Cambium Networks™

cnMaestro Cloud 5.0.1

USER GUIDE

Copyrights

This document, Cambium products, and 3rd Party software products described in this document may include or describe copyrighted Cambium and other 3rd Party supplied computer programs stored in semiconductor memories or other media. Laws in the United States and other countries preserve for Cambium, its licensors, and other 3rd Party supplied software certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Cambium, its licensors, or the 3rd Party software supplied material contained in the Cambium products described in this document may not be copied, reproduced, reverse engineered, distributed, merged or modified in any manner without the express written permission of Cambium. Furthermore, the purchase of Cambium products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Cambium or other 3rd Party supplied software, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

Restrictions

Software and documentation are copyrighted materials. Making unauthorized copies is prohibited by law. No part of the software or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Cambium.

License Agreements

The software described in this document is the property of Cambium and its licensors. It is furnished by express license agreement only and may be used only in accordance with the terms of such an agreement.

Contents

Introduction

cnMaestro is Cambium Networks next-generation network management platform. It is available in two versions: **cnMaestro Essentials** and **cnMaestro X**.

- cnMaestro Essentials is free and provides basic network management support for Cambium Networks devices.
- cnMaestro X is a paid service that includes advanced features such as long-term statistics.
- Both versions are available in cloud and on-premises deployments.

This section covers the following topics:

Supported Devices and Features

Devices and minimum software versions

The following table lists the device model and the minimum software version supported by cnMaestro (not the recommended software version).

Table 1: Supported devices and minimum software versions

Device	Minimum Software Version
60 GHz cnWave V1000	1.1
60 GHz cnWave V2000	1.2.2
60 GHz cnWave V3000	1.1
60 GHz cnWave V5000	1.1
cnMatrix	2.0.4-r1
cnPilot e400/e500	3.2.1-r6
cnPilot e425H/e505	4.0
cnPilot e430W/e410/e600	3.5.2-r4
cnPilot e501S	3.2.1-r6
cnPilot e502S	3.2.1-r6
cnPilot e510	3.11.4-r9

Table 1: Supported devices and minimum software versions

Device	Minimum Software Version
cnPilot e700	3.7-r9
cnPilot r190	4.4.2-R2
cnPilot r195P	4.7
cnPilot r195W	4.5.2
cnPilot r200/r201	4.4.2-R2
cnRanger Sierra 800	1.0.1.0-r1
cnRanger Tyndall 101	1.0.1.0-r1
cnRanger Tyndall 201	2.0-r1
cnReach N500	5.2.17e
cnVision Client	4.6
cnVision Hub	4.6
cnWave 5G Fixed B1000	2.0
cnWave 5G Fixed C100	2.0
ePMP 1000	2.6.2
ePMP 1000 Hotspot	3.2.1-r6
ePMP 2000	3.0.1
ePMP 3000	4.4.1
ePMP 4600	5.4.0
ePMP4600L	5.4.0
ePMP Elevate	3.2
ePMP Elevate SXGLIT5/LHG5	4.3.2.1
ePMP Elevate XM/XW	3.2
ePMP Force 130 2.4 GHz	4.4
ePMP Force 130 5 GHz	4.3.2

Table 1: Supported devices and minimum software versions

Device	Minimum Software Version
ePMP Force 180/200	2.6.2
ePMP Force 190	3.5
ePMP Force 200L	4.7.0
ePMP Force 300	4.1
ePMP Force 300-13	4.4
ePMP Force 300-13L	4.5.2
ePMP Force 300-13LC	4.6
ePMP Force 300-19	4.4
ePMP Force 300-19R	4.4
ePMP Force 300-22L	4.6
ePMP Force 300-25L	4.6
ePMP Force 300 CSM	4.3.2
ePMP Force 400	5.1.0.18
ePMP Force 425	5.1.0.18
ePMP Force 4500	5.4.0
ePMP Force 4525	5.4.0
ePMP Force 4600C	5.4.0
ePMP Force 4625	5.4.0
ePMP MP 3000	4.5
ePMP PTP 550	4.1
ePMP PTP 550E	4.4.2
Machfu	7.1.2-1.1.0.5
NSE 3000	1.0
PMP	15.0.1
PMP 450 MicroPoP Omni	16.2.1

Table 1: Supported devices and minimum software versions

Device	Minimum Software Version
PMP 450 MicroPoP Sector	16.2.1
PMP 450b Retro	16.2.2
PMP 450v	23.0
PTP 650	01-47
PTP 670 (650 Emulation)	01-47
PTP 670, PTP 700	02-67
PTP 820, PTP 850	11.9
XE3-4	6.4
XE3-4TN	6.5.1
XE5-8	6.4.1
XV2-2	6.1
XV2-2T0	6.4
XV2-2T1	6.4.1
XV2-22H	6.5
XV2-21X	6.5
XV2-23T	6.5
XV3-8	6.0
PON	1.1.0
RV22 Home Mesh Router	1.0.0

