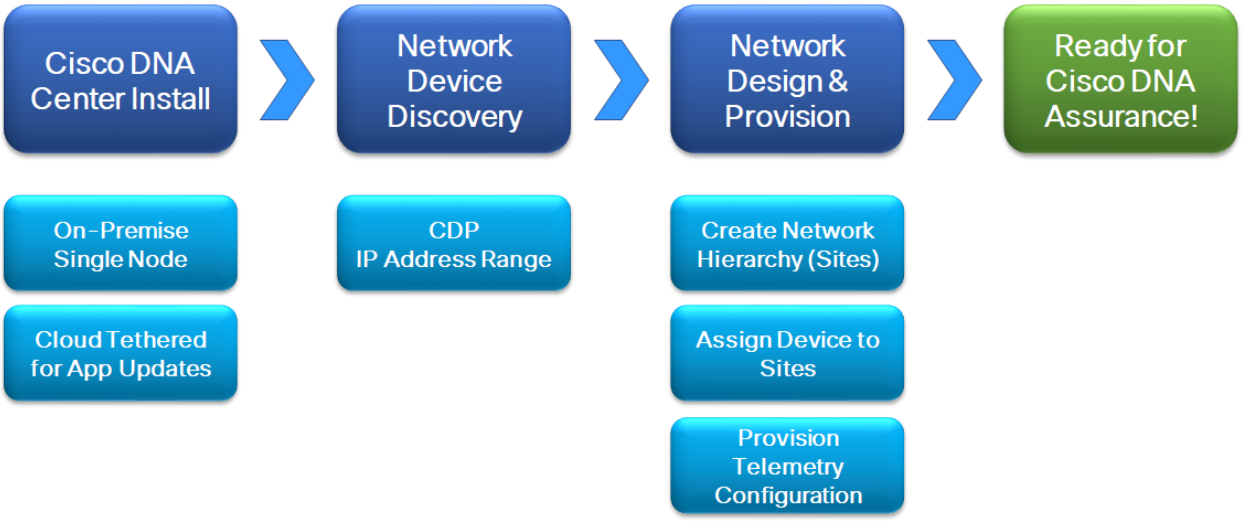
Table of contents

Introduction

About the solution

This solution assumes you are deploying Cisco DNA Assurance in an existing brownfield network. This will help transform your network operations through actionable insights and simplicity. Cisco DNA Assurance uses unique network graph technology developed by Cisco that draws from a combination of data resources in real time and a historical capture of interrelationships, among users, devices, applications, and network services across time and location. This document will walk you through your existing network to get Cisco DNA Assurance ready.

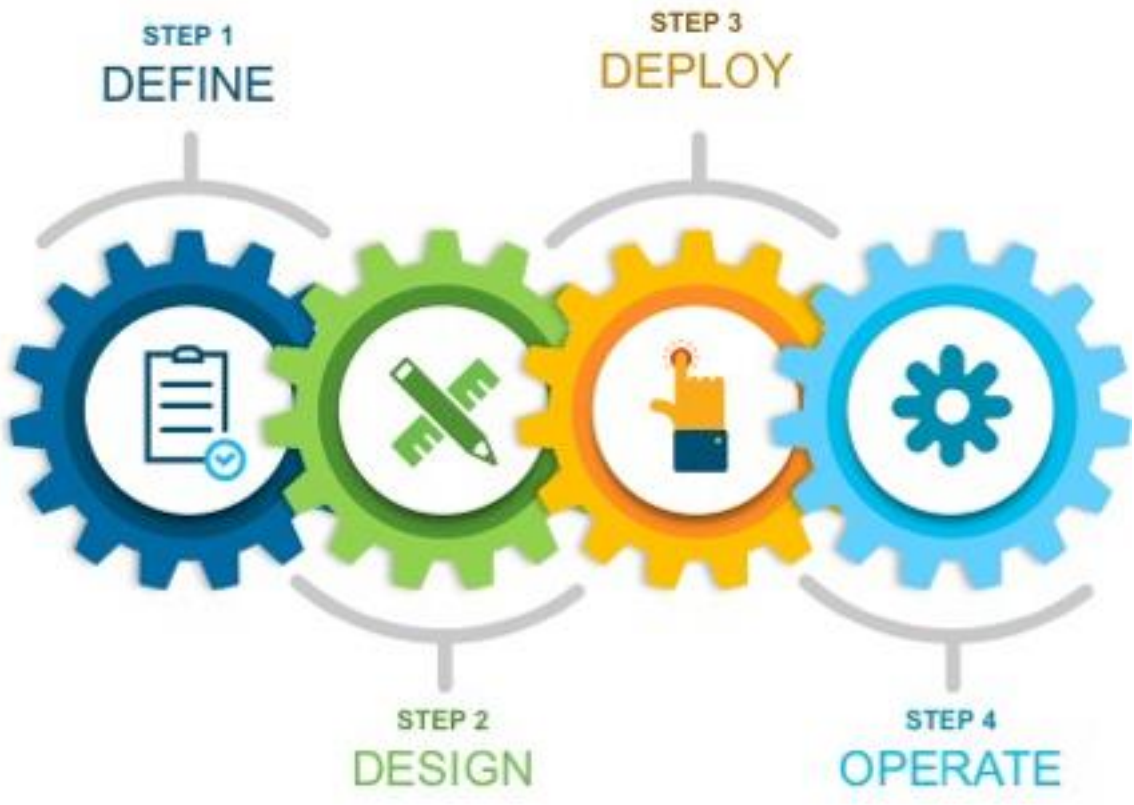
Figure 1 Cisco DNA Assurance Workflow



About this guide

This guide focuses on technical guidance to design, deploy and operate Cisco DNA Assurance on existing networks.

Figure 2 Implementation flow



This document contains four major sections:

- The Define section presents a high-level overview of the existing campus network that will be designed and deployed through Cisco DNA Center. It consists of an enterprise campus network with a traditional L2 design which includes switches, routers, WLCs, access points and clients.
- The Design section shows how to integrate Cisco DNA Center with Cisco Identity Services Engine (ISE); creation of the network hierarchy for your enterprise network - including the importing of floor maps – within Cisco DNA Center; and configuration of various network services necessary for network operations – such as AAA, DNS, DHCP, NTP, SNMP, and Syslog servers.
- The Deploy section shows how to use Cisco DNA Center to discover and manage devices, assign devices to a network hierarchy site, and enable network telemetry visibility for your enterprise network.
- The Operate section shows how to use Cisco DNA Assurance to proactively troubleshoot and monitor an enterprise network.

Define – Cisco DNA Assurance on an existing network

Audience

The audience for this document includes network design engineers, network operations personnel, and those who wish to benefit from Cisco DNA Center.

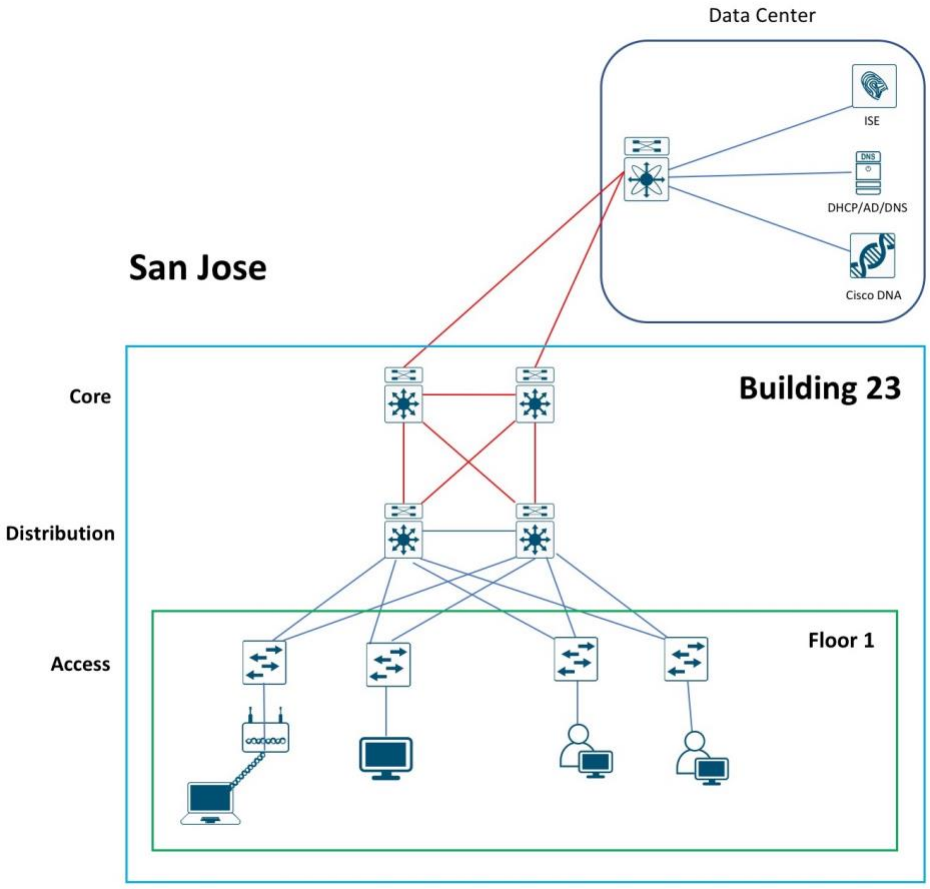
Purpose of this document

This guide details the necessary steps to get Cisco DNA Assurance to an operational state. It assumes you are deploying it in an existing network, brownfield deployment also help get telemetry from existing networks with Cisco DNA Center.

Solution overview

In this document we will assume that you have an existing network design similar to that shown in the following figure; and you will use that network topology with Cisco DNA Center to get telemetry data from it. You may refer to the link below for guidance on the design of your campus network.
https://www.cisco.com/c/dam/en/us/td/docs/solutions/CVD/Campus/CVD-Campus-LAN-WLAN-Design-Guide-2018JAN.pdf

Figure 3 Legacy 3-tier network with Cisco DNA Center



Design the network

There are some latency requirements to consider regarding the placement of Cisco DNA Center in your network. The round trip delay between your Cisco ISE and your network devices needs to be less than 300 msec. The other round trip delay consideration is between your Cisco DNA Center and ISE. This needs to be no more than 200 msec.

Having said that, for this deployment guide, we decided to deploy Cisco DNA Center in the Data Center as shown in Figure 3 above, along with other services like Cisco ISE, DHCP, DNS and Microsoft Active directory (AD). These being the services in our existing network.

The processes for integrating Cisco DNA Center to an existing deployment are as follows:

- Integrate the existing Cisco Identity Services Engine (ISE) with Cisco DNA Center.
- Configure the network site hierarchy within Cisco DNA Center and import floor maps.
- Configure network services necessary for network operation.

Process: Integrate Cisco Identity Services Engine (ISE) with Cisco DNA Center

Integration of Cisco ISE and Cisco DNA Center enables sharing of information between the two platforms, including device and group information.

Use the following procedures to integrate Cisco ISE with Cisco DNA Center:

- Enable pxGrid services on Cisco ISE
- Configure Cisco ISE as an authentication and policy server to Cisco DNA Center.
- Permit pxGrid connectivity from Cisco DNA Center into Cisco ISE.

Procedure 1: Enable pxGrid services on Cisco ISE

1. Login to Cisco ISE web console using the IP address or fully qualified domain name of your instance.

For example: https://<Cisco ISE IPaddress or FQDN>/admin

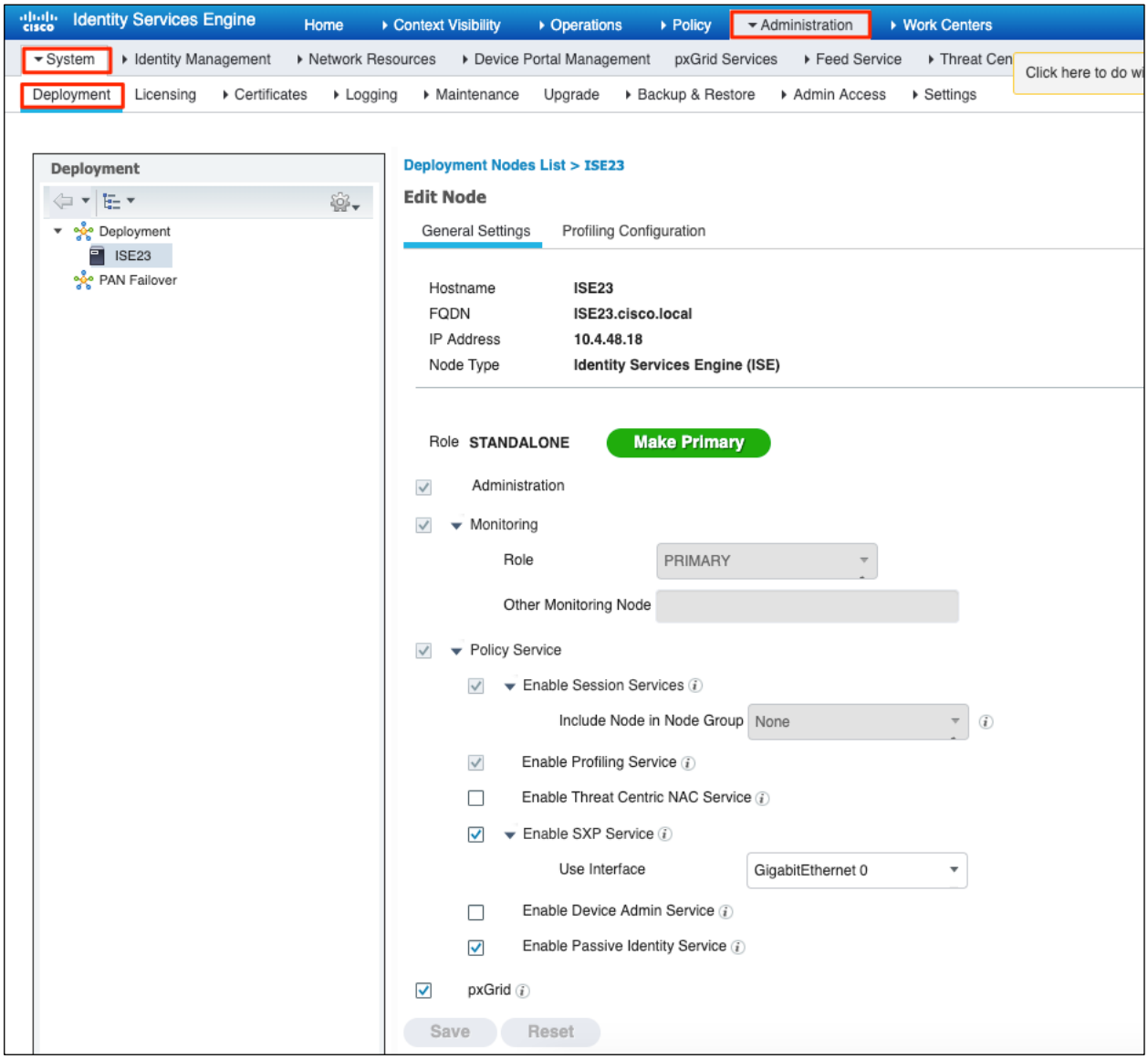
2. Enter the credentials for your ISE instance to login.

Figure 4 Cisco ISE login window

To integrate Cisco DNA Center and ISE, pxGrid must be enabled.

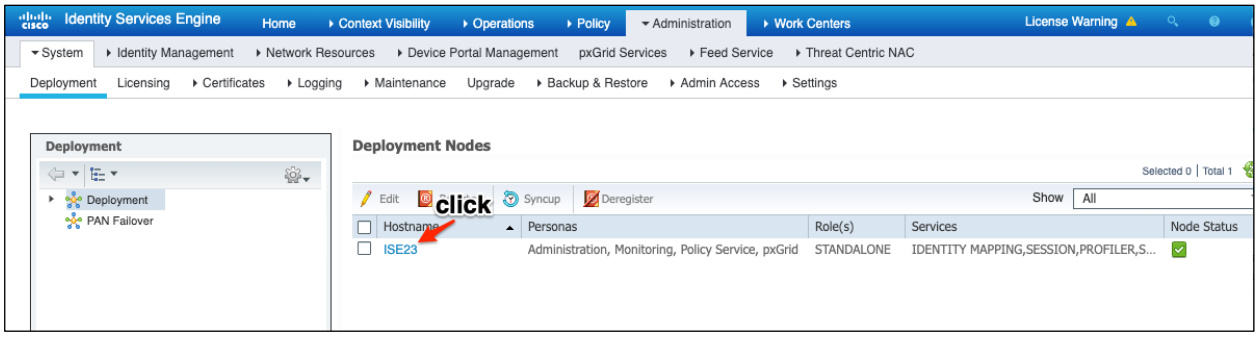
3. On the ISE home screen, go to **Administration > System > Deployment.**

Figure 5 Cisco ISE Administrator screen



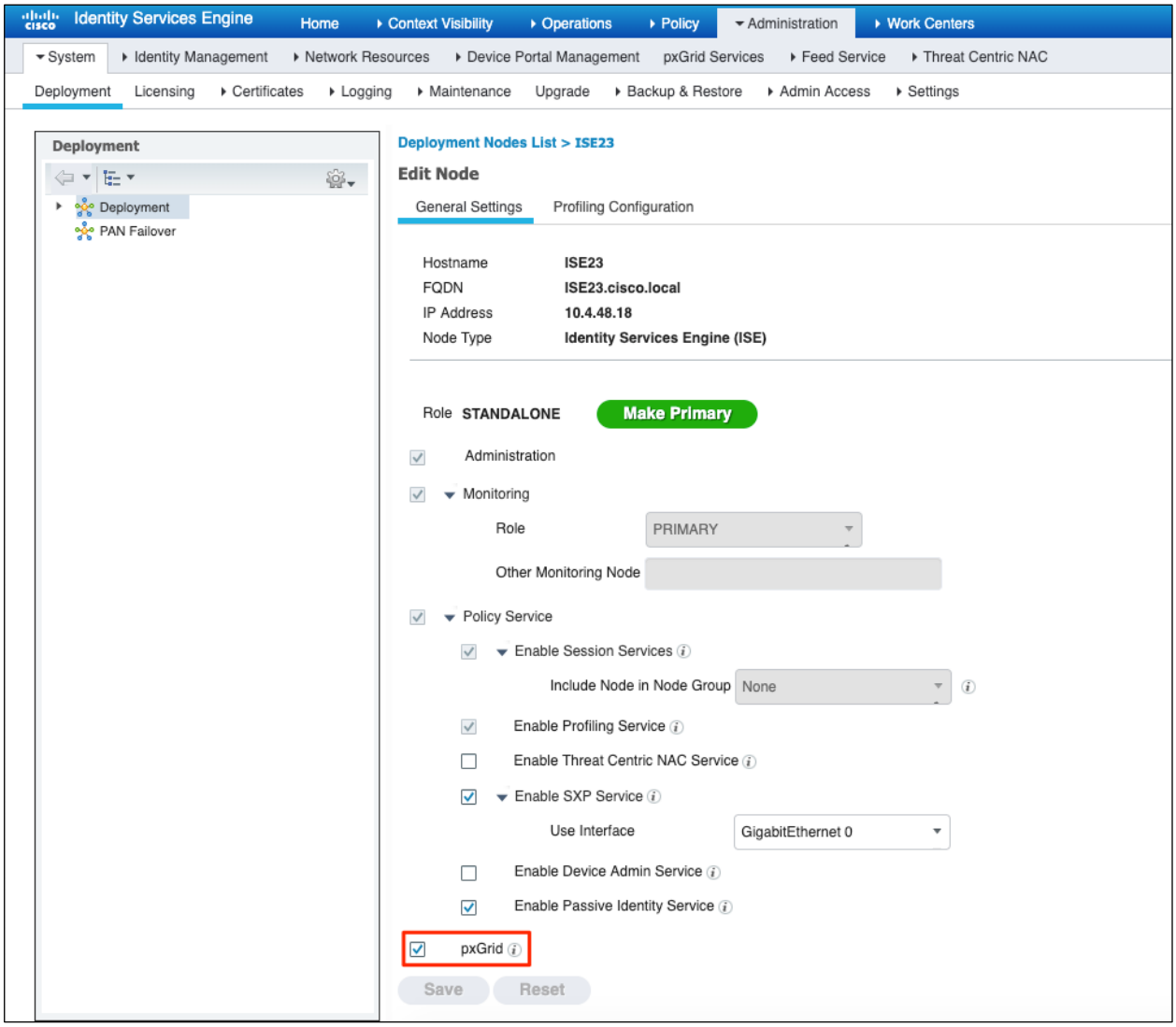
4. In the **Deployment** screen, on the right panel, click on your ISE node. See the figure below.

Figure 6 Deployment screen



Another window will open as follows.

Figure 7 Cisco ISE node



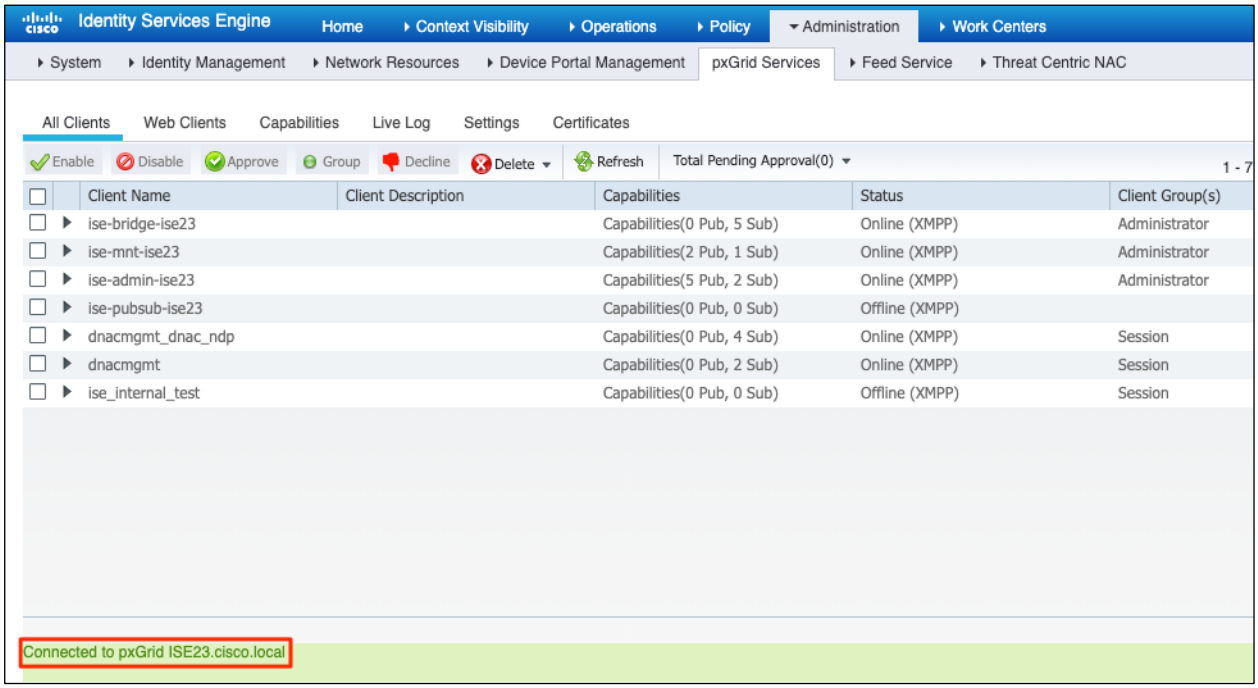
5. Check to see if **pxGrid** is checked. If not, check the box next to **pxGrid** and click on **Save**.

Make note of the FDQN (you will need this later for Cisco DNA Center integration with ISE).

6. Navigate to **Administration > pxGrid Services**.

You will see a screen similar to the figure below.

Figure 8 pxGrid Services page



The next procedure of the integration needs to be done on Cisco DNA Center.

Procedure 2: Configure ISE as an authentication and policy server on Cisco DNA Center

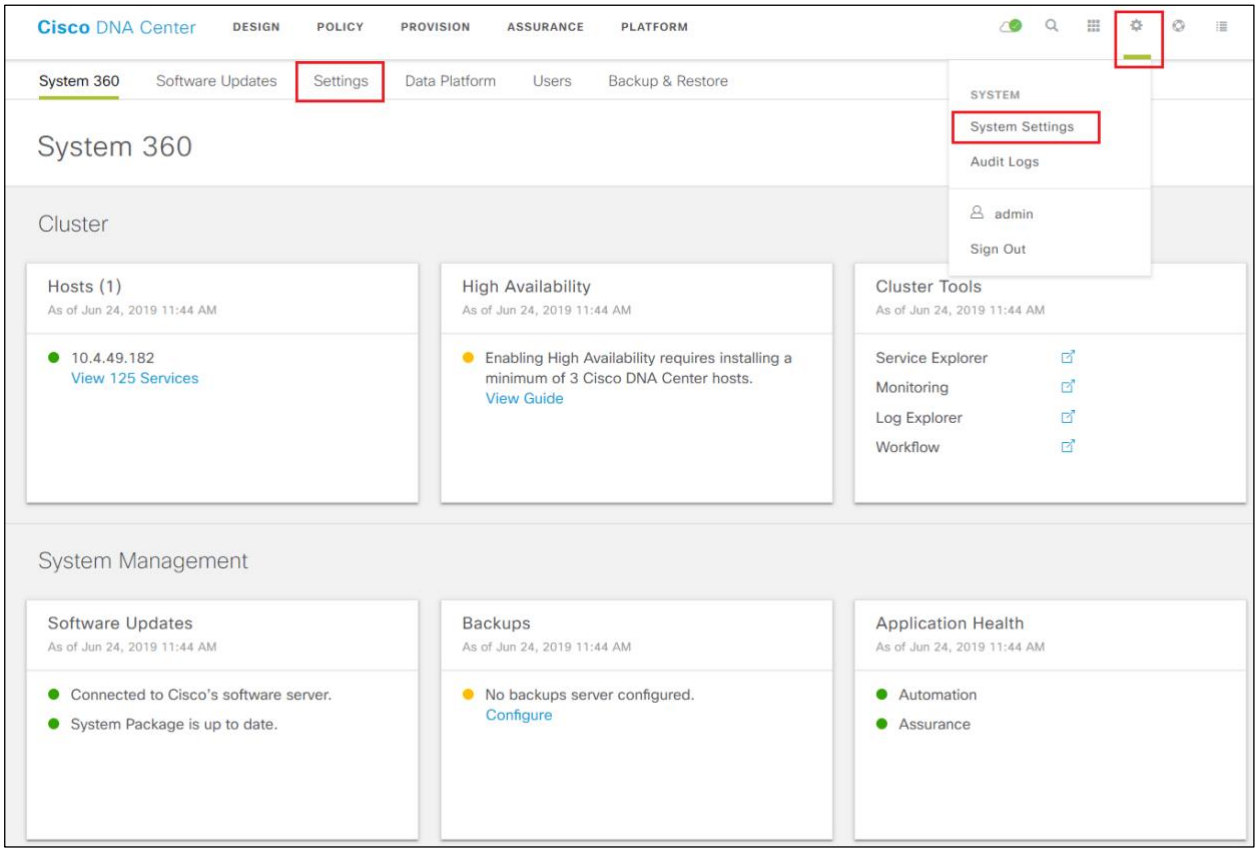
1. Login to your Cisco DNA Center server web console using the IP address or fully qualified domain name.

For example: https://Cisco DNA Center IPaddr or FQDN>. The credentials (userid and password) you enter must have SUPER-ADMIN-ROLE OR NETWORK-ADMIN-ROLE privileges.

2. In the top right corner of any screen within Cisco DNA Center click on the gear icon. From the drop-down menu select **System Settings**

This will take you to the **System 360** tab within the **System Settings** screen. An example is shown in the following figure.

Figure 9 System setting screen – System 360 tab



3. Click on the **Settings** tab

4. In the navigation panel on the left side of the screen, select **Authentication and Policy Servers**.

This will bring up the **Authentication and Policy Servers** dashboard.

5. Click the Add button and add and ISE Server

6. Fill in the information within the **Add AAA/ISE server** panel which appears

The following table discusses the fields within the Add **AAA/ISE server** panel which appears.

Table 1 Add AAA/ISE server panel fields

Field	Settings	Description
Server IP Address	Text Field	The IP address of the AAA/ISE server
Shared Secret	Text Field	This is the shared secret used by network devices for communicating with the AAA/ISE server. This is also referred to the PAC key within IOS XE device configuration.
Cisco ISE Server	Toggle Switch	Enabled when the AAA server is a Cisco ISE server. Note that although there can be multiple AAA servers, there can only be one ISE server (high-availability standalone ISE deployment or distributed ISE deployment) defined to Cisco DNA Center.
Username	Text Field	This is the username of the default super admin account that you created during the Cisco ISE installation.
Password	Text Field	This is the password of the default super admin account that you created during the Cisco ISE installation.

Field	Settings	Description
FQDN	Text Field	This is the fully-qualified domain name of the Cisco ISE server.
Subscriber Name	Text Field	This is client name which the Cisco DNA Center server will be known by to the pxGrid service within Cisco ISE.
SSH Key	Check Box	Optional SSH key for authentication between Cisco DNA Center and Cisco ISE.
Virtual IP Address	Text Field	One or more Policy Services Nodes (PSN) may be behind a single load balancer. In those cases, you can add the load balancer IP(s) in the Virtual IP field.
Advanced Settings > Protocol	Multiple Choice Radio Button	Determines the authentication protocol(s) used. The choices are as follows: - RADIUS - This is the default setting, using the RADIUS protocol - TACACS - Uses the TACACS protocol
Advanced Settings > Authentication Port	Text Field	When RADIUS is selected, the default port is 1812.
Advanced Settings > Accounting Port	Text Field	When RADIUS is selected, the default port is 1813.
Advanced Settings > Port	Text Field	This field appears only when TACACS is selected. The default port is 49.
Retries	Number	The number of authentication retries before failure. The default is 3.
Timeout (seconds)	Number	The number of seconds before an attempt times out. The default is 4 seconds.

For this design and deployment guide, the following information was entered.

Table 2 Add AAA/ISE server panel settings

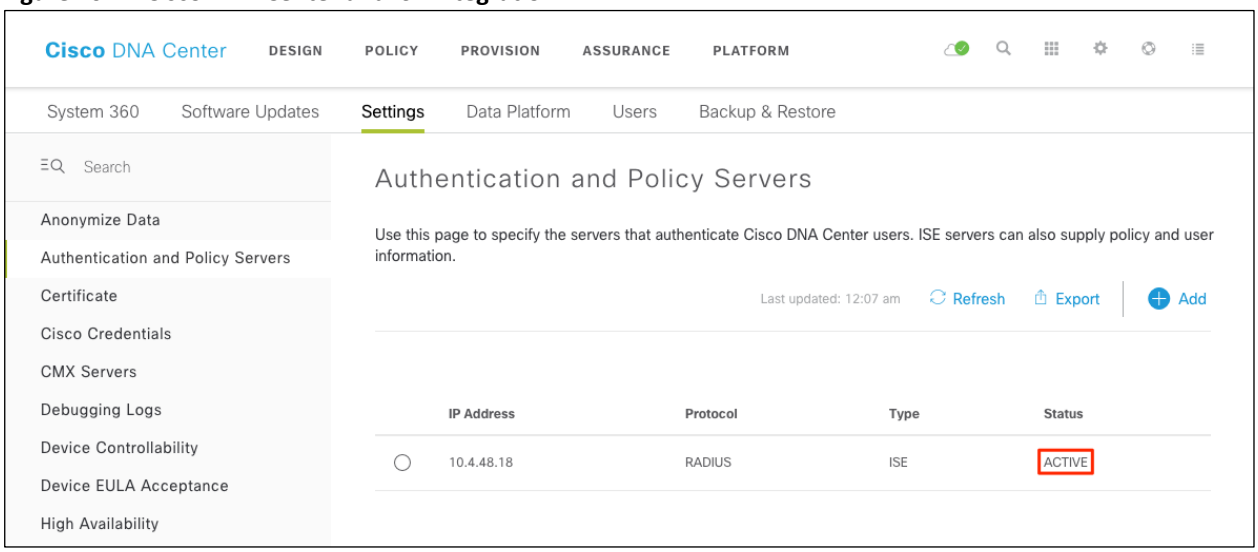
Field	Value
Server IP Address	10.4.48.18
Shared Secret	****
Cisco ISE Server	On
Username	admin
Password	****
FQDN	ISE23.cisco.local
Subscriber Name	dnacmgmt
SSH Key	None (empty)
Virtual IP Address	None (empty)
Advanced Settings > Protocol	RADIUS
Advanced Settings > Authentication Port	1812
Advanced Settings > Accounting Port	1813
Advanced Settings > Port	Not applicable - TACACS not selected

Field	Value
Retries	3
Timeout (seconds)	4

7. Click the **Apply** button to create the Cisco ISE server within Cisco DNA Center.

This will take you back to the **Authentication and Policy Servers** dashboard. The new Cisco ISE server should appear with a **Status** of **Active**. See figure below

Figure 10 Cisco DNA Center and ISE Integration



Procedure 3: Permit pxGrid connectivity from Cisco DNA Center into Cisco ISE

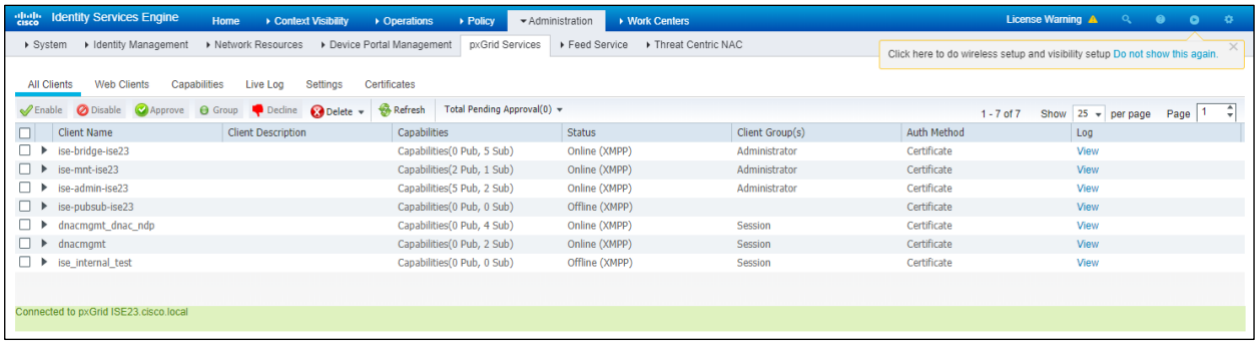
1. Log back into the Cisco ISE web console using the IP address or fully qualified domain name of your instance.

For example: https://<Cisco ISE IPaddr or FQDN>/admin.

2. Navigate to **Administration > PxGrid Services > All Clients**.

This will take you to a screen similar to the following.

Figure 11 ISE PxGrid Services screen



3. Locate and select the **Client Name** in the list based upon the subscriber name you configured when adding the Cisco ISE server to Cisco DNA Center in the previous procedure.

For this design and deployment guide the **Client Name** is **dnacmgmt**.

4. Click the ✓**Approve** button to activate the new client.

The status of the client should transition to **Online (XMPP)**.

Technical Note: Alternatively, you could change the pxGrid settings to automatically approve new certificate-based accounts through the **Settings** tab shown in the figure above.

Cisco ISE should now be integrated with Cisco DNA Center through pxGrid.

Process: Creating the network site hierarchy for your network within Cisco DNA Center

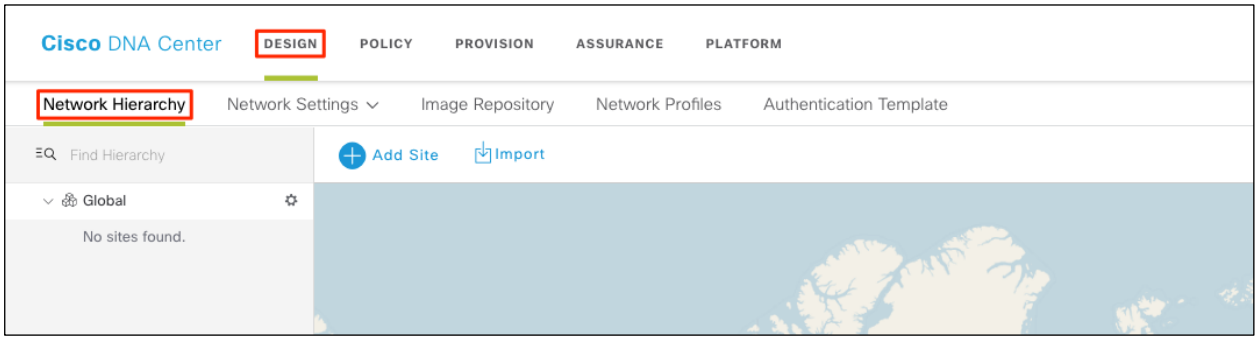
Configuring the site hierarchy involves defining the network sites for deployment, and their hierarchical relationships. Network sites consist of areas/sites, buildings, and floors. Their hierarchical relationship is important because child sites automatically inherit certain attributes from parent sites. However, these attributes may be overridden within the child site

Procedure 1: Adding an area / site to a network hierarchy

1. Click on the **Design** workflow icon within Cisco DNA Center.

Tech Tip: By default, the Design dashboard should have the **Network Hierarchy** tab selected. The default **Global** site should be displayed along with a map of the world.