Table 2: Supported Xirrus device models

Device Model	Minimum Software Version
Wave 2 APs: • XA4-240 • XD2-230 • XD2-240 • XD4-240 • XH2-240	8.7.0
Wave 1 APs: • XD4-130 • XH2-120 • XR-630 • XR-620	8.7.0
Wave 1/2 Modular 4-radio • XR-2436/Wave 2 • XR-2426 • XR-4436 • XR-4426 • XR-2226 • XR-2236 • XR-2247 • XR-2447 • XR-4447	8.7.0
Wave 1 Modular 8-radio: • XR-4836/Wave 2 • XR-4826	8.7.0

Supported browsers

The following table lists browsers supported by cnMaestro on different operating systems:

Table 3: Supported browsers

Operating System	Browser	Version
Linux	Chrome	49 and above
	Firefox	45 and above
macOS	Safari	9 and above
MS Windows	Chrome	49 and above
	Firefox	45 and above
	Microsoft Edge	44.17763.1.0 and above

Network connectivity

Cambium devices use https://cloud.cambiumnetworks.com over port 443 to access cnMaestro in the cloud. The devices initiate the connection, and they can be located in a private subnet behind a NAT firewall.

cnMaestro shared features

The following table lists the features shared between the on-premises and cloud deployments.

Table 4: Primary features supported by cnMaestro

cnMaestro Essentials	cnMaestro X	Feature	Description
✔	✔	Advanced Troubleshooting	Display tower-to-edge status in a single graphic, which is used to: • View Wi-Fi client details and health. • Troubleshoot client connectivity directly on the AP.
✔	✔	AP Group Configuration	Support configuration of Enterprise Wi-Fi and cnPilot Home devices.
✔	✔	AP Group Dashboard	Display aggregate Wi-Fi AP statistics for the configured AP Group.
	✔	Assists	Assists scans the configurations and generates assists scores.
	✔	Audit Logs	Record administrator activities.
✔		60 GHz cnWave Auto Manage Routes	Support automated IPv6 routes for Distribution Node (DN) and Client Node (CN) based on topology and status of Point of Presence (PoP) Node.
✔	✔	Automatic Device Software Updates	Automatically update device software during onboarding or reconnection.

Table 4: Primary features supported by cnMaestro

cnMaestro Essentials	cnMaestro X	Feature	Description
✔	✔	Bulk Acknowledge Alarms	Acknowledge multiple alarms and clear them in a single action.
✔	✔	Bulk Image Upgrade	Schedule software image upgrades across sectors and device groups.
✔	✔	Citizen Broadband Radio Service Subscription (CBRS)	Support CBRS-compliant devices in the 3.6 GHz band (from 3550 MHz to 3700 MHz).
	✔	Client -Application Visibility	Allows methods to control, or block applications or terminate based on consumption of applications.
✔	✔	Client - Renaming the host-name	Rename wireless and wired client host-names to more appropriate names for easy reference.
	✔	cnArcher Installation Summary	Displays the installation summary of PMP & ePMP SMs.
	✔	Data Reports	Export device, performance, alarm, and event statistics data in CSV format.
✔	✔	Device Inventory	Aggregate inventory data for a group of devices at the System, Network, Tower, Sector, or Site level in PDF or CSV format.
✔	✔	Enterprise View	Display a simplified UI tailored for Enterprise Wi-Fi.
✔	✔	Guest Access Portal	Allow Wi-Fi Clients to access wireless service for free or by using vouchers.
	✔	Guest Access Portal (Paid Access)	Allow Wi-Fi Clients to connect to wireless service through paid access.
	✔	Guest Access Portal (Enterprise)	Allow Wi-Fi clients to access wireless network using one of the following access methods: • Google • Microsoft Azure • Self Registration • Sponsored Guest
✔	✔	Hierarchical Dashboards	Visualize devices from tower to edge through customized dashboards for each device type.
✔	✔	IPv6 Support	Provide IPv6 support for cnPilot Enterprise devices.

Table 4: Primary features supported by cnMaestro

cnMaestro Essentials	cnMaestro X	Feature	Description
✔	✔	LTE	Manage cnRanger LTE devices.
	✔	Managed Server Provider (MSP)	Allow cnMaestro account owners to split their installation into separate Managed Accounts. Each Managed Account contains independent administration and configuration.
✔	✔	Maps and Map Modes—Street View	Leverage maps to position devices and visualize their health and connectivity. Change the map mode to display various wireless key performance indicators.
	✔	Maps and Map Modes—Satellite and Terrain	
	✔	Mesh Peers	Display details of available Mesh clients.
✔	✔	Multiple Administrators	Invite colleagues by email to manage the account with an assigned role.