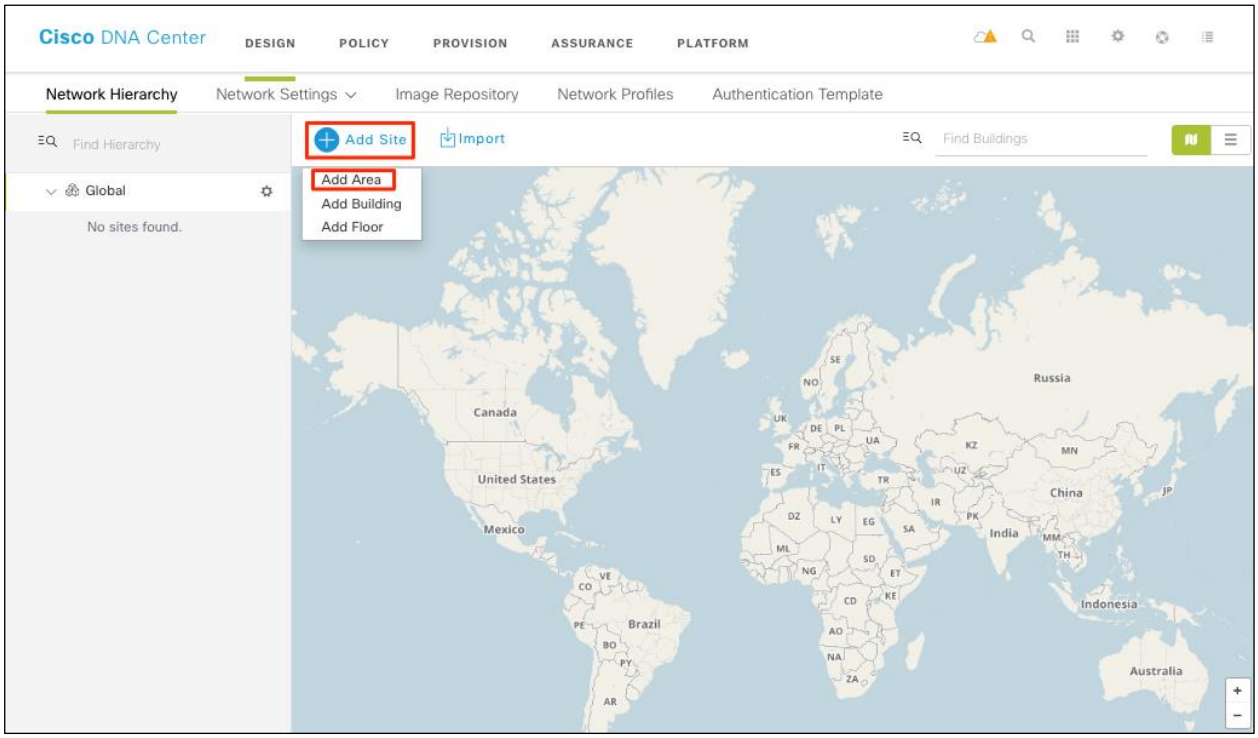
Figure 12 Network Hierarchy dashboard



2. Click **Add Site**.

A small drop-down window should appear.

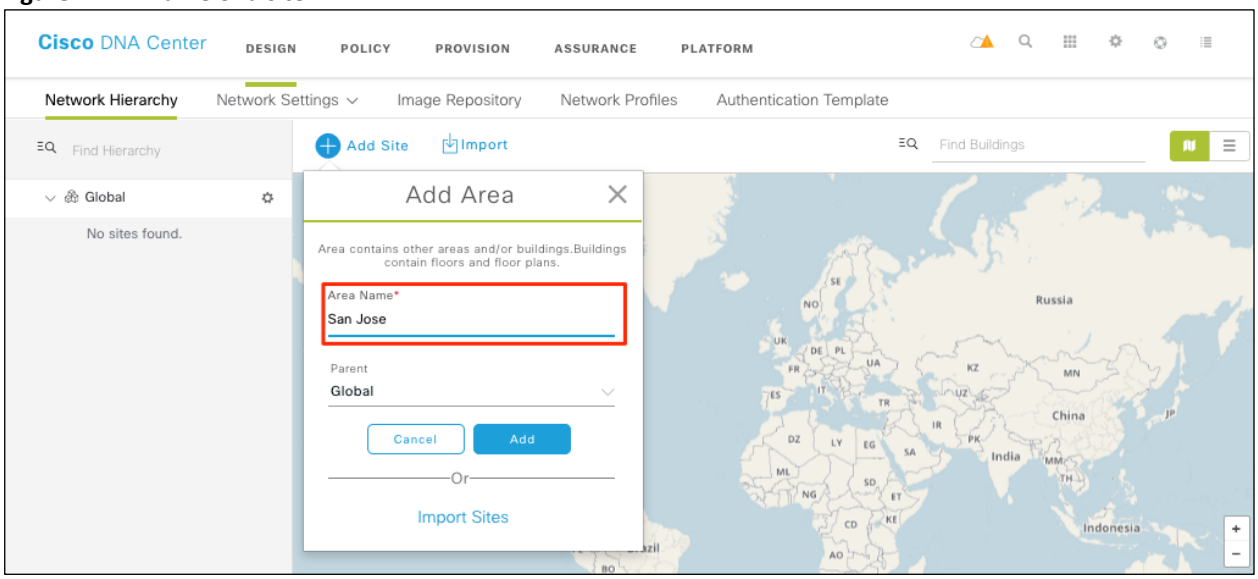
Figure 13 Add site



3. Click on **Add Area**.

The **Add Area** pop-up window should appear.

Figure 14 Name of a site



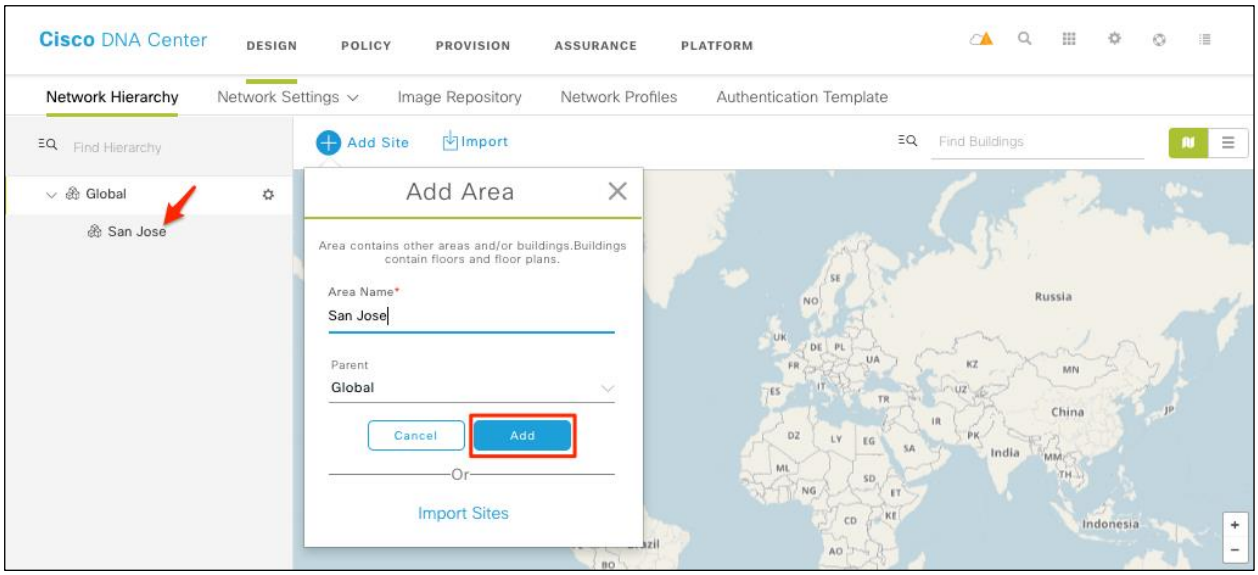
Areas area also referred to as sites – although this can be a confusing since adding a site can refer to adding an area, building, or floor. Areas don't have a physical address (for example, United States). You can think of areas as the largest element of the site hierarchy. Areas can contain buildings and sub-areas. For example, an area called United States can contain a sub-area called California. And the sub-area California can contain a sub-area called San Jose.

4. Enter an **Area Name** for the site.

By default, **Global** is the **Parent** for the site. You can leave that alone.

5. Click **Add** and the site will be created under the parent node in the left menu.

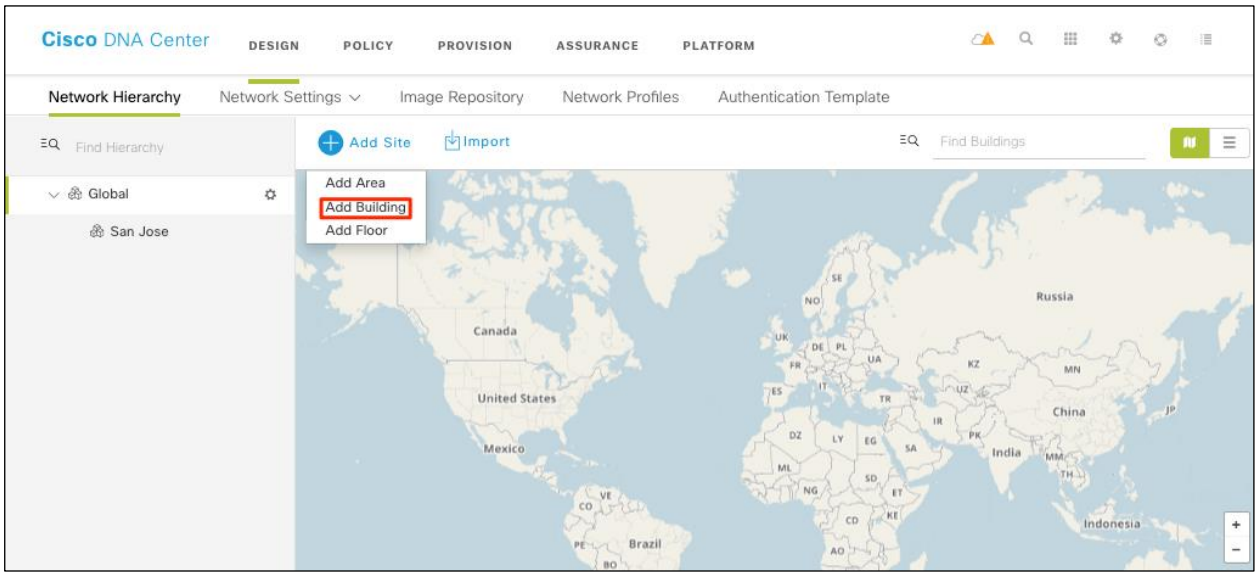
Figure 15 Site added in Global



Procedure 2: Add a building within an area

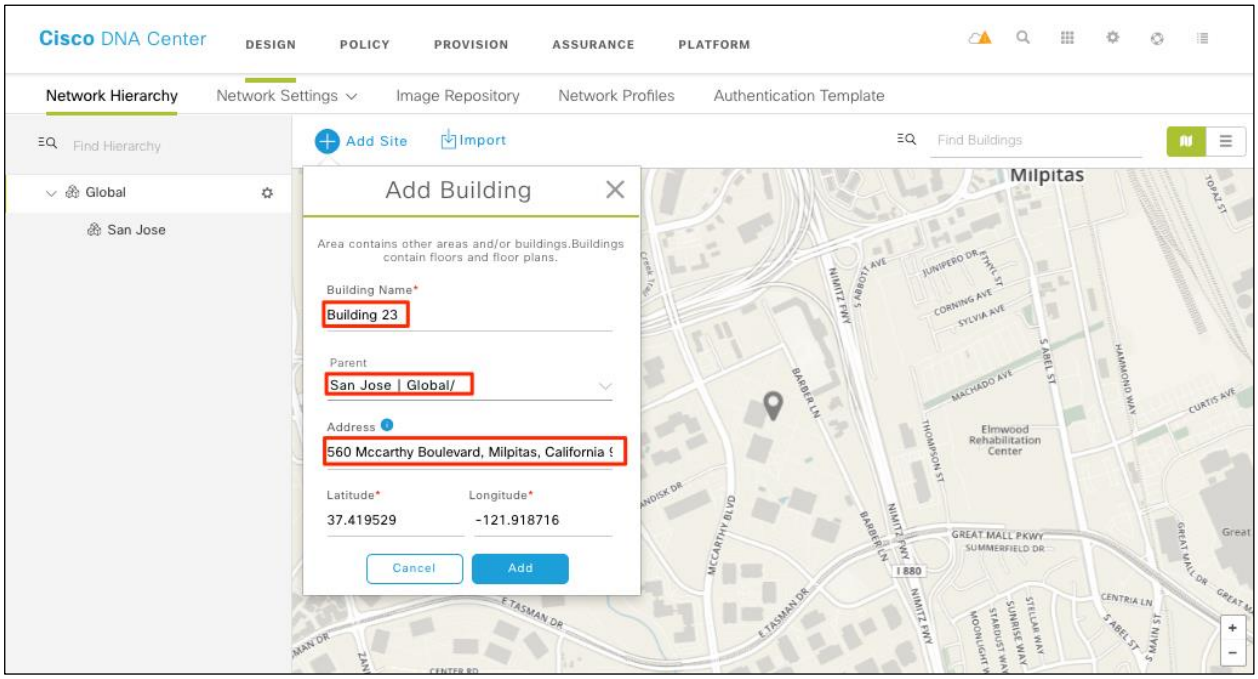
6. Click on **Design > Network Hierarchy > Add Site > Add Building**

Figure 16 Add a building to a site



The **Add Building** pop-up window should appear.

Figure 17 Add Building pop-up window



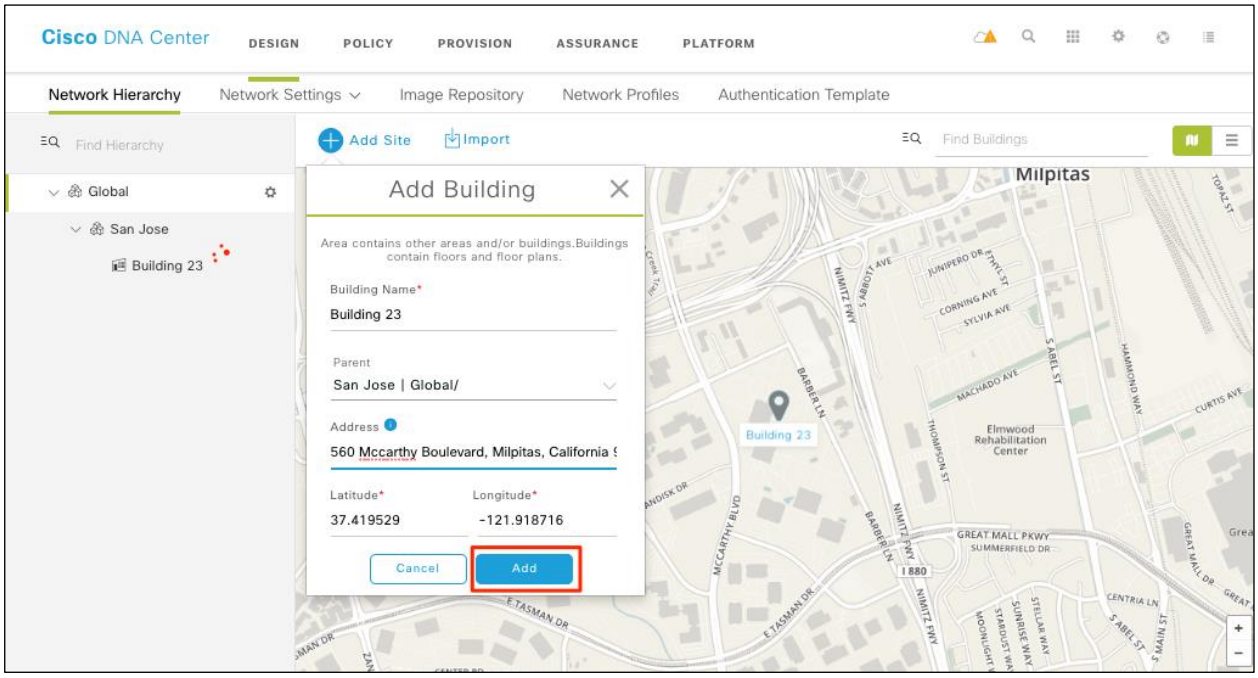
Buildings have physical addresses and contain floors and floor plans. When you create a building, you must specify a physical address or latitude and longitude coordinates. Buildings cannot contain areas. By creating buildings, you can apply settings to a specific area.

7. Enter a **Building Name** for the building and an **Address** for your building.

8. Be sure to change the **Parent** to **San Jose | Global/**.

9. Click **Add** and the building you just created will appear on the left. If you do not see it, be sure to expand the area.

Figure 18 Add a building to a site

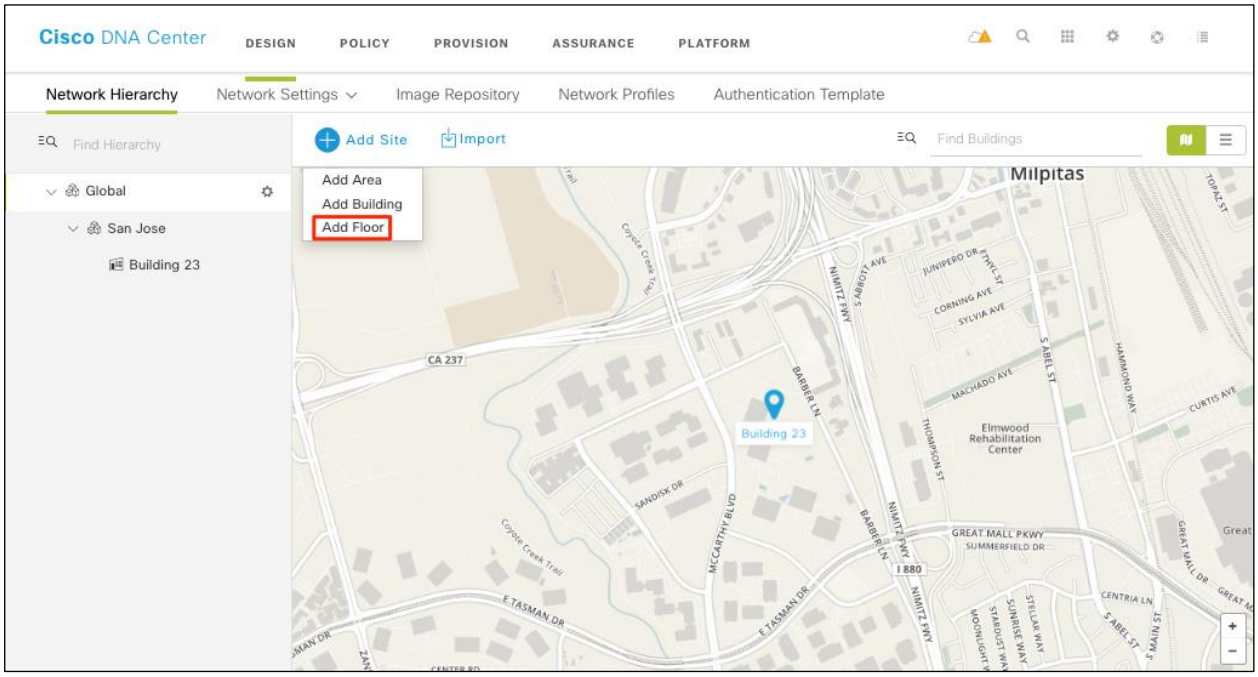


Procedure 3: Add a floor to your building

Floors are the spaces within the building which are comprised of cubicles, walled offices, wiring closets, and so on. You can add floors only to buildings.

10. Click **Design > Network Hierarchy > Add Site > Add Floor**

Figure 19 Adding a floor to your building



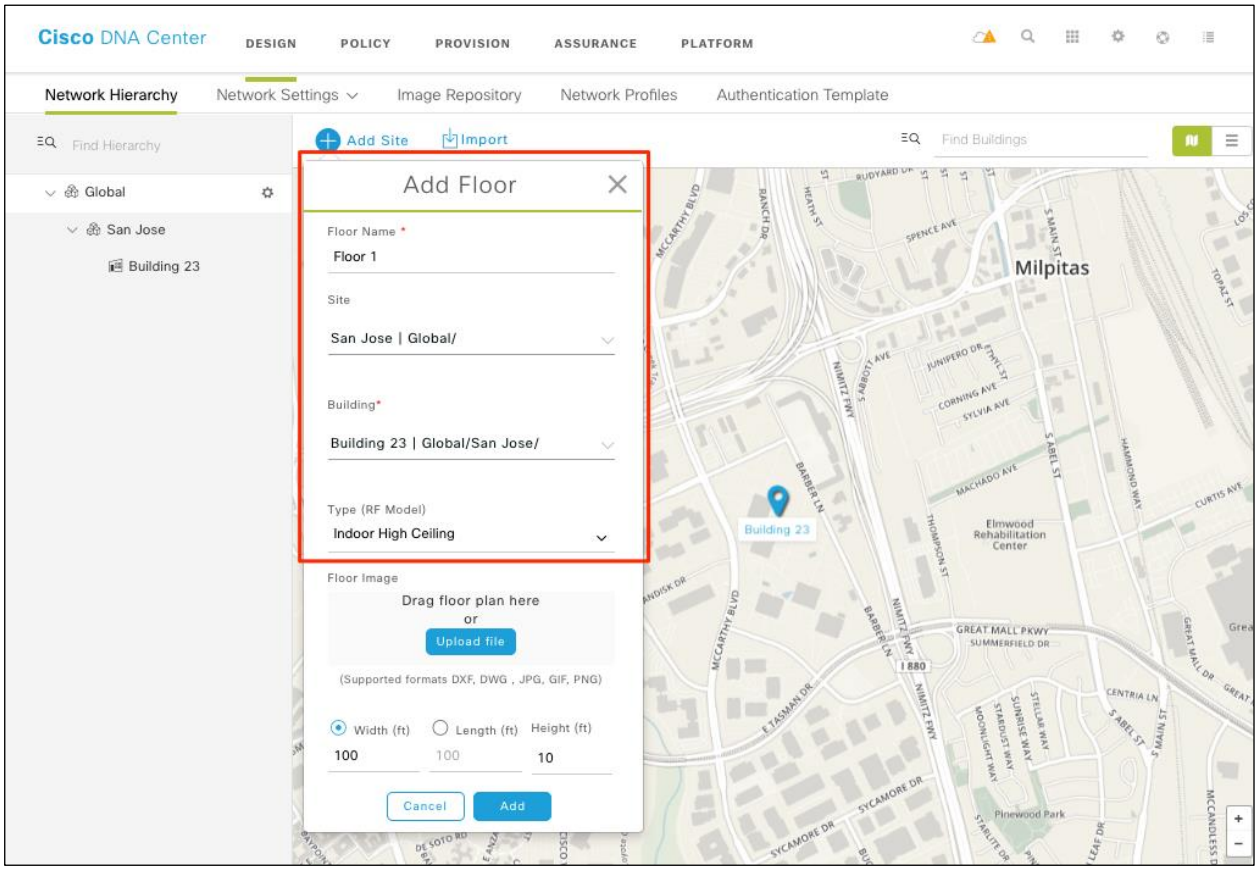
The **Add Floor** pop-up window should appear.

11. Enter the **Floor Name**, select the appropriate **Site**, **Building**, and **Type (RF Model)**.

12. Import the image of your floor plan by dragging-and-dropping a file to the pop-up window, or by selecting the **Upload file** button and choosing a file from your laptop / PC.

13. Adjust the **Width** and **Length** as necessary to match the dimensions of your floor.

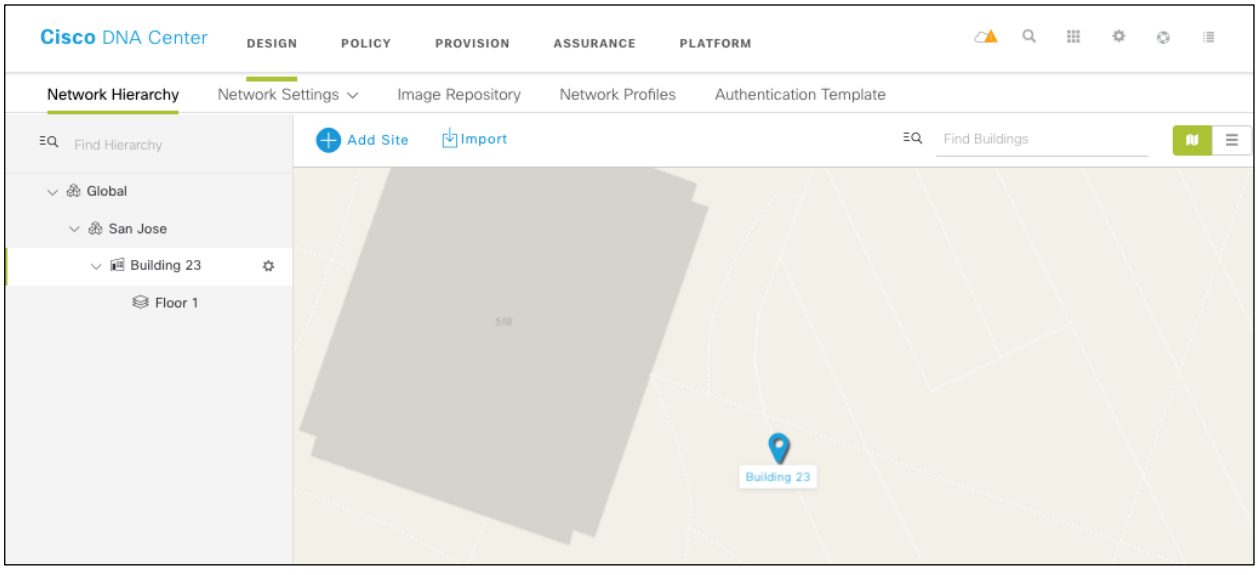
Figure 20 Add Floor pop-up window



The **Type (RF Model)** setting is used to calculate heat maps for radio frequency (RF) coverage, when Access Points (APs) are added to the floor. Choose the RF model that most closely matches the floor to which you are adding.

14. Click **Add** and the floor should be on the left side of the window. If the window is overshadowed by a heat map, resize it appropriately.

Figure 21 Floor added to a building



Once you have designed your network site hierarchy of areas/sites, buildings, and floors; you are ready to create network device credentials.

Process: Configure network device credentials necessary for discovery of your devices

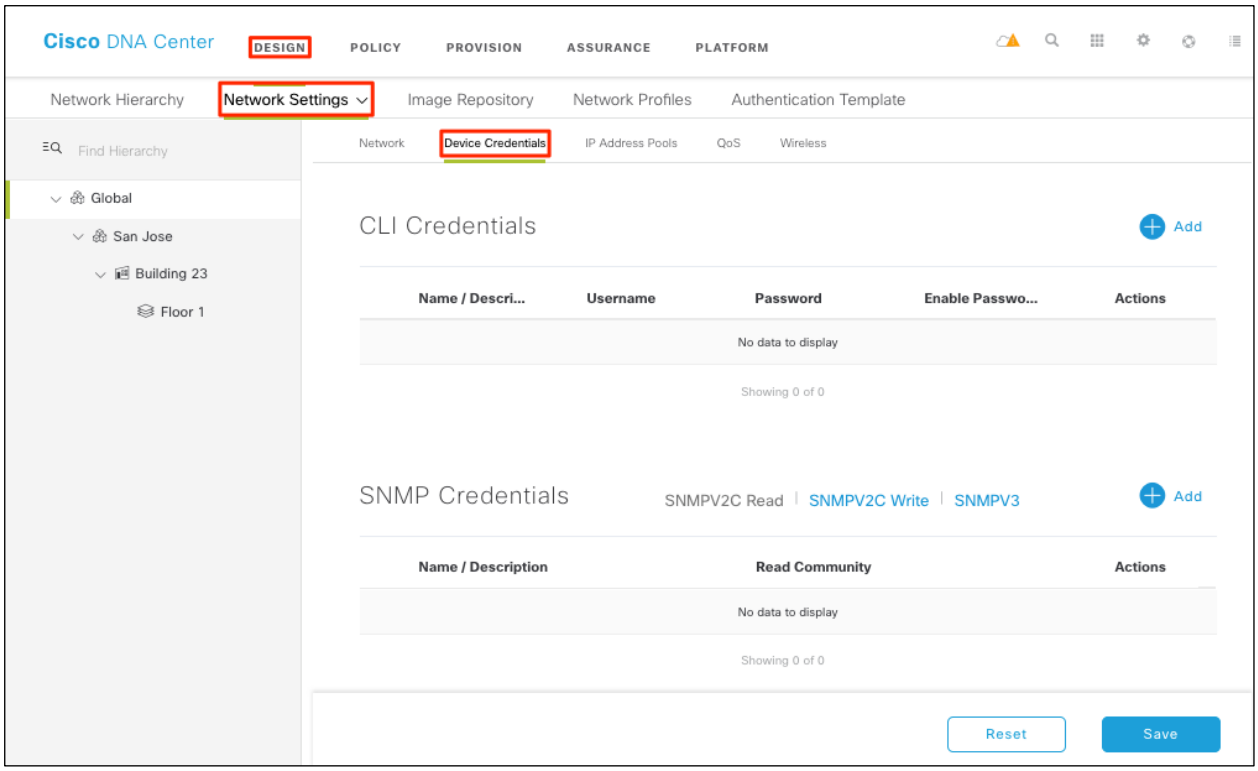
In this process, you will configure CLI and SNMP services that will be used later in this guide to be able to discover your network devices.

Procedure 1: Network CLI credentials

Device credentials refer to the CLI, SNMP, and HTTPS credentials that are configured on network devices. Cisco DNA Center uses these credentials to discover and collect information about the devices in your network. In Cisco DNA Center, you can specify the credentials that most of the devices use so that you do not have to enter them each time you run a discovery job. After you set up these credentials, they are available for use in the Discovery tool.

1. Navigate to **Design > Network Settings > Device Credentials**.

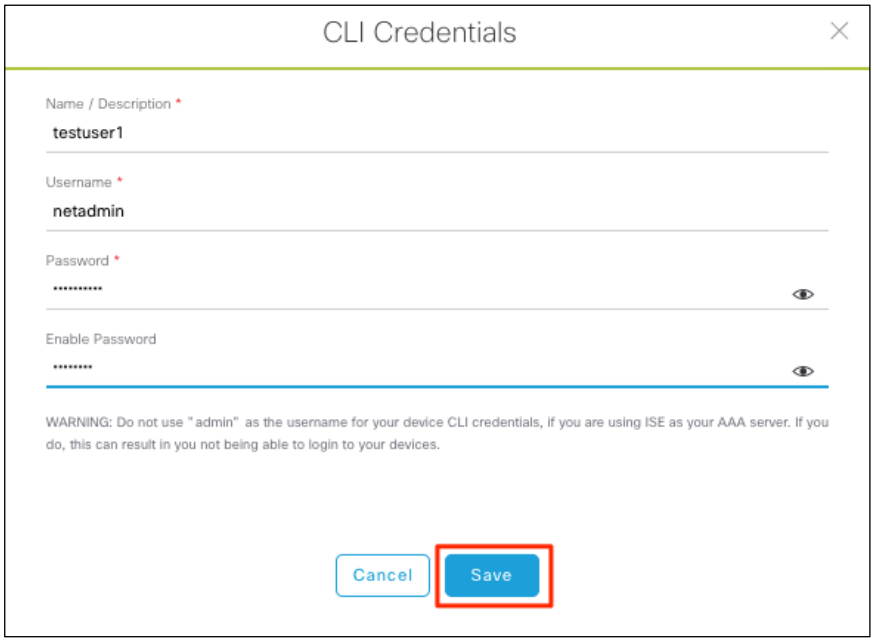
Figure 22 Device Credentials



2. In the **CLI Credentials** area, click **Add** and enter the following fields:

- **Name/Description** - Name or label that describes the CLI credentials.
- **Username** - Name that is used to login in via CLI to the devices in your network.
- **Password** - Password that is used to log in via CLI to the devices in your network. Passwords need to be re-entered for confirmation and are encrypted for security reasons.
- **Enable Password** - Password used to move to a privileged level.

Figure 23 CLI Credentials information



3. Click **Save**.

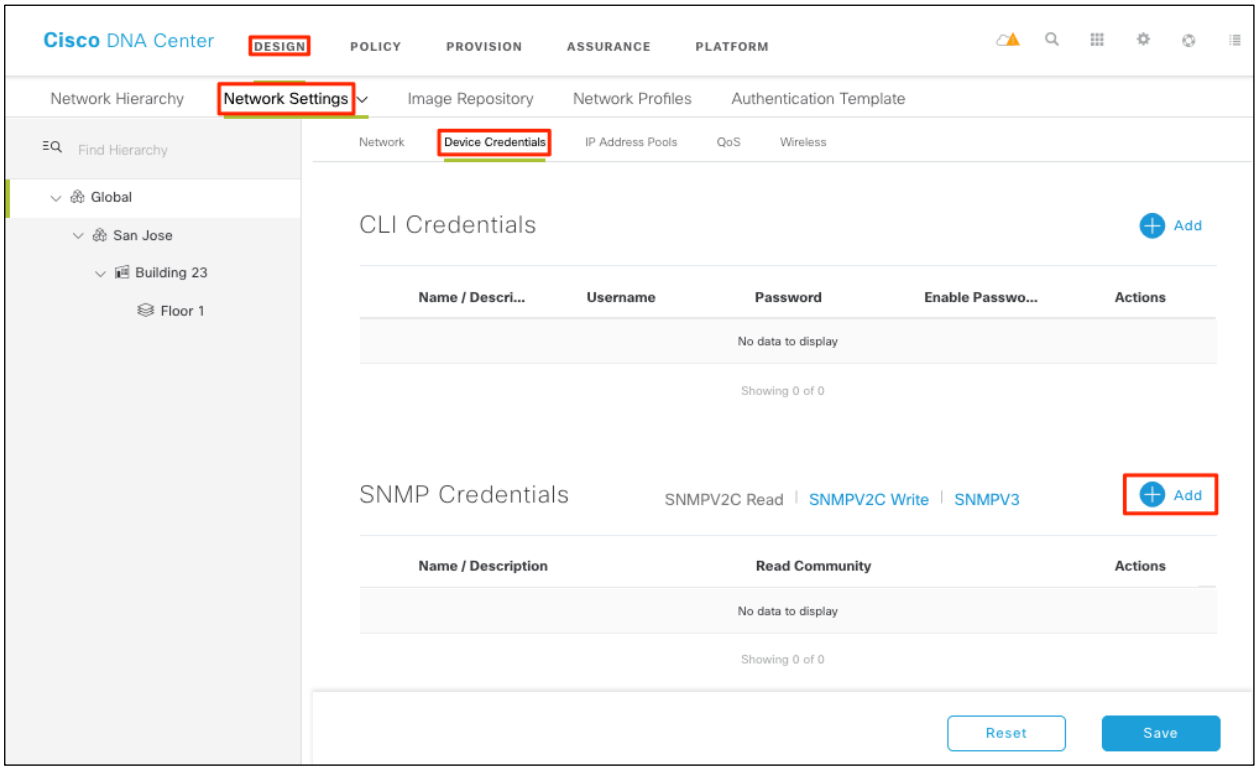
Procedure 2: SNMP v2c credentials

SNMP credentials are used to monitor and manage network devices. Follow the step below to create credentials for SNMP read and write communities.

Tech Tip: In this document we will be using SNMPv2c. SNMPv3 is also supported, and generally recommended.

4. Click on **Design > Network Setting > Device Credentials**

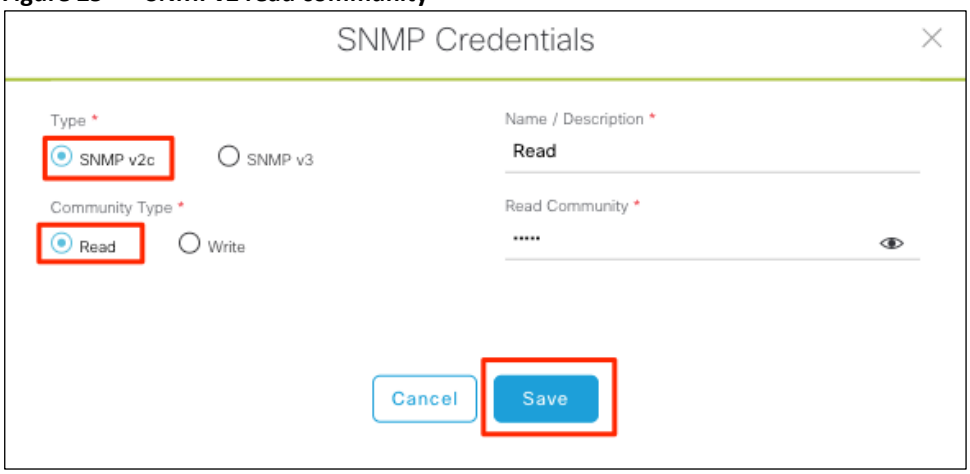
Figure 24 SNMP Credentials



In the **SNMP Credentials** area, click **Add**, as shown in **Figure 15** above.

5. Select **SNMPv2c** and select **Read**.

Figure 25 SNMPv2 read community



6. Enter the following information, as shown in **Figure 25** and click **Save**.

Read

- **Name / Description** - Name or description of the SNMPv2c settings that you are adding.
- **Read Community** - Read only community string password used to view SNMP information on devices.

7. Repeat Step 4 with the Write community and click Save.

Write

- **Name / Description** - Name or description of the SNMPv2c settings that you are adding.
- **Write Community** - Write community string password used to view and/or modify SNMP information on devices.

Now that the design phase is done, you can move on to deploying by discovering the networks.

Deploy the network

This section of the guide will focus on the following processes in order to get your network ready for Cisco DNA Assurance.

- Discover and manage the network devices – switches, routers, and wireless controllers (WLCs).
- Assign network devices to sites.
- Configure network devices for telemetry with Optimal Visibility within Cisco DNA Center.

Process: Discover and manage your network devices

This deployment guide uses IP address ranges for discovery of all network devices.