✔	✔	Multiple UI Views	Support the following tailored views in the cnMaestro UI:
			• **Access and Backhaul View**: Used for managing Fixed Wireless and Wi-Fi deployments, including the following:
			  ◦ 60 GHz cnWave
			  ◦ cnMatrix
			  ◦ cnPilot Home (cnPilot R-Series)
			  ◦ cnRanger
			  ◦ cnVision
			  ◦ cnWave 5G Fixed
			  ◦ Enterprise Wi-Fi (E-Series and XE/XV-Series) and cnPilot Enterprise (ePMP 1000 Hotspot)
			  ◦ Enterprise Wi-Fi (Xirrus-Series)
			  ◦ ePMP
			  ◦ NSE
			  ◦ PMP
			  ◦ PTP 650/670/700
			  ◦ PTP 820/850
			  ◦ RV22 Home Mesh
			  ◦ PON
			• **Enterprise View**: Used for managing Wi-Fi

Table 4: Primary features supported by cnMaestro

cnMaestro Essentials	cnMaestro X	Feature	Description
			deployments, including the following: • cnMatrix • Enterprise Wi-Fi (E-Series and XE/XV-Series) and cnPilot Enterprise (ePMP 1000 Hotspot) • Enterprise Wi-Fi (Xirrus-Series) • NSE • **Industrial Internet View**: Used for managing Fixed Wireless, Wi-Fi, and IIoT deployments, including the following: • 60 GHz cnWave • cnMatrix • cnPilot Home (cnPilot R-Series) • cnRanger • cnReach • cnVision • cnWave 5G Fixed • Enterprise Wi-Fi (E-Series and XE/XV-Series) and cnPilot Enterprise (ePMP 1000 Hotspot) • Enterprise Wi-Fi (Xirrus-Series) • ePMP • Machfu • NSE • PMP • PTP 650/670/700 • PTP 820/850 • RV22 Home Mesh • PON
✔	✔	Multi-Floor Plans	Multiple floor plans for Sites.
✔	✔	Notifications	Communicate immediate status with stateful alarms and events. Notifications help troubleshoot customer issues.
	✔	Organization	Allow users to manage multiple accounts through a single CBRS payment subscription.
✔	✔	Role-Based Access	Assign the following roles to users:

Table 4: Primary features supported by cnMaestro

cnMaestro Essentials	cnMaestro X	Feature	Description
			• Super Administrator • Administrator • Operator • Monitor • CPI
✔	✔	Scheduled Configuration Update	Specify a time to configure devices.
✔	✔	Scheduled Software Update	Specify a time to install device software.
✔	✔	Site Dashboard	Aggregate Wireless LAN AP statistics by location.
✔	✔	Statistics and Trending	Present historical radio and network statistics.
✔	✔	Switch Groups	Support shared configuration across cnMatrix switches.
✔	✔	Template-Based Configuration	Schedule configuration of single devices or a group of devices across your network by using templates for cnPilot Home (R-Series), cnMatrix, cnReach, cnVision, ePMP, Machfu, PMP, and PTP 820/850 devices.
	✔	User Session Management	Track current cnMaestro users and support forced logoff.
✔	✔	Zero Touch Onboarding	Allow cnVision Client, PMP SMs, and ePMP SMs to automatically appear in the onboarding queue if the parent AP is already onboarded.

Differences between cnMaestro Cloud and On-Premises

The majority of features in cnMaestro On-Premises are identical to cnMaestro Cloud, but there are some differences.

The following table lists the feature differences between cnMaestro Cloud and On-Premises:

Table 5: Differences between Cloud and On-Premises

cnMaestro Essentials	cnMaestro X	Feature	Description
✔	✔	Account Recovery	Password and account recovery issues are resolved locally.
	✔	Auto-Provisioning	New devices, such as cnPilot Home (R-Series), cnVision, Enterprise Wi-Fi, Enterprise Wi-Fi (Xirrus-Series), ePMP, and PMP, can automatically be approved and onboarded using the subnet.
✔	✔	Backup and Restore	Backup or restore configuration and monitoring data from cnMaestro.
✔	✔	Cloud Synchronization	Allows to connect to the Cloud Anchor account and also push announcements form Cloud Anchor account to to On-Premises instances.
✔	✔	Certificate Management	SSL certificate management is available for the UI and Guest Access Portal.
✔	✔	cnMaestro Software Upgrade	Enable three types of software upgrade: • **Virtual machine upgrade** requires the customer to replace the entire virtual machine with a new instance. The configuration and the data are exported from the old instance and imported to the new. • **Package upgrade** only updates the cnMaestro software. It does not require a virtual machine reinstallation. • **OVA upgrade** only overwrites the OS partition.
✔	✔	Configuration Backup	Backup configuration from fixed wireless devices (cnVision, PMP and ePMP) and cnReach devices that are currently online.
✔	✔	Deployment	• The Cloud version is fully hosted and maintained by Cambium Networks at https://cloud.cambiumnetworks.com. • The cnMaestro On-Premises version is released as an OVA (Open Virtualization Archive) file that needs to be installed on either VMware or VirtualBox.
✔	✔	Device Connectivity	• In the Cloud version, all devices can be accessed through https://cloud.cambiumnetworks.com.

Table 5: Differences between Cloud and On-Premises

cnMaestro Essentials	cnMaestro X	Feature	Description
			• In the cnMaestro On-Premises version, all devices contact the local cnMaestro server. The devices must be configured to access the server before they can be managed. Alternatively, DHCP options can be configured to provide the cnMaestro URL when the device boots up.
✔	✔	Device Image Management	• In the Cloud, device images are automatically available. • In the cnMaestro On-Premises device, new images need to be downloaded from Support Center and added to the cnMaestro server. • Device image can be downloaded from the anchor.
✔	✔	Local and Authentication Server Administrators	Multiple types of administration access for local administrators (with a username and password maintained by cnMaestro) or authentication services (including TACACS+, RADIUS, LDAP, Active Directory, OpenID Connect, and SAMI).
✔	✔	Onboarding	• In the Cloud version, devices onboard using either the device Manufacturer Serial Number (MSN) or through the Cambium ID or Onboarding Key (entered on the device). • In the cnMaestro On-Premises version, all the cloud modes of onboarding or devices contacting cnMaestro are added to the Onboarding Queue, where they are approved and managed.
✔	✔	On-Premises Console	Configure networking parameters and update the system password using the CLI available through the virtual machine console.
✔	✔	Server Management	Monitor virtual machine parameters such as disk, memory, and CPU utilization through the UI.
	✔	SNMP	Basic SNMP for inventory and alarms.
✔	✔	System Events	System events for cnMaestro On-Premises server instance.
✔	✔	System Log	Forward events to a remote system log server.

Table 5: Differences between Cloud and On-Premises

cnMaestro Essentials	cnMaestro X	Feature	Description
	✔	Webhooks	Send alarm notifications to the external servers.
✔	✔	Wi-Fi Speed Test	Test the speed between the Wi-Fi APs and cnMaestro.
	✔	Topology Scan X	Toposcan Discovery tool allows a user to select a DN and scan for nodes on the same channel sector.
	✔	Device Auto Refresh	Device Auto Refresh allows to refresh data automatically in the E2E Network.

Quick Start

This section guides users through the initial process of creating an account; logging into cnMaestro; and claiming and onboarding devices.

You must perform the following procedures to create an account and onboard devices.

- **For account management:**
    1. Create a Cambium Support Center login (if you do not have one already).
    2. Create a cnMaestro account.
    3. Login to cnMaestro.
- **For claiming devices:**
    1. Claim devices using a Manufacturer Serial Number (MSN).
    2. Claim devices using a Cambium ID.

Create and manage accounts

To access cnMaestro, you must create a Cambium Support Center account, which sets your username and password.

Create a Cambium Support Center login

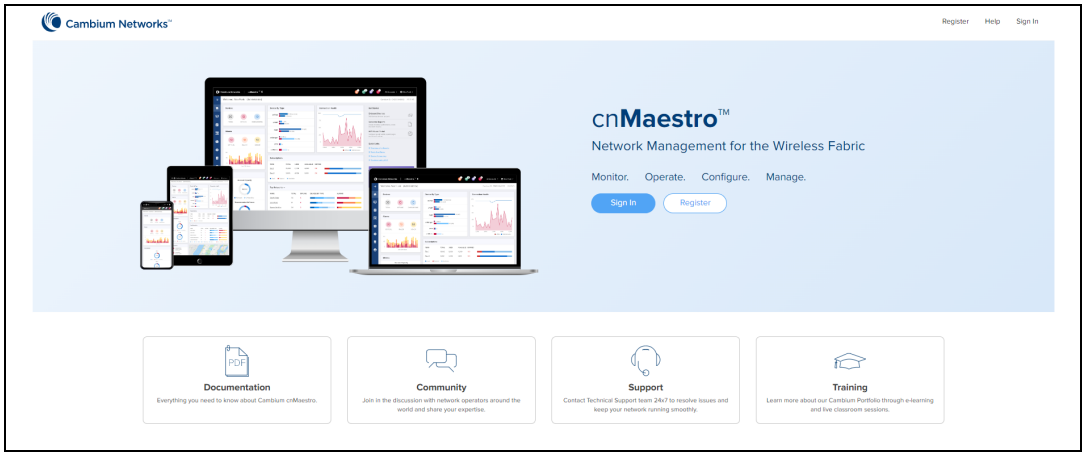
cnMaestro uses an existing Cambium Support Center account. If you do not have an account, you must create one.

To create a Cambium Support Center account, perform the following steps:

1. Open a web browser and enter https://cloud.cambiumnetworks.com into the address bar.

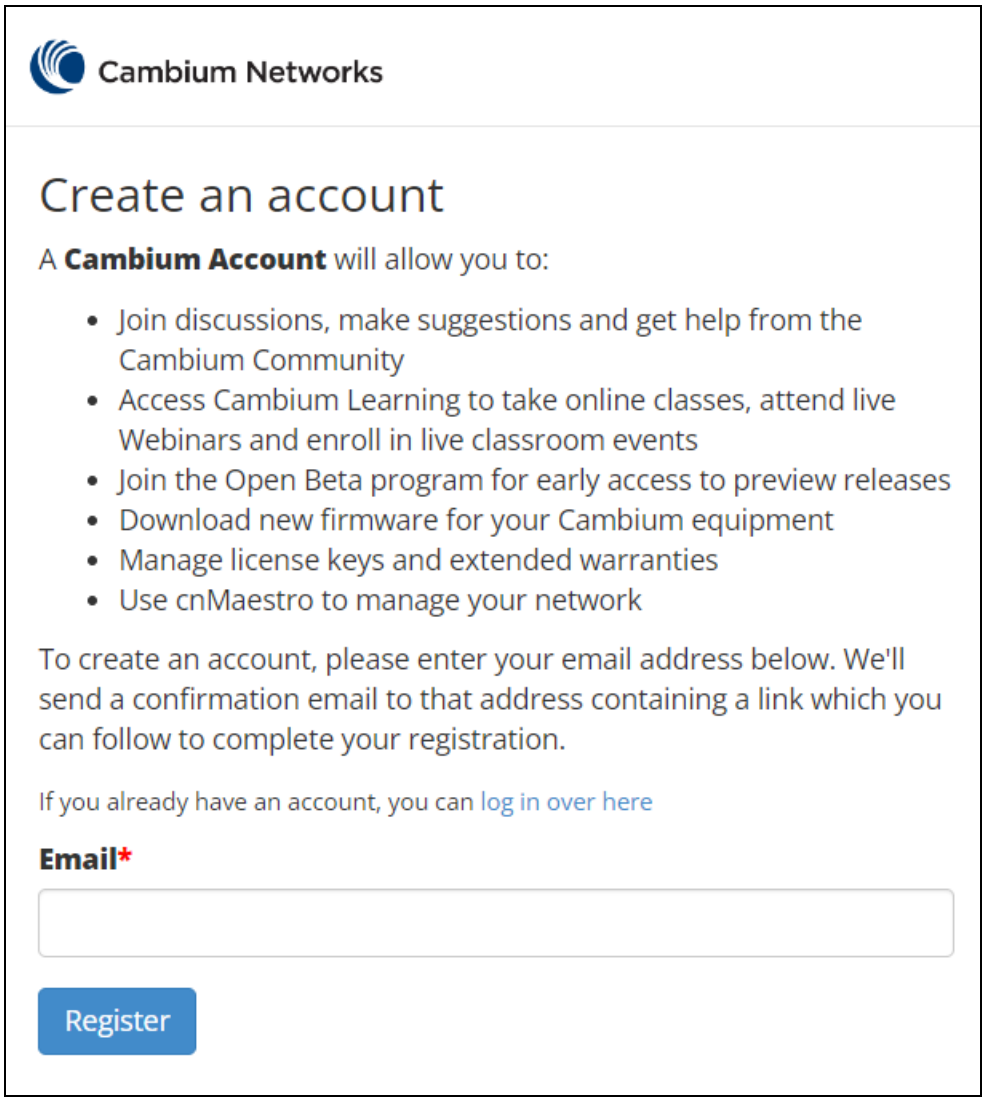
   The cnMaestro Main login page appears, as shown in Figure 1.
2. Click **Register**.

Figure 1 The main login page



A registration form appears, as shown in Figure 2.

Figure 2 Initial registration form

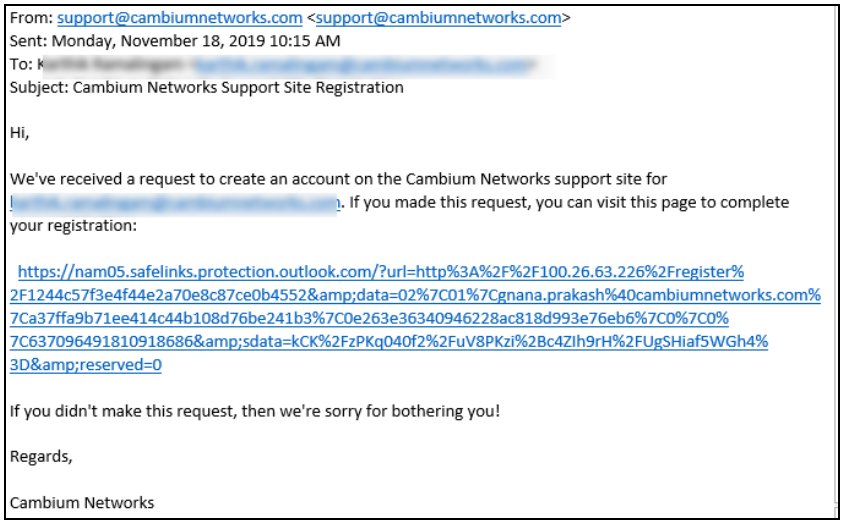


3. Enter your email address and click the **Register** button.

   An email from Cambium Support Center is sent with a link for validation.

4. Check email and click the validation link, as shown in Figure 3.

Figure 3 Email from Cambium Support to validate account



From: support@cambiumnetworks.com <support@cambiumnetworks.com>
Sent: Monday, November 18, 2019 10:15 AM
To: [redacted]
Subject: Cambium Networks Support Site Registration

Hi,

We've received a request to create an account on the Cambium Networks support site for [redacted]. If you made this request, you can visit this page to complete your registration:

https://nam05.safelinks.protection.outlook.com/?url=http%3A%2F%2F100.26.63.226%2Fregister%2F1244c57f3e4f44e2a70e8c87ce0b4552&data=02%7C01%7Cgnana.prakash%40cambiumnetworks.com%7Ca37ffa9b71ee414c44b108d76be241b3%7C0e263e36340946228ac818d993e76eb6%7C0%7C0%7C637096491810918686&sdata=kCK%2FzPKq040f2%2FuV8PKzi%2Bc4ZIh9rH%2FUgSHiaf5WGh4%3D&reserved=0

If you didn't make this request, then we're sorry for bothering you!