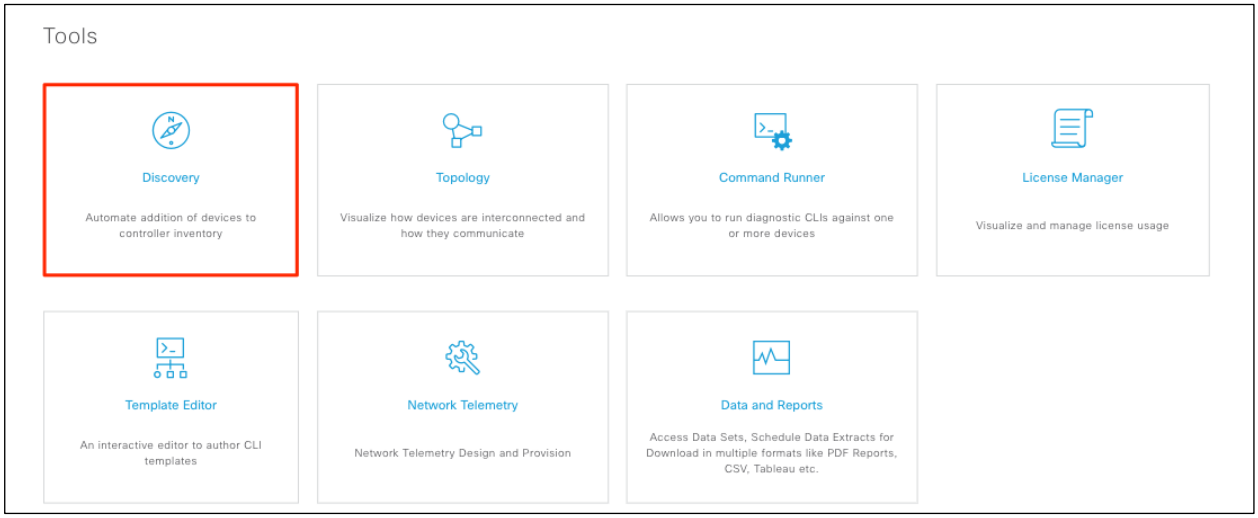
Tech Tip: Alternatively, you can supply an initial device for discovery and direct Cisco DNA Center to use Cisco Discovery Protocol (CDP) to find connected neighbors.

Procedure 1: Discovering your network

The Discovery feature scans the devices in you network and sends the list to the **Device Inventory** under the **Provision** tab.

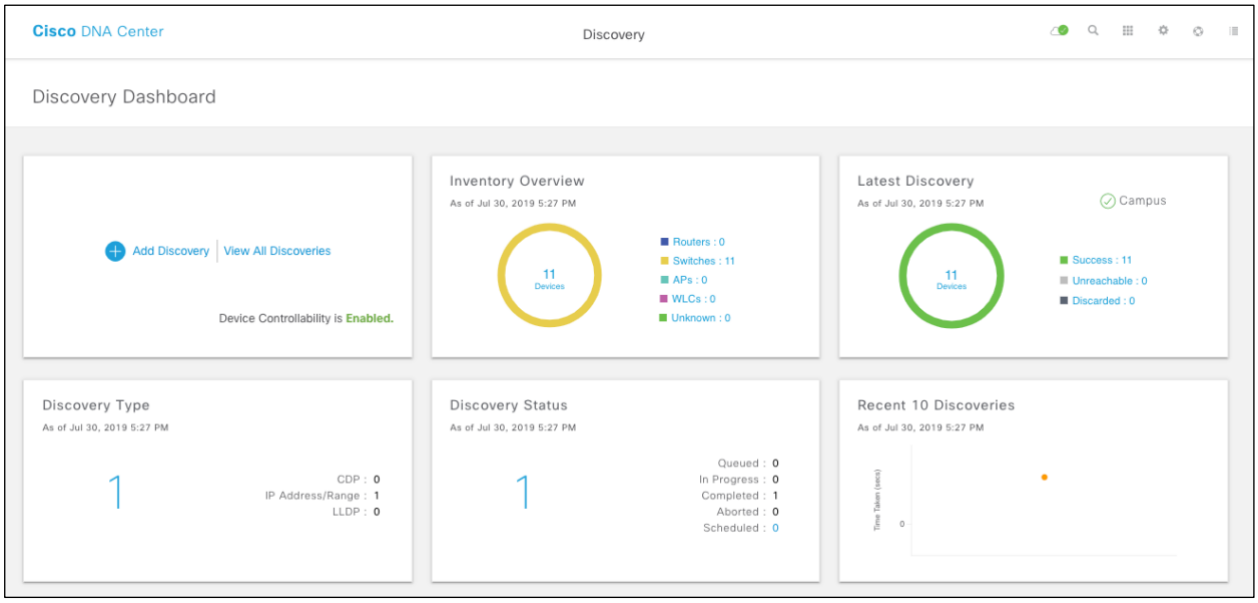
1. From Cisco DNA Center home screen, use the scroll bar and scroll to the **Tools** section and click on **Discovery**.

Figure 26 Discovery section under tools



This will take you to the **Discovery Dashboard**.

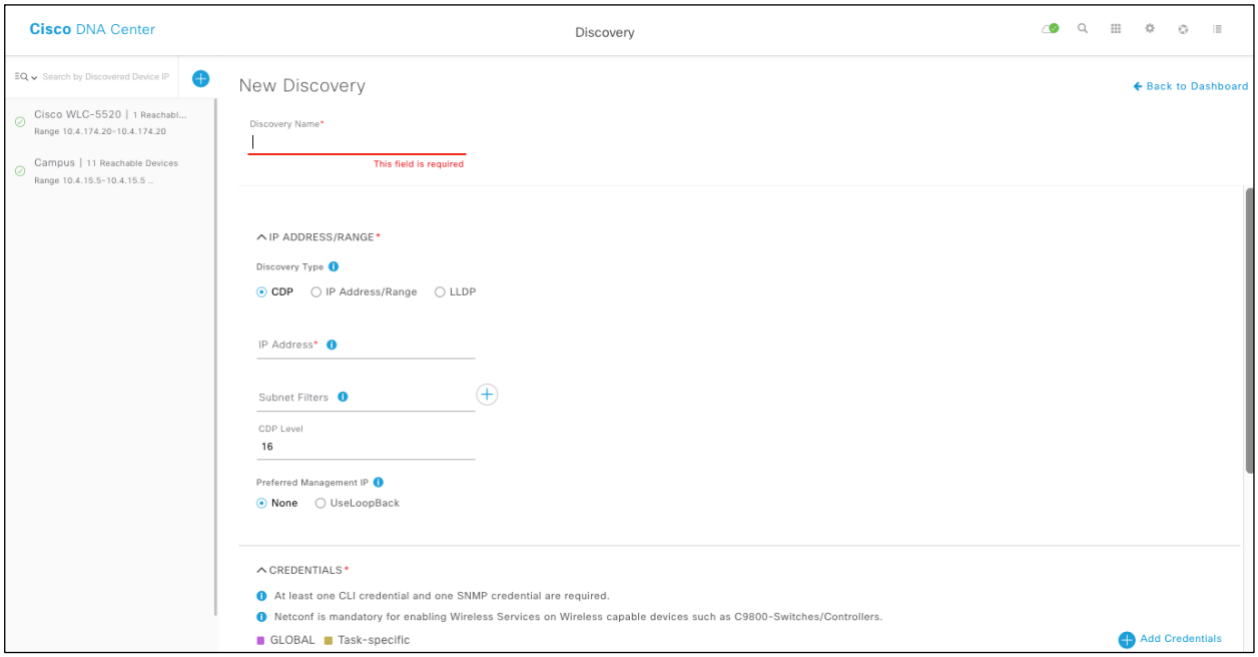
Figure 27 Discovery dashboard



2. Click on the **+ Add Discovery** widget to create a new discovery.

This will take you to the **New Discovery** dashboard.

Figure 28 New Discovery dashboard



3. Expand the **IP Address/Range** area if it is not already visible, and configure the following:

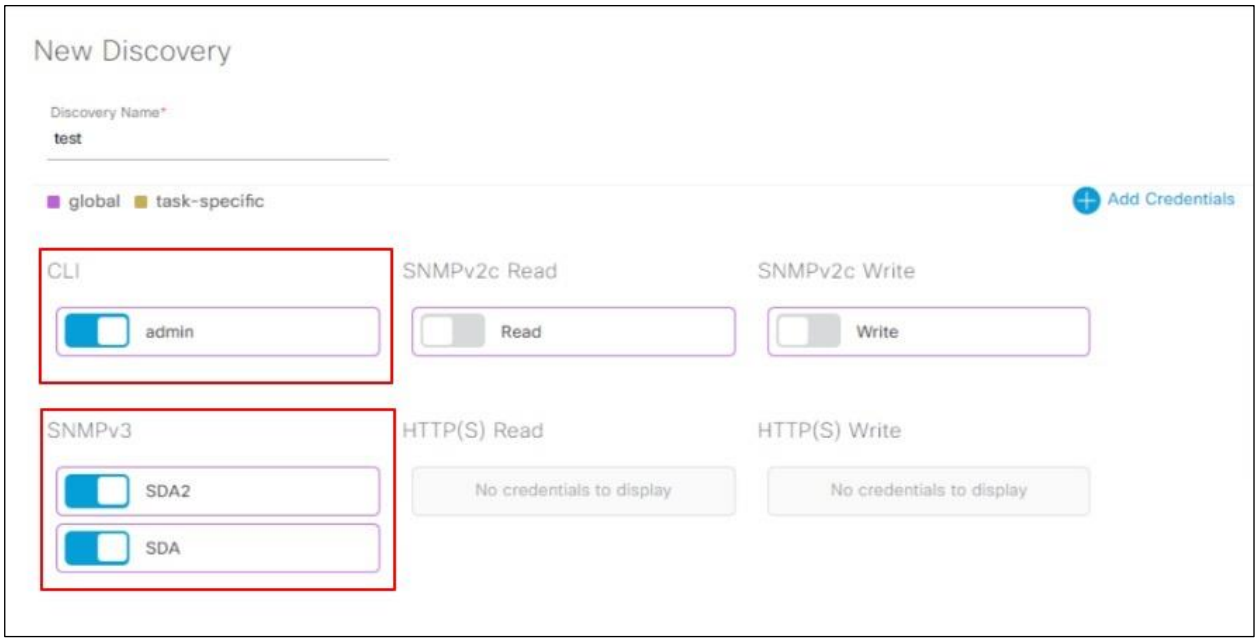
For **Discovery Type**, click **CDP** or **IP Address/Range**.

- If you select **CDP** In the **Discovery Type** field, enter a seed device that is using Cisco Discovery Protocol (CDP).
- If you select **IP Address/Range**, the fields will change allowing you to configure a range through a beginning IP address (**From**) and an ending IP address (**To**). You can enter a single IP address range or multiple ranges.

Tech Tip: It is recommended to use loopback for discovery but for Layer 2 access switches, the SVI interface can use for discovery.

4. Expand the **Credentials** area if not already visible and use the credentials that were created earlier in the design section of this guide. You can also create additional credentials here as well, if you need. Make sure that the toggle switches next to the credential fields are set to the **ON** position.

Figure 29 Credential fields for CLI and SNMP



5. Expand the **Advanced** section if not already visible

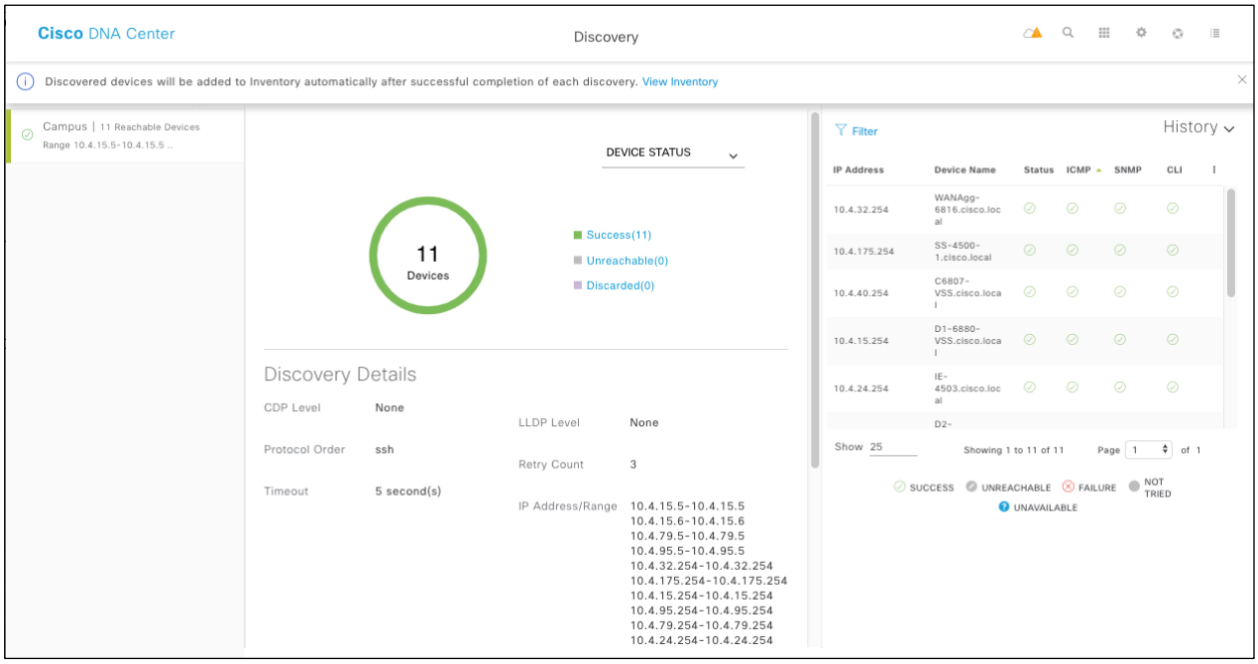
The SSH check mark should be check by default for increase security. This is recommended method for discovering of your network devices

6. Click on **Discover** at the bottom right corner start the discovery process.

Tech Tip: The time to discover your network devices varies depending on how large your network is.

The discovery details are displayed while the discovery runs. When the discovery has completed, it should appear as shown in the following figure.

Figure 30 Completed discovery

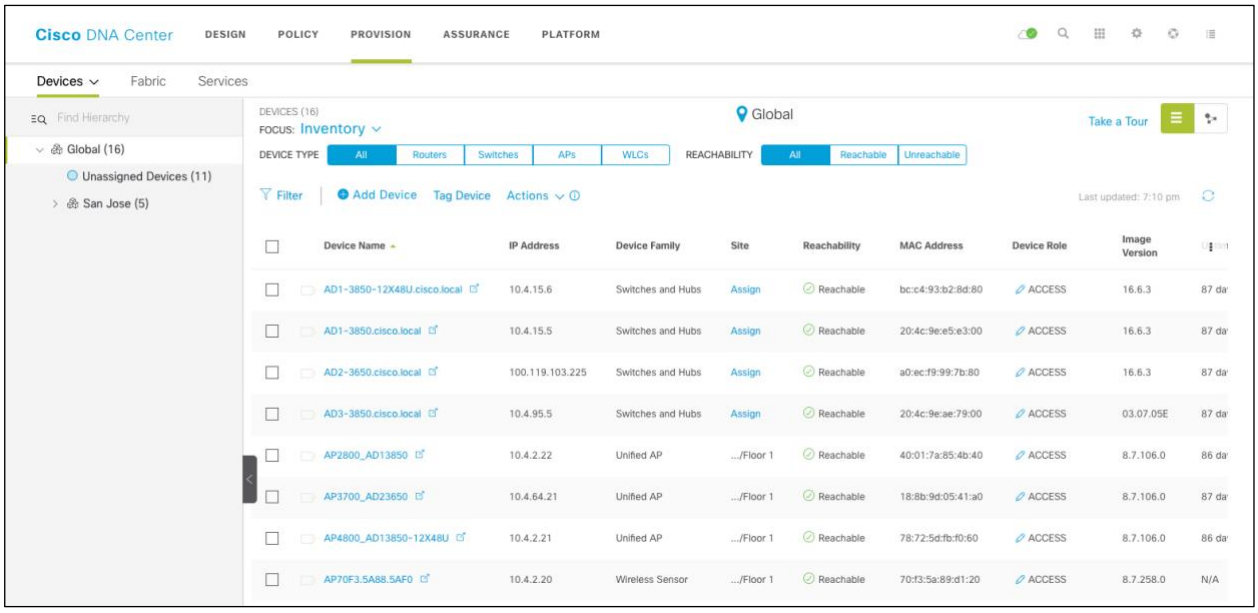


7. After the discovery process successfully finishes, navigate to the main Cisco DNA Center dashboard.

8. Navigate to **Provision** to display the inventory

This will display all the network devices that are known to Cisco DNA Center.

Figure 31 Cisco DNA Center inventory



Cisco DNA Center can access the devices, synchronize the inventory, and make configuration changes on the devices.

Process: Assign network devices to sites

Cisco DNA Assurance displays some information based on site. Therefore, you should assign the devices discovered in the previous process to sites (areas, buildings and floors) within the Cisco DNA Center site hierarchy created in the design section of this guide.

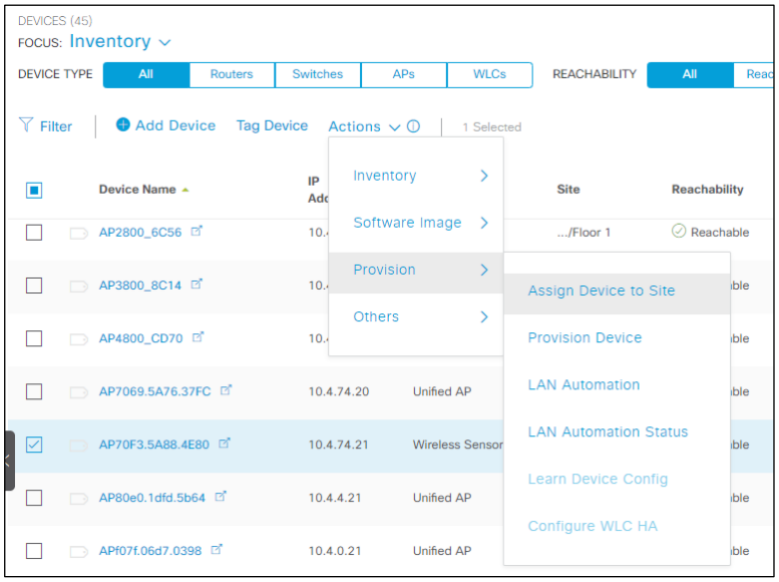
1. From the Cisco DNA Center home screen, navigate to **Provision** to display the inventory.

This will display all the network devices that are known to Cisco DNA Center. Any devices which are not assigned to a site will appear within the inventory table with the word "Assign" in blue under the **Site** column. See **Figure 31** above.