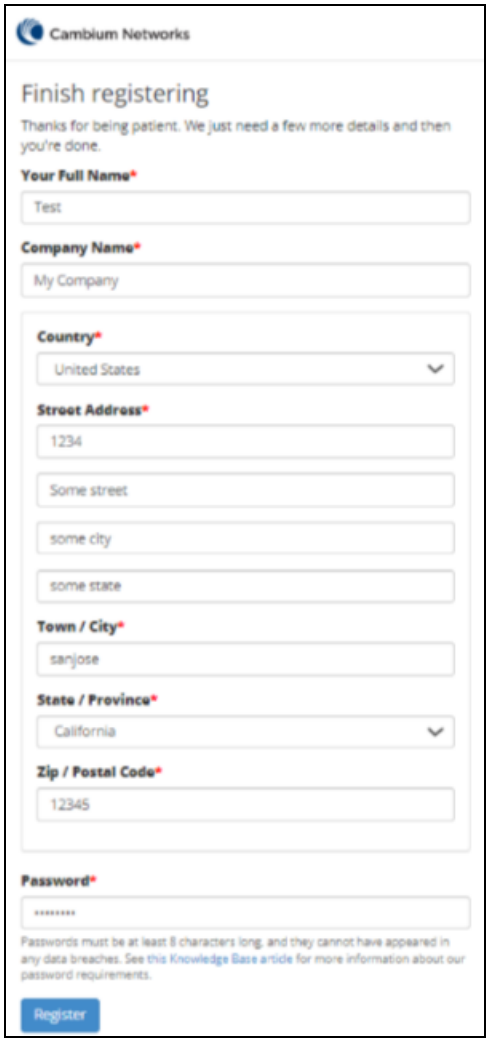
Regards,

Cambium Networks

	Note: If you do not receive the email, check your spam folder.

The **Finish registering** form appears, as shown in Figure 4.

Figure 4 Finish registering form



5. In the registration form, you must enter details such as your name, company name, country name, and password.
6. Click **Register** to complete the process.

Create a cnMaestro account

Use the Cambium Support Center account to log on to cnMaestro and create a cnMaestro account.

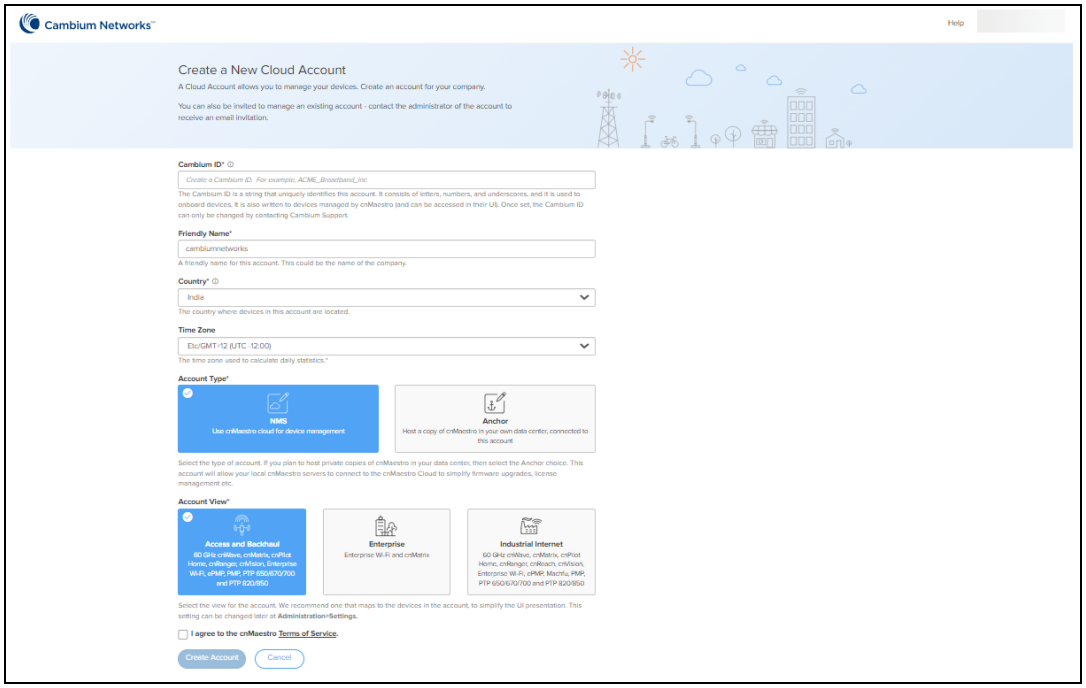
1. Open a web browser and enter https://cloud.cambiumnetworks.com into the address bar.

   The Main login page appears.
2. Log on to cnMaestro using your Cambium Support Center account.

   Create a New Cloud Account window appears.
3. Click **Add New Account**.

   The **Create a New Cloud Account** page appears, as shown in Figure 5.

Figure 5 Create a Cloud Account form



4. Enter the required details and complete the form.

	Note: The **Cambium ID** is the primary identifier of the account. It may optionally be used to onboard devices.

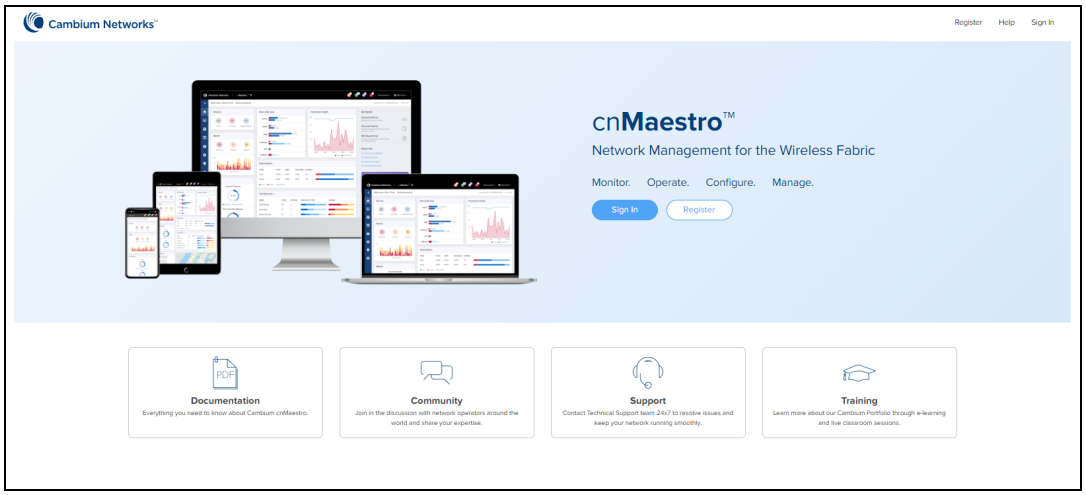
5. Click **Create Account** to complete the process.

Log on to cnMaestro

To log on to the cnMaestro, perform the following steps:

1. Open a web browser and enter https://cloud.cambiumnetworks.com into the address bar.
   The cnMaestro Main login page appears, as shown in Figure 6.

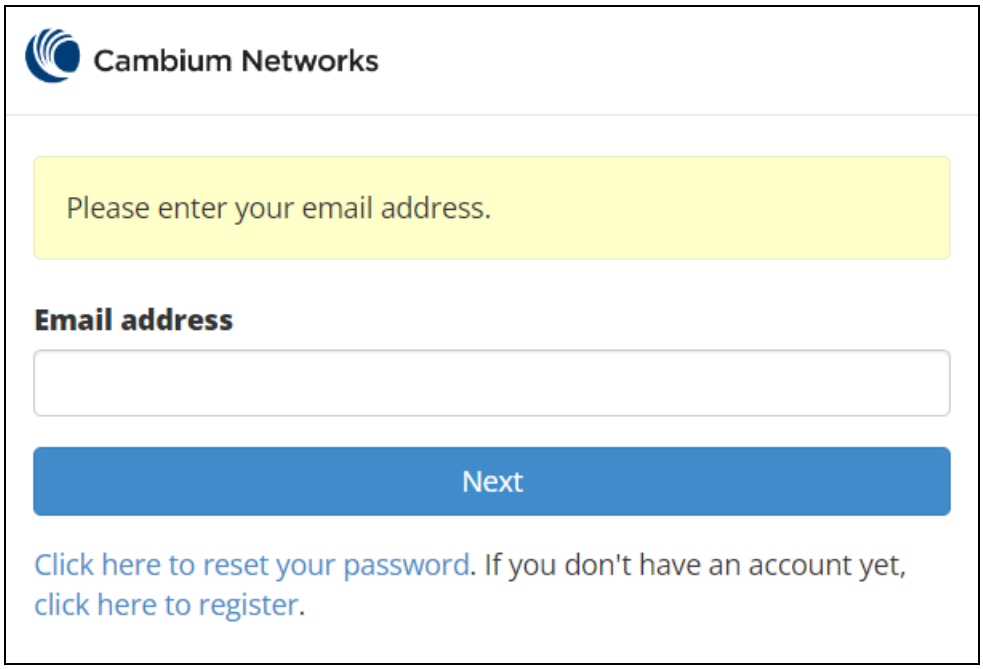
Figure 6 Main login page



2. Click **Sign In**.

   Please enter your email address page appears as shown in Figure 7.