2. Select one of the network devices which is not currently assigned.

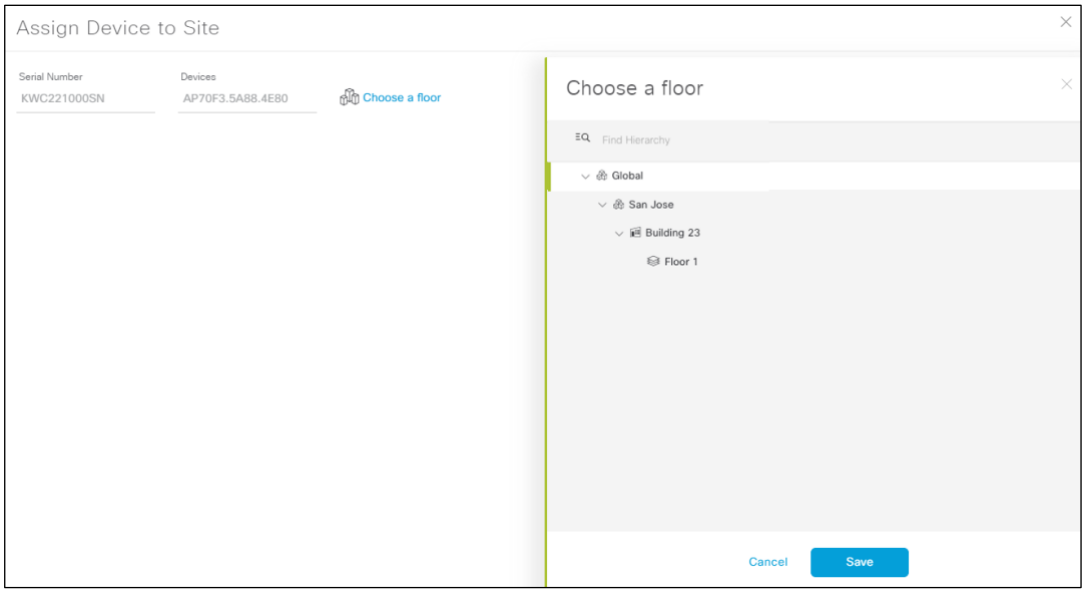
From the drop-down menu under **Actions** select **Provision > Assign Device to Site**

Figure 32 Assign a network device to a site



This will bring up the **Assign Device to Site** side panel.

Figure 33 Assign Device to Site side panel



3. Click the **Choose a floor** button.

This will bring up the **Choose a floor** side panel. See **Figure 33** above.

4. Expand the site hierarchy and select the area, building, or floor to which you wish to assign the network device.

5. Click **Save** to close the **Choose a floor** side panel.

6. Click **Assign** to assign the device to the site and close the **Assign Device to Site** side panel.

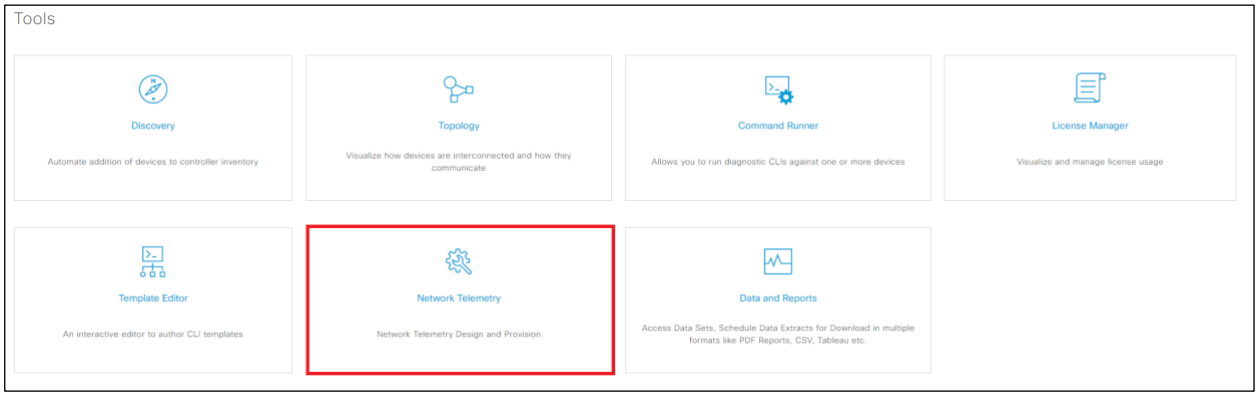
7. Repeat **Steps 1 – 8** for all other devices which are not currently assigned to a site.

Process: Configure network devices for telemetry with Optimal Visibility within Cisco DNA Center

You should verify that all network devices which you discovered are configured for telemetry with a minimum of optimal visibility within the Network Telemetry dashboard within Cisco DNA Center.

1. From the Cisco DNA Center home screen, use the scroll bar and scroll to the **Tools** section and click on **Network Telemetry**.

Figure 34 Network Telemetry section under tools

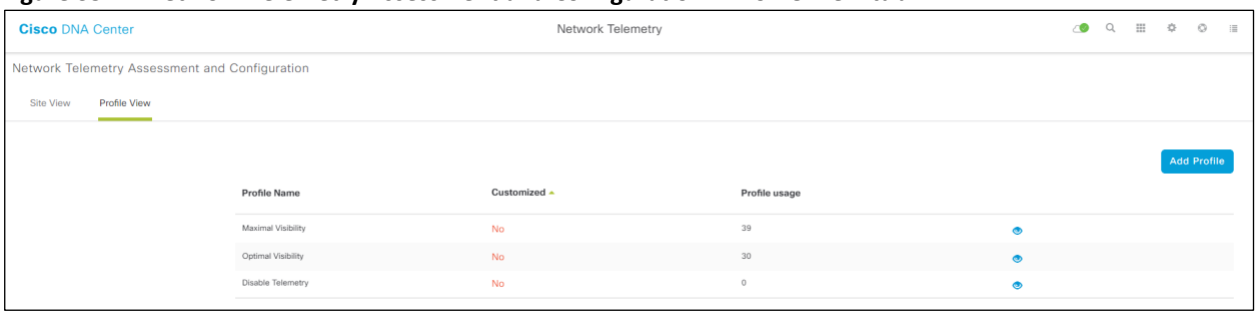


This will take you to the **Network Telemetry Assessment and Configuration** dashboard.

2. Click on the **Profile View** tab.

This will display the three pre-configured telemetry profiles which can be applied to network devices.

Figure 35 Network Telemetry Assessment and Configuration – Profile View tab



The three telemetry profiles are as follows:

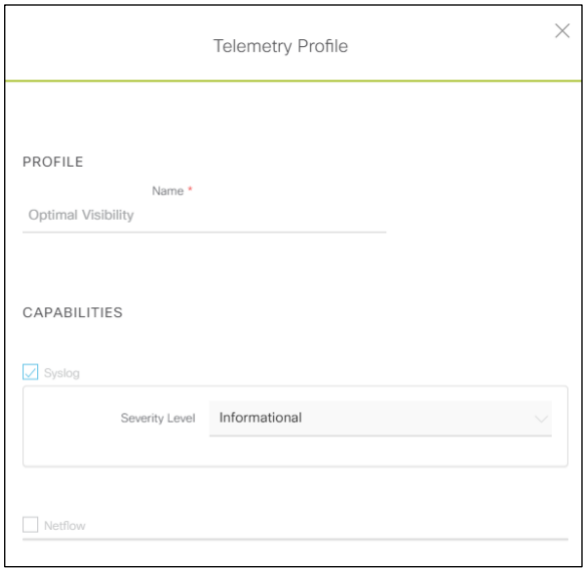
- **Maximal Telemetry** – This enables collection of telemetry information via Syslog (Severity Level – Informational) and via NetFlow / IPFIX (Cisco Performance Monitor (ezPM) Application Performance profile context) on the network device. This telemetry profile is only supported on router platforms running IOS XE 16.x and higher as of Cisco DNA Center release 1.3.0.
- **Optimal Visibility** - This enables collection of telemetry information via Syslog (Severity Level – Informational).
- **Disable Telemetry** – Neither Syslog or NetFlow / IPFIX collection of telemetry is enabled with this option.

You can create custom telemetry profiles by clicking on the **Add Profile** button at the top right corner of the screen. However, this is not needed for this design and deployment guide

3. Click the "eye" icon at the far right of any of the telemetry profiles.

This will bring up the details for the selected profile. See **Figure 36** for details on the **Optimal Visibility** profile.

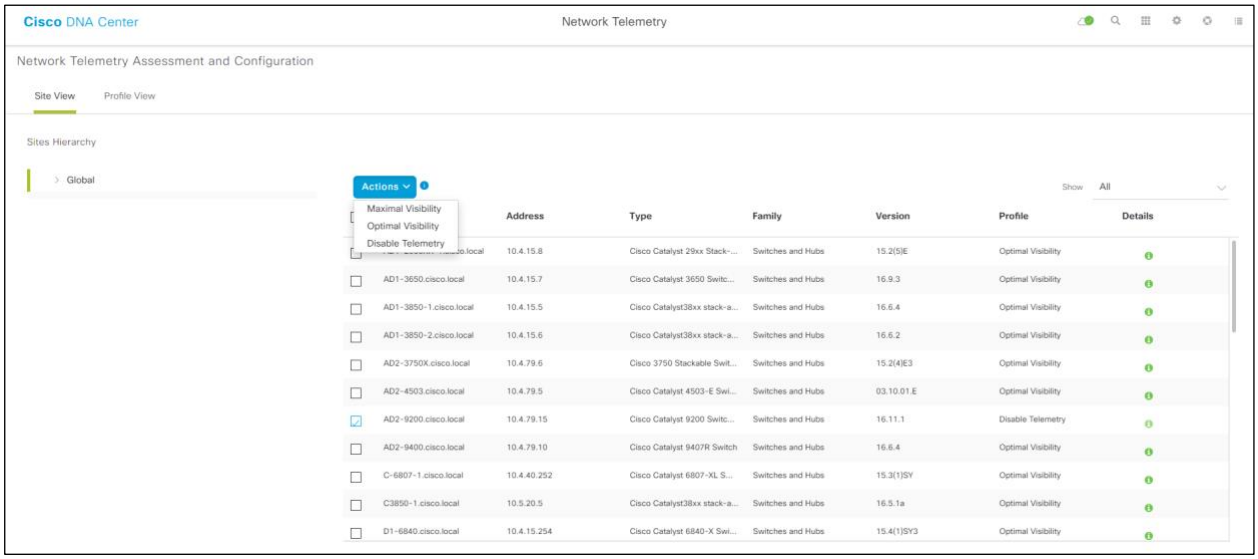
Figure 36 Optimal Visibility profile details



4. Click the **X** in the upper right corner to close the details pop-up window when you are done viewing the telemetry profile.
5. Within the **Network Telemetry Assessment and Configuration** dashboard click on the **Site View** tab.
6. Click **Global** in the navigation panel on the left to view all discovered devices.

The telemetry profile applied to each network device is listed under the **Profile** column.

Figure 37 Network Telemetry Assessment and Configuration – Site View tab



7. Select any network devices which have their telemetry profiles set for **Disable Telemetry**.

8. From the drop-down menu under **Actions**, select **Optimal Visibility**.

Under the **Profile** column, the entries for these network devices should change to **Optimal Visibility**. This enables basic telemetry collection on the network devices. Note that you don't need to change any devices already configured for **Maximal Visibility**.

Operate the network

This section of the design and deployment guide briefly discusses how Cisco DNA Assurance can be used to monitor and troubleshoot the network deployment. Cisco DNA Assurance provides the ability to monitor the health of Cisco switches, routers, WLCs, access points, and wireless clients.

A single use case – using Cisco DNA Network Assurance for visibility and troubleshooting RF issues on Access Points (APs), and Cisco DNA Client Assurance for monitoring wireless clients – is discussed in this section.

This section of the deployment guide assumes that telemetry with Optimal Visibility is enabled for the WLCs within the Telemetry section of Cisco DNA Center.

Use Case: Using Cisco DNA Network Assurance and Cisco DNA Client Assurance

This use case combines the use of Cisco DNA Network Assurance to gain visibility into the wireless infrastructure in order to assist in troubleshooting RF issues on Access Points (APs), with the use of Cisco DNA Client Assurance for monitoring wireless clients. Both combined provide a powerful tool for maintaining the health of your wireless network.

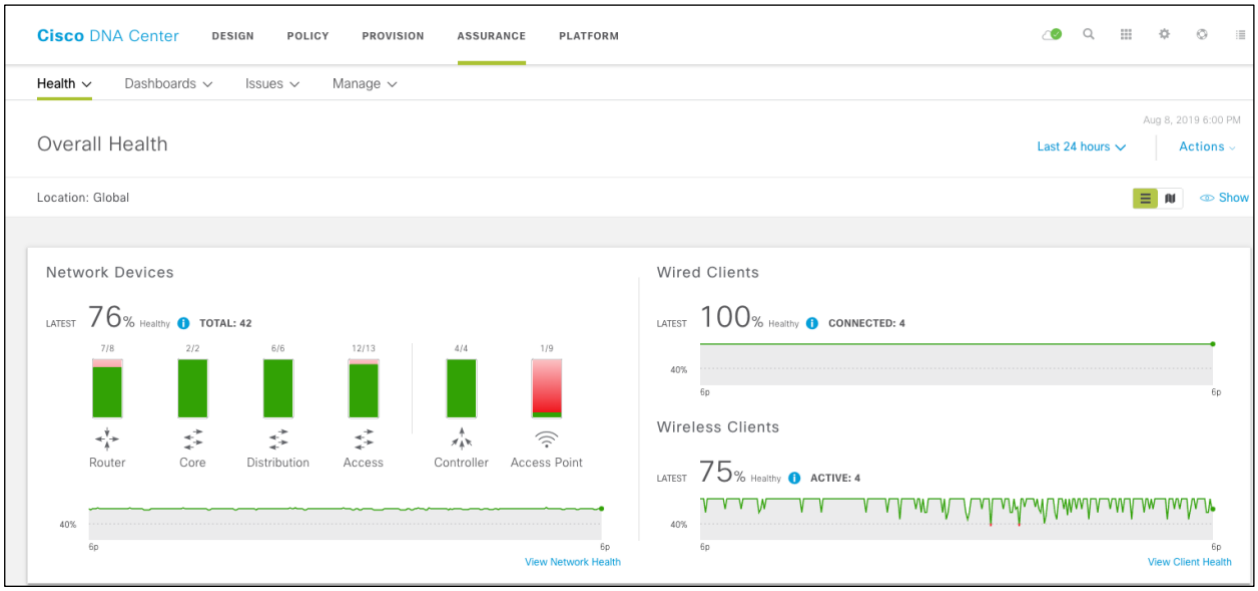
Procedure 1: Assurance home page

Tech Tip: The network administrator should see telemetry from their devices approximately 25 minutes from the time that the devices are added to the inventory and telemetry is enabled.

1. From the Cisco DNA Center home page, click on **Assurance** to bring up the **Assurance** dashboard.

The **Assurance** dashboard has four drop-down menus across the top of the page - **Health**, **Dashboards**, **Issues**, and **Manage**. By default, the **Assurance** dashboard displays the **Overall Health** page, which can be navigated to by clicking **Health > Overall**.

Figure 38 Assurance dashboard - Overall Health



The **Overall Health** page contains multiple panels.

The top panel displays aggregate health information for network devices and clients, in separate sections. Within each section, a percentage score (from 0% to 100%) of the health of all client or network devices over the most recent collection interval is provided. The timeline adjacent to the health score provides a visual record of the health of all client or network

devices over the specified time period. By default, the time period is set for the last 24 hours. This can be adjusted (Last 3 Hours, Last 24 Hours, or Last 7 Days) from the drop-down menu at the top of the **Overall Health** page.

Each section also provides a breakdown of the overall health score. For clients, the breakdown shows the health percentage of wired and wireless clients. This provides you with a quick visual indicator of whether any issues exist that affect the health of wired or wireless clients. Similarly, for the network, the breakdown shows the health percentage of core switches, access-layer switches, distribution-layer switches, routers, and wireless access points. Again, this provides you with a quick visual indicator of where any issues may exist which affect the health of different layers of the network infrastructure.

The **Top 10 Issues** panel displays the top 10 issues that must be addressed. The issue with the most recent timestamp is displayed first on the list.

The next procedure drills down into more detail around the information Cisco DNA Assurance provides around network health.

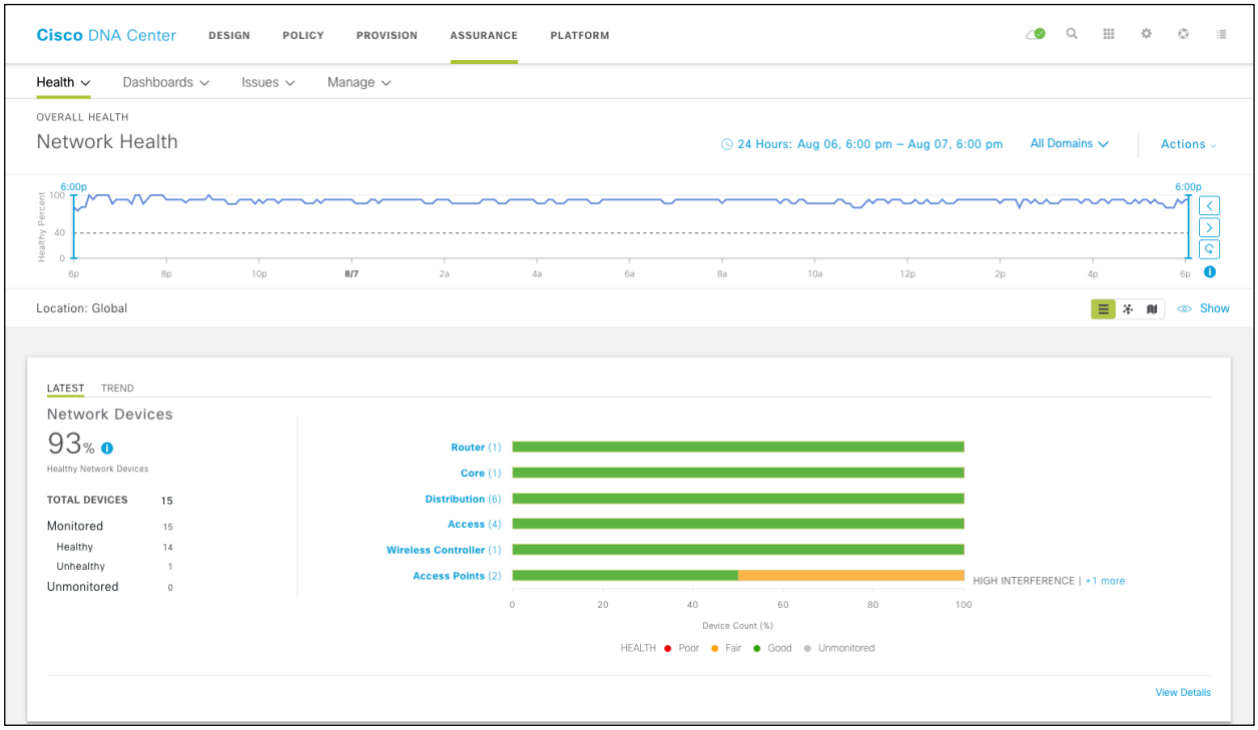
Procedure 2: Network Health

1. From Cisco DNA Center home page, click on **Assurance** to bring up the **Assurance** dashboard.

2. Click **Health > Network** to bring up the **Network Health** dashboard.

The **Network Health** dashboard has several panels, each of which will be discussed. The following figure shows an example of the first panel.

Figure 39 Network Health



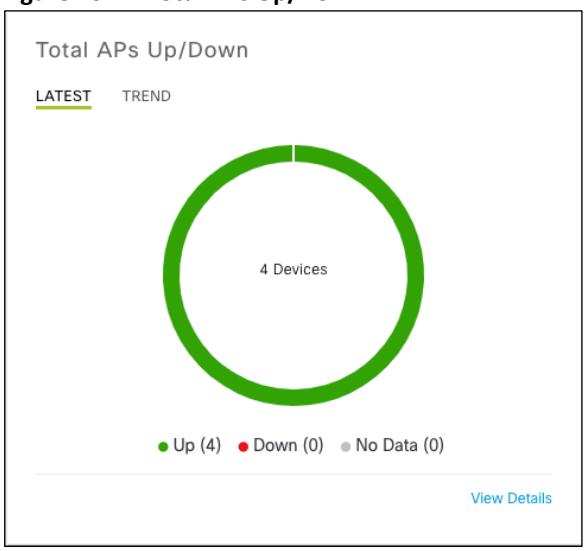
The timeline at the top of the dashboard controls the time period over which the remaining panels within the **Network Health** dashboard display data. By default, the time period is set for the last 24 hours. This can be adjusted (3 Hours, 24 Hours, or 7 Days) from the drop-down menu to the right above the timeline. The time period can be further adjusted by the sliders on the right side of the timeline.

The **Network Devices** panel shown in the figure above has two separate sections. The section on the left provides a percentage score of the health of all network devices for the latest collection interval – from 0% to 100%. The right panel

shows the current health score by device role (core switch, access-layer switch, distribution-layer switch, wireless access point, or router) in a bar graph.

The following figure shows an example of the next panel - **Total APs Up/Down**.

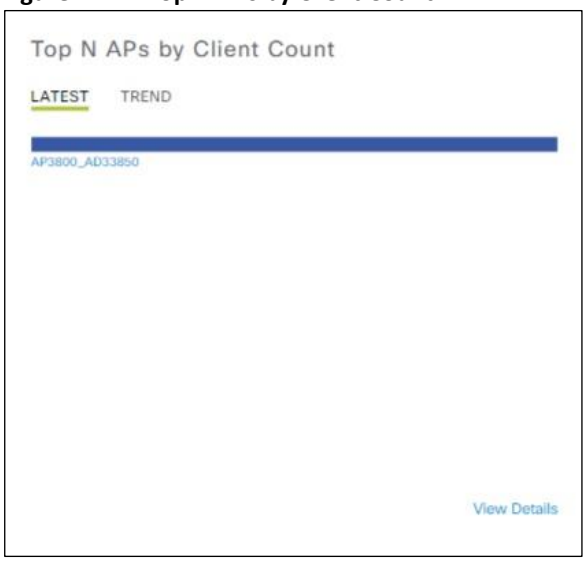
Figure 40 Total APs Up/Down



The **Total APs Up/Down** panel provides the network administrator with a history (**TREND** tab) of Access Points that were previously connected. The color-coded circle provides the status of the number of Access Points that are currently connected (**LATEST** tab) to the network (**Up**) not connected (**Down**).

The following figure show an example of the next panel - **Top N APs by client Count**.

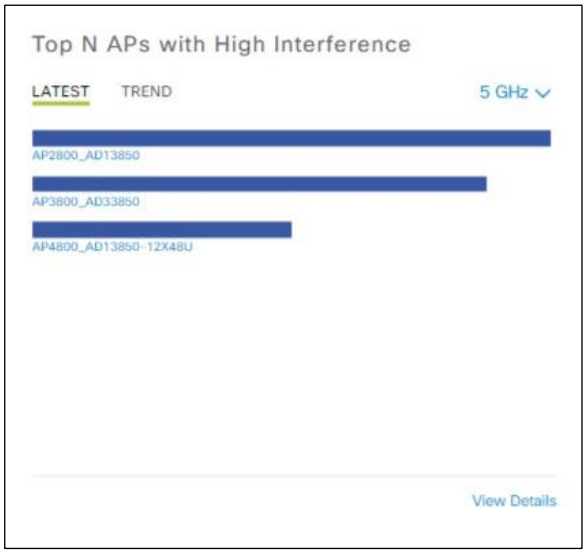
Figure 41 Top N APs by Client Count



The **Top APs by Client Count** panel provides the network administrator with information about Access Points with the highest number of clients. Again, the information can be displayed historically (**TREND** tab) or currently (**LATEST** tab).

The following figure show an example of the next panel - **Top N APs with High Interference**.

Figure 42 Top N APs with High Interference

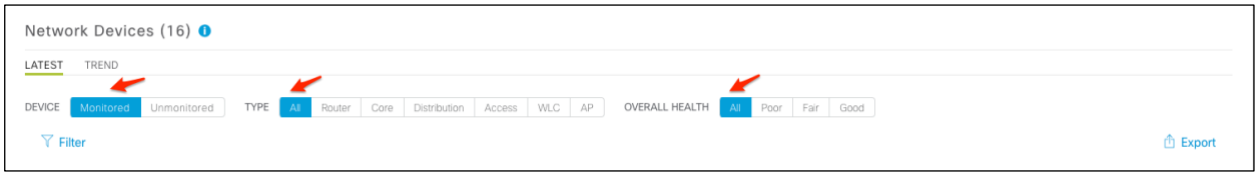


The **Top N APs with High Interference** panel provides information about Access Points with the highest RF interference. You can choose between the 2.4 GHz and 5 GHz RF bands. Again, the information can be displayed historically (**TREND** tab) or currently (**LATEST** tab).

The **Network Devices** panel is at the bottom of the **Network Assurance** dashboard. In order to view any information regarding network devices, the network administrator needs to first select the device type and health.

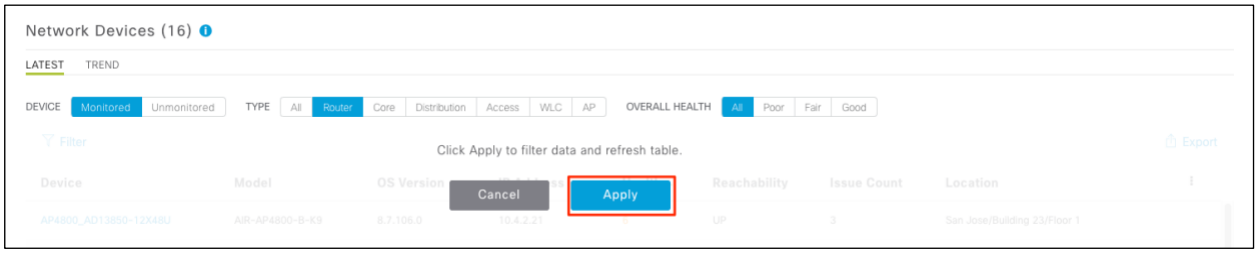
Click in one of the predefined filters for **Device**, **Type**, and **Overall Health**, as shown in the figure below.

Figure 43 Predefined filters for Device, Type, and Overall Health



3. Click **Apply** to set filter and display the information as shown in the figure below

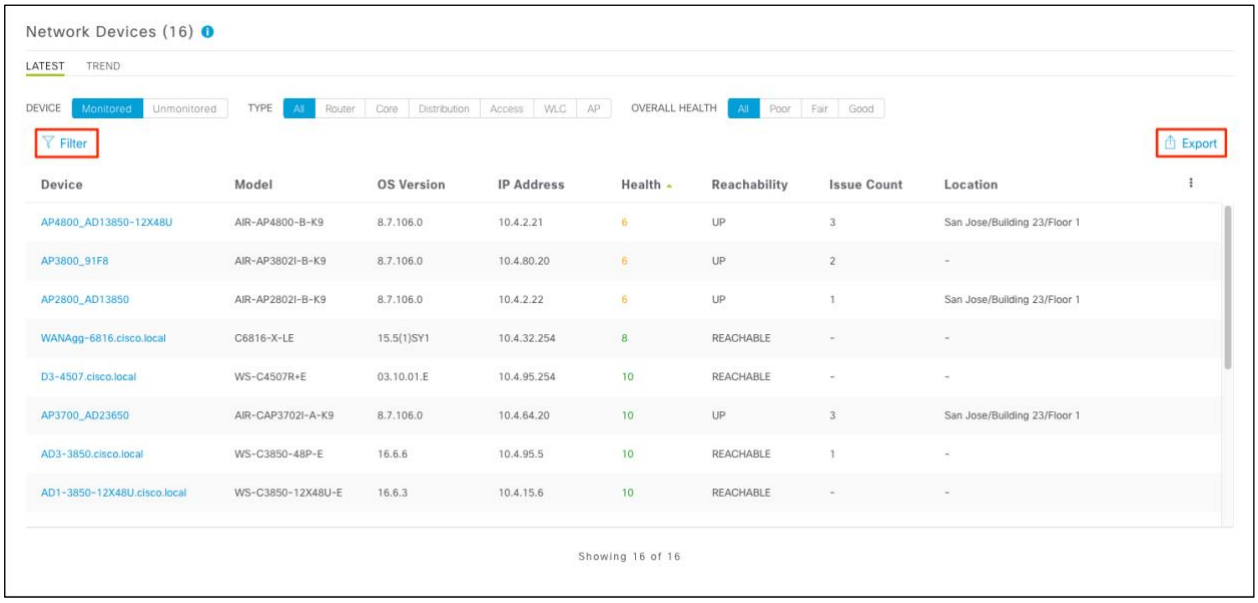
Figure 44 Apply filter



The **Network Devices** panel displays the overall health score of the network device. The panel also displays the number of issues associated with each network device, as well as the site location of the particular device. You can us this to identify issues associated with specific devices or sites quickly.

An example of the information is shown in the figure below.

Figure 45 Network devices



As discussed earlier, the network administrator can filter and even export the network device information by clicking on the **Export** button shown in the figure above.

The next procedure drills down into more detail around the information Assurance provides around client health.

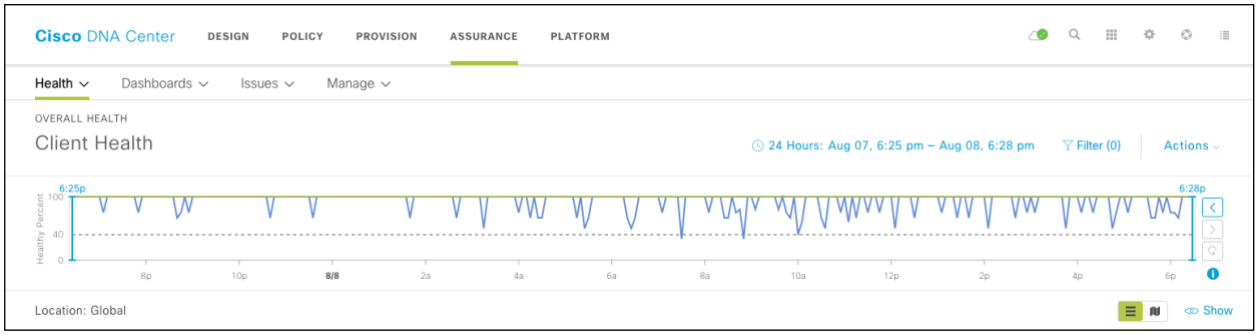
Procedure 3: Client Health

1. From Cisco DNA Center home page, click on **Assurance** to bring up the **Assurance** dashboard.

2. Click **Health > Client** to bring up the **Client Health** dashboard.

The **Client Health** dashboard has several panels, each of which will be discussed. The following figure shows and example of the top-panel.

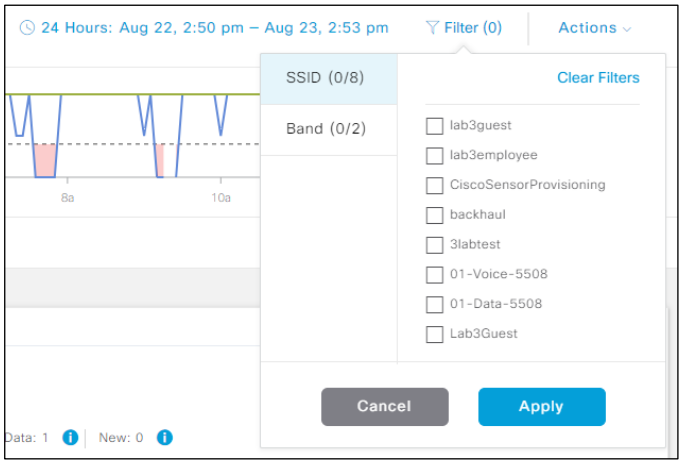
Figure 46 Client Health top-panel



The timeline at the top of the dashboard controls the time period over which the remaining panels within the **Client Health** dashboard display data for both wired and wireless clients. By default, the time period is set for the last 24 hours. This can be adjusted (3 Hours, 24 Hours, or 7 Days) from the drop-down menu to the right above the timeline. The time period can be further adjusted by the sliders at the bottom of the drop-down menu and on the side of the timeline.

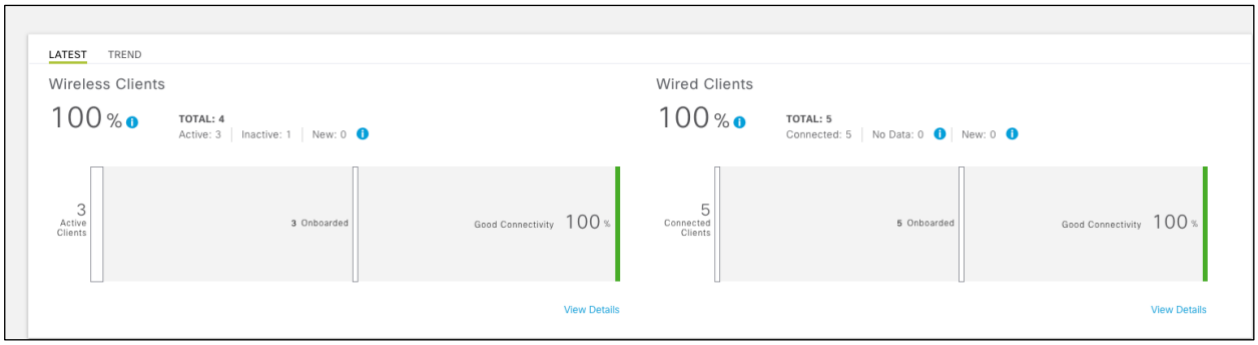
You can adjust the SSIDs and RF bands (2.4 GHz and 5 GHz) from which you want to receive wireless client information from the drop-down menu under **Filter**.

Figure 47 Filtering wireless client information



The next panel displays aggregate information for all clients. The panel breaks out the information between wireless and wired clients. This provides you with a quick visual indicator of whether any issues exist that affect the health of wired or wireless clients.

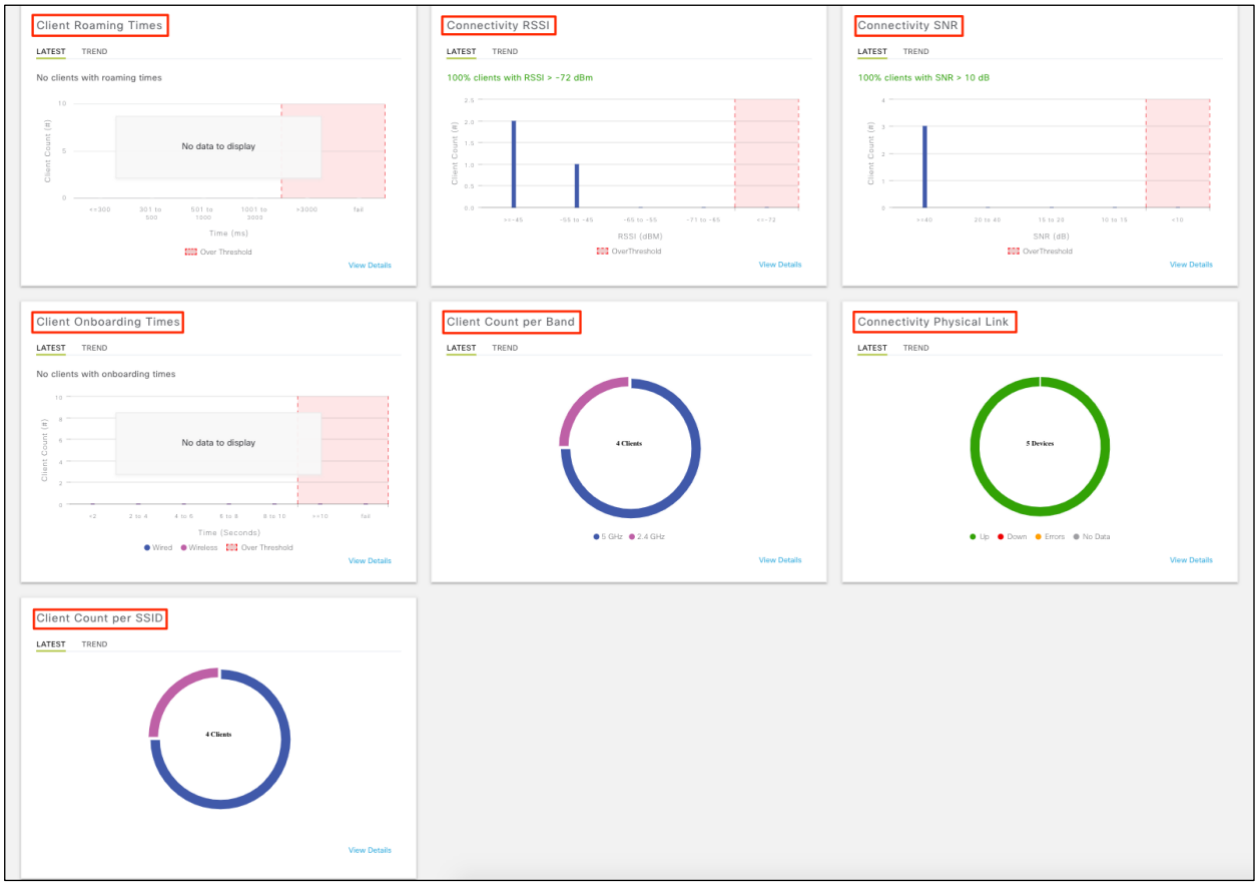
Figure 48 Client Health – second panel



Within the panel, a percentage score (from 0% to 100%) of the health of client devices over the last collection period is displayed by default (when the **LATEST** tab is selected). The collection interval for **LATEST** is set for every 5 minutes. The information can also be displayed historically by selecting the **TREND** tab.

The next panel is the **Client Health Analytic Chart**, as show in figure below.

Figure 49 Client Health Analytic Chart



The **Client Health Analytic Chart** consists of seven different panels. All of the panels display information over a default setting of the latest interval (5 minutes) through the **LATEST** tab. However, the information can also be displayed historically (24 hours) by selecting the **TREND** tab.

Each of the panels is briefly discussed below.

Client Roaming Times panel

The **Client Roaming Times** panel shows the distribution of wireless clients by roaming and failures. This panel provides the percentage of clients with roaming times less than 3000 milliseconds.

3. Click on **View Details** to bring up additional details regarding client roaming times.

An example of the detailed information provided for client roaming times is shown in the following figure.

Figure 50 Client roaming Times detail

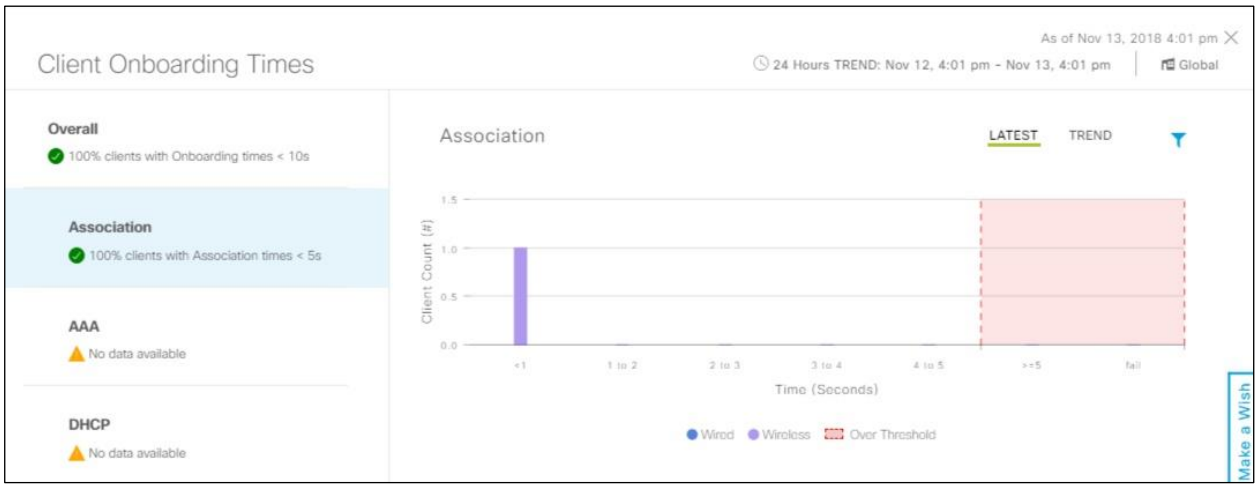
Client Onboarding Times panel

The **Client Onboarding Times** panel show a distribution of the overall time for attempts to onboard taken by clients over a displayed time interval. The default threshold for overall onboarding time is set for 10 seconds. Any onboarding times greater than 10 seconds appear within the red shaded area of the graph.

4. Click **View Details** to bring up additional details regarding client onboarding times

An example of the detailed information provided for client onboarding time is shown in the following figure.

Figure 51 Client Onboarding Times detail



In the details screen, the time required to associate with an Access Point (wireless clients only), the time required for AAA authentication/authorization to the network, and the time required to receive a DHCP address can each be displayed separately. Individual information regarding specific clients can be displayed by selecting the appropriate filters at the bottom of the details screen.

High onboarding times can negatively influence your end-user's perception of the overall network and decrease productivity within your organization. The ability to break out the individual components of onboarding time provides you with valuable information in troubleshooting the issue. For example, high association time may indicate one or more Access Points with high CPU utilization, or simply too many wireless clients already associated. High AAA authentication/authorization times could be indicative of your AAA server(s) being overrun with requests/responses, a possible failure of the primary AAA server in a redundant deployment, or possibly simply poor placement of the AAA server(s) - in the case where the AAA server(s) is remote from the location of where the clients are onboarding to the network. High DHCP times can also be the result of your DHCP server being overrun with requests/responses, or again poor placement of the DHCP server - in the case where the DHCP request is being relayed to a DHCP server which is remote from the location where the clients are onboarding to the network.

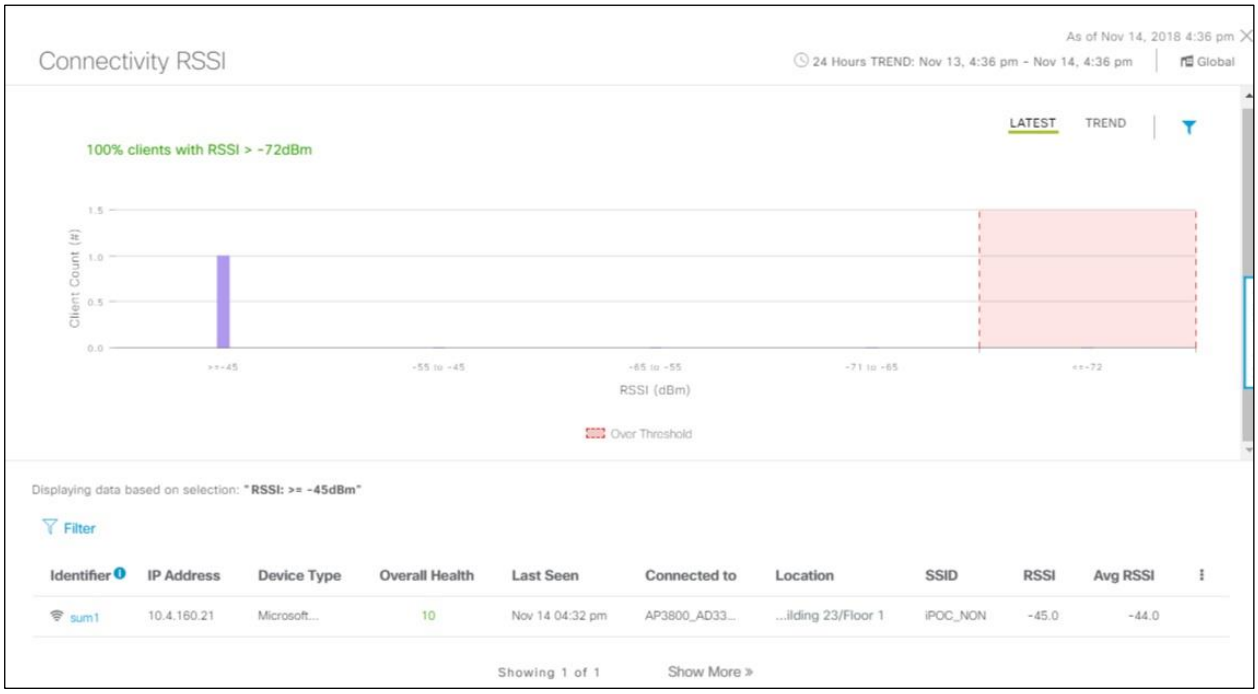
Connectivity RSSI panel

The **Connectivity RSSI** panel shows a Received Signal Strength Indication (RSSI) distribution for all wireless clients, as **LATEST** and **TREND** with **LATEST** as the default setting. The default threshold for RSSI is set for -72 dBm seconds. Any RSSI less than -72 dBm appears within the red shaded area of the graph.

5. Click **View Details** to bring up additional details regarding client RSSI

An example of the detailed information provided from client RSSI is show in the following figure.

Figure 52 Client RSSI details



In this screen, client information is displayed by clicking on the bar graph. Received signal strength is a factor in determining the rate at which a client can transmit and receive frames over a wireless network. RSSI values may help you in troubleshooting potential performance problems within the wireless network. Low RSSI values may be the result of possible wireless coverage issues within your deployment.

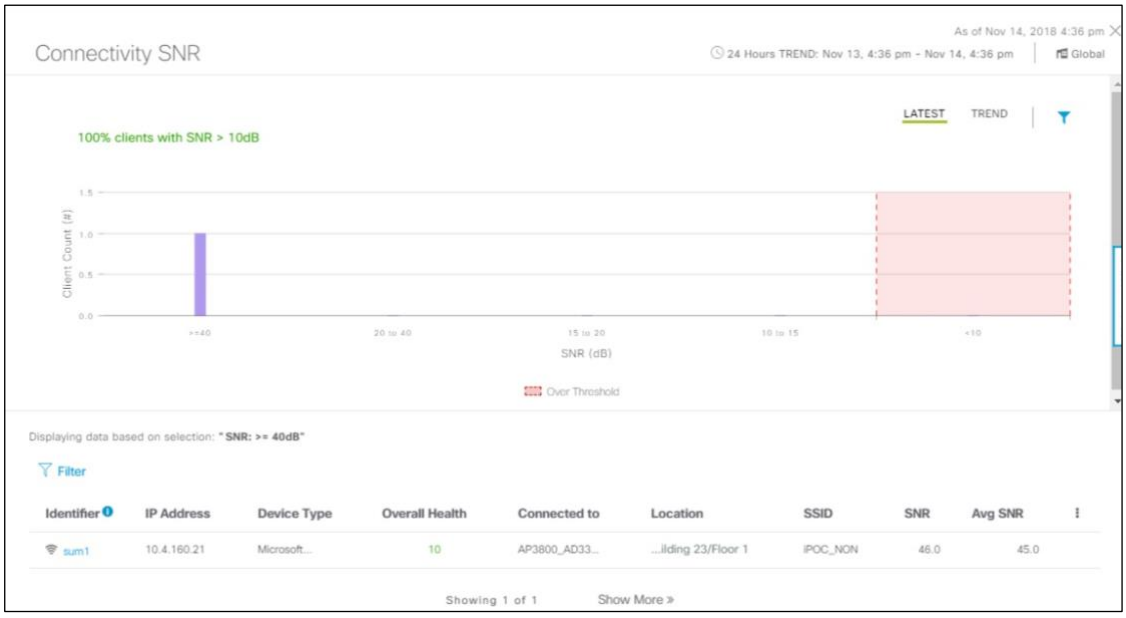
Connectivity SNR panel

The **Connectivity SNR** panel shows the Signal to Noise Ratio (SNR) distribution for all wireless clients, as **LATEST** and **TREND** with **LATEST** as the default setting. The default threshold for SNR is set for 10. Any SNR less than 10 appears within the red shaded area of the graph.

6. Click **View Details** to bring up additional details regarding client SNR.

An example of the detail information provides for client SNR is shown in the following figure.

Figure 53 Client SNR details



In this screen, client information is displayed by clicking on the bar graph.

SNR is also factor in determining the rate at which a client can transmit and receive frames over a wireless network - generally with higher SNRs resulting in higher transmission rates for a given wireless client. Therefore, SNR values may also help you in troubleshooting potential performance problems within the wireless network. Low SNR values may be the result of possible wireless coverage issues within your deployment, or the result of certain types of wireless interference that increases the 'noise' of the wireless network.

Client Count per SSID panel

The Client Count per SSID panel shows the number of clients associated with each SSID, as **LATEST** and **TREND** with **LATEST** as the default setting. Information is displayed in a circular graph - visually showing the distribution of wireless clients per SSID. Clicking the **View Details** link brings up additional information. Again, specific client information can be displayed by selecting the appropriate filters at the bottom of the details screen.

It should be noted that client count per SSID does not display client count per Access Point, unless there is a single Access Point for the given SSID. However, with some knowledge of the number Access Points for a given SSID, you may still be able to gain some insight into possible SSIDs where the number of clients per Access Point may be resulting in decreasing performance of the wireless infrastructure at given points in time.

Client Count per Band panel

The **Client Count per Band** panel shows the number of clients associated with each radio frequency (RF) band (2.4 GHz or 5 GHz), as **LATEST** and **TREND** with **LATEST** as the default setting. Information is displayed in a circular graph - visually showing the distribution of wireless clients per RF band. Clicking the **View Details** link brings up additional information. Again, specific client information can be displayed by selecting the appropriate filters at the bottom of the details screen.

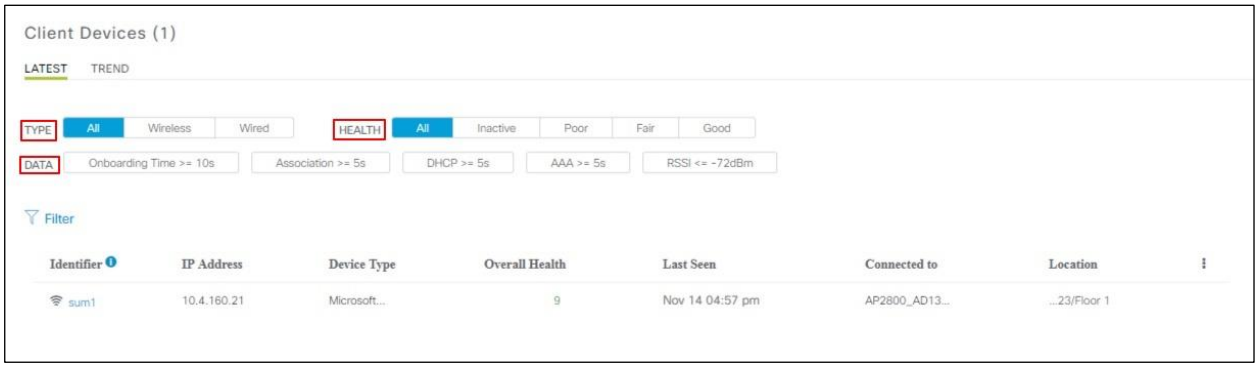
It should be noted that client count per band does not display client count per Access Point, unless there is a single Access Point for the given band. It should also be noted that 802.11ac does not operate in the 2.4 GHz band. However, 802.11n can operate in both the 2.4 GHz and 5 GHz bands. Many wireless clients can be set up to connect in either the 2.4 GHz and 5 GHz bands, with a preference for one band over the other. Information regarding the number of clients per band can be used to quickly assess whether your end-users are connecting to your wireless network using the 2.4 GHz or 5 GHz bands. Generally, due to the lower number of overlapping channels in the 2.4 GHz band, the 5 GHz band is often preferred. Finally, if you are migrating to 802.11ac and are interested in determining if there are any wireless clients on your network that don't support 802.11ac, you may be able to gain some insights based on the number of clients connecting to the 2.4 GHz band.

Connectivity Physical Link panel

The **Connectivity Physical Link** panel shows the aggregate number of wired client devices with link state of up, down, or with link errors - as **LATEST** and **TREND** with **LATEST** as the default setting. Clicking the **View Details** link brings up additional information. Again, specific client information can be displayed by selecting the appropriate filters at the bottom of the details screen. This information includes the network device to which a given wired client is connected, the location of the wired client, and the VLAN to which the wired client is connected. This information may be used to quickly identify and troubleshoot issues with access-layer switches within the network.

The final panel in the **Client Health** dashboard is the **Client Devices** panel. An example is shown in the figure below.

Figure 54 Clients Devices panel



The **Client Devices** panel provides the similar client specific information to what was discussed when clicking on the **View Details** links within the individual panels of the **Client Health Analytic Chart**. Individual information regarding specific clients can be displayed by selecting the following filters.

Client **TYPE** gives you the choice of displaying information for all clients, only wireless clients, or only wired clients.

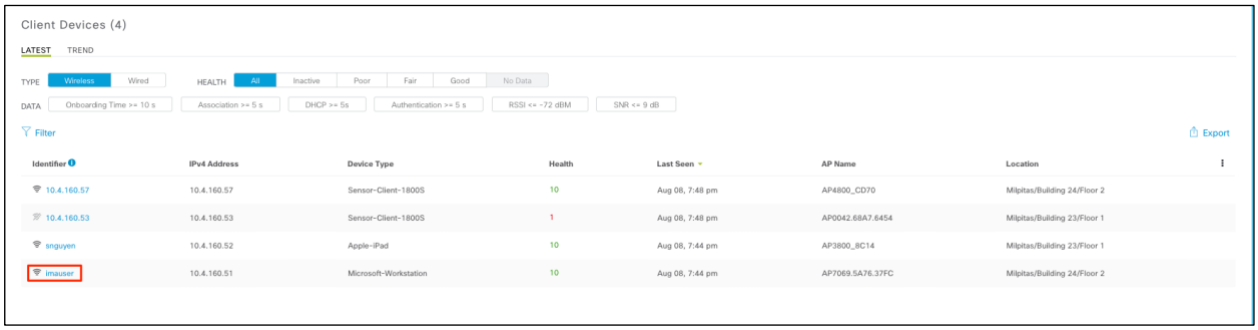
HEALTH gives you the choice of displaying information for clients with a given health score. The choices are to display clients with all (any) health score, clients which are inactive (no health score), or clients with poor, fair, or good health scores.

DATA gives you the choice of narrowing the client information down to look at specific issues. The choices are to display clients with onboarding times greater than 10 seconds, wireless association times greater than five seconds, DHCP times greater than five second, AAA times greater than 5 seconds, or RSSI values less than -72 dBm.

7. Click on the userid under the Identifier column of a client to get more detail about that client.

The administrator can view in-depth detail about specific clients by clicking on the userid of the client within the displayed list, as shown in the figure below.

Figure 55 Client in depth view



This design and deployment guide has only briefly touched upon how to enable Cisco DNA Assurance on your network; and the benefits you get doing so. Additional design and deployment guides will further discuss specific features of Cisco DNA Assurance, and the benefits of those features.

Appendix A — Product list

This design & deployment guide was created using the following hardware and software.

Table 3 Hardware and software

Functional area	Product	Software version
Enterprise SDN Controller	Cisco DNA Center running Cisco DNA Assurance	1.3.0
LAN Access Layer		
Modular Access Layer	Cisco Catalyst 4500E Series 4507R+E 7 Slot Chasis with 48Gbps per slot	03.10.01
	Cisco Catalyst 4500E Supervisor Enigine 8-E Unified Access, 928 Gbps	
	Cisco Catalyst 9400R Series 7 Slot Chasis	16.06.03
	Cisco Catalyst 9400R Supervisor 1	-
Stackable Access Layer Switches	Cisco Catalyst 9300 Series	16.06.03
	Cisco Catalyst 3850 Series	16.06.03
	Cisco Catalyst 3650 Series	16.06.03
LAN Distribution Layer		
Extensible Fixed Distribution Layer	Cisco Catalyst 6800 Series 6880-X	15.4(1)
Modular Distribution Layer Virtual Switch	Cisco Catalyst 4500E Series 4507R+E 7 Slot Chasis with 48Gbps per slot	03.10.01
	Cisco Catalyst 4500E Supervisor Enigine 8-E Unified Access, 928 Gbps	-
Fixed Distribution Layer Virtual Switch	Cisco Catalyst 4500-X	03.10.01
Stackable Distribution Switch	Cisco Catalyst 3850 Series	16.06.03
Core Layer		
Modular Core Layer Virtual Switch	Cisco Catalyst 6800 Series 6807-XL 7 Slot	155-1.SY1

The list in the Table 3 is used to validated in this doc. The following link list a complete hardware and software that is compatible with Cisco DNA Center: https://www.cisco.com/c/en/us/support/cloud-systems-management/dna-center/products-device-support-tables-list.html

Appendix C—Glossary

AAA Authentication, Authorization, and Accounting

AP Access Point

Cisco ISE Cisco Identity Service Engine

CDP Cisco Discovery Protocol

DHCP Dynamic Host Configuration Protocol

ezPM Cisco Easy Performance Monitor

IPFIX IP Flow Information Export

L2 Layer 2

RF Radio Frequency

RSSI Received Signal Strength Indication

SNR Signal to Noise Ratio

SSID Service Set Identifier

SVI Switched Virtual Interface

VLAN Virtual Local Area Network

WLAN Wireless Local Area Network

WLC Wireless LAN Controller

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