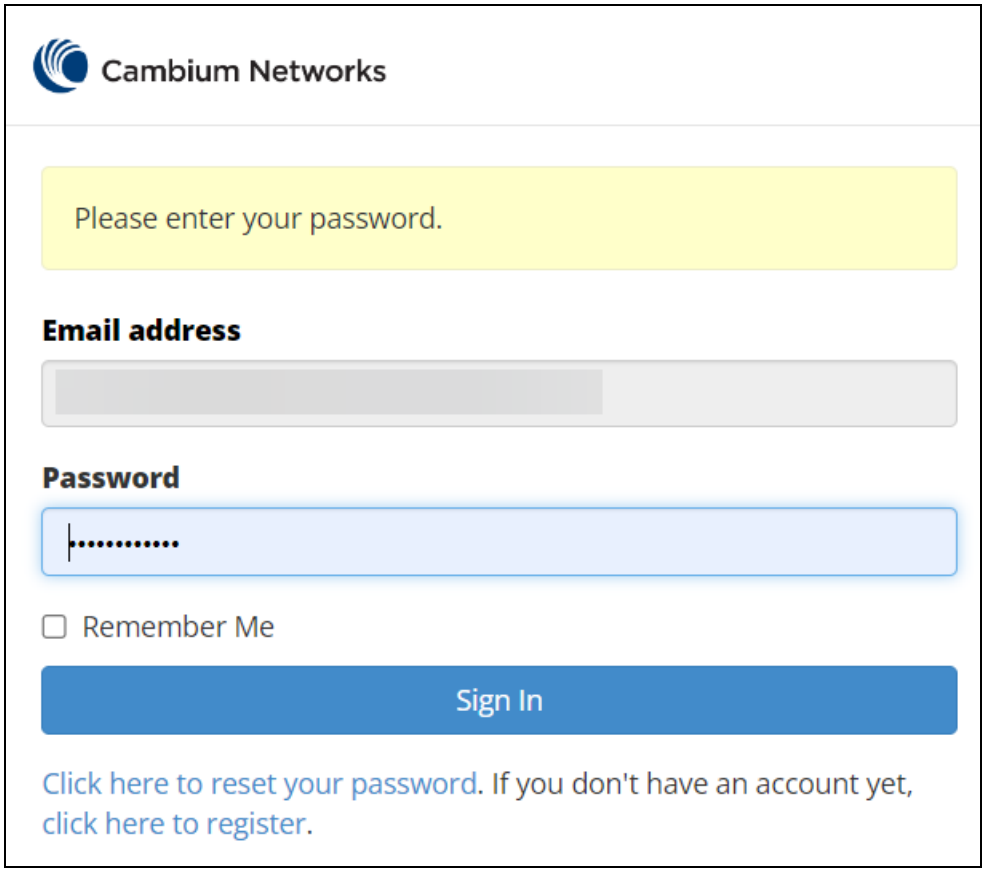
Figure 7 Email address page



3. Enter your **Email address**.
4. Click **Next**.

   Please enter your password page appears as shown in Figure 8.

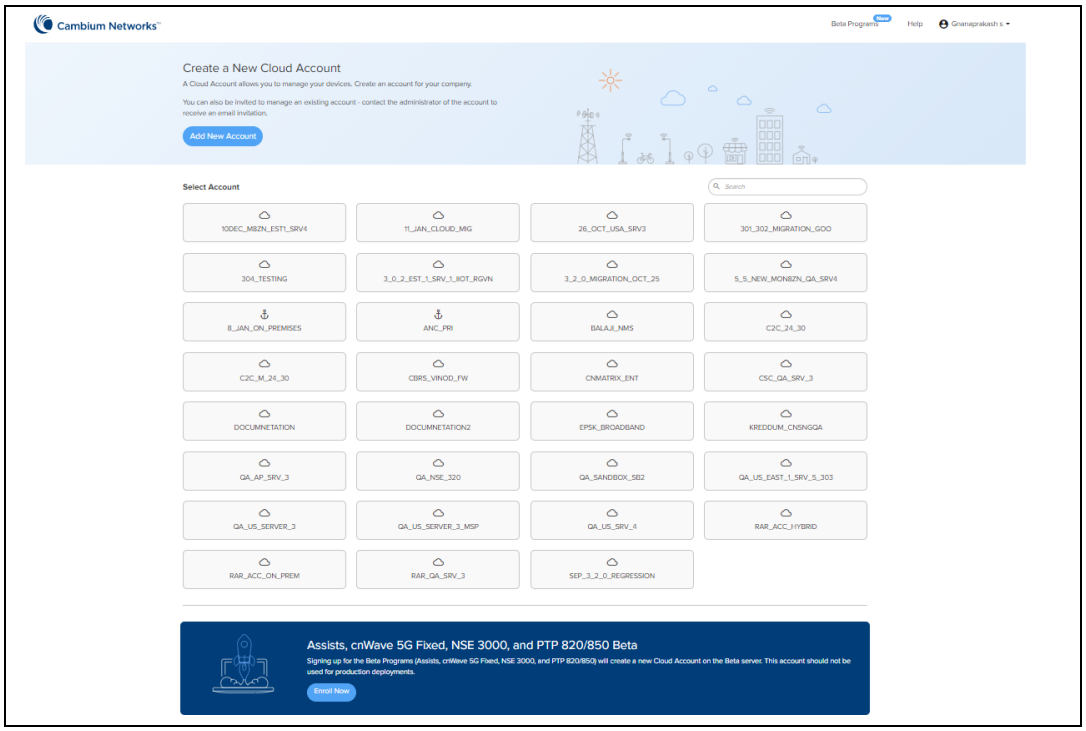
Figure 8 Password page



5. Click **Sign in**.

   Select Account page appears as shown in Figure 9.

Figure 9 Select account page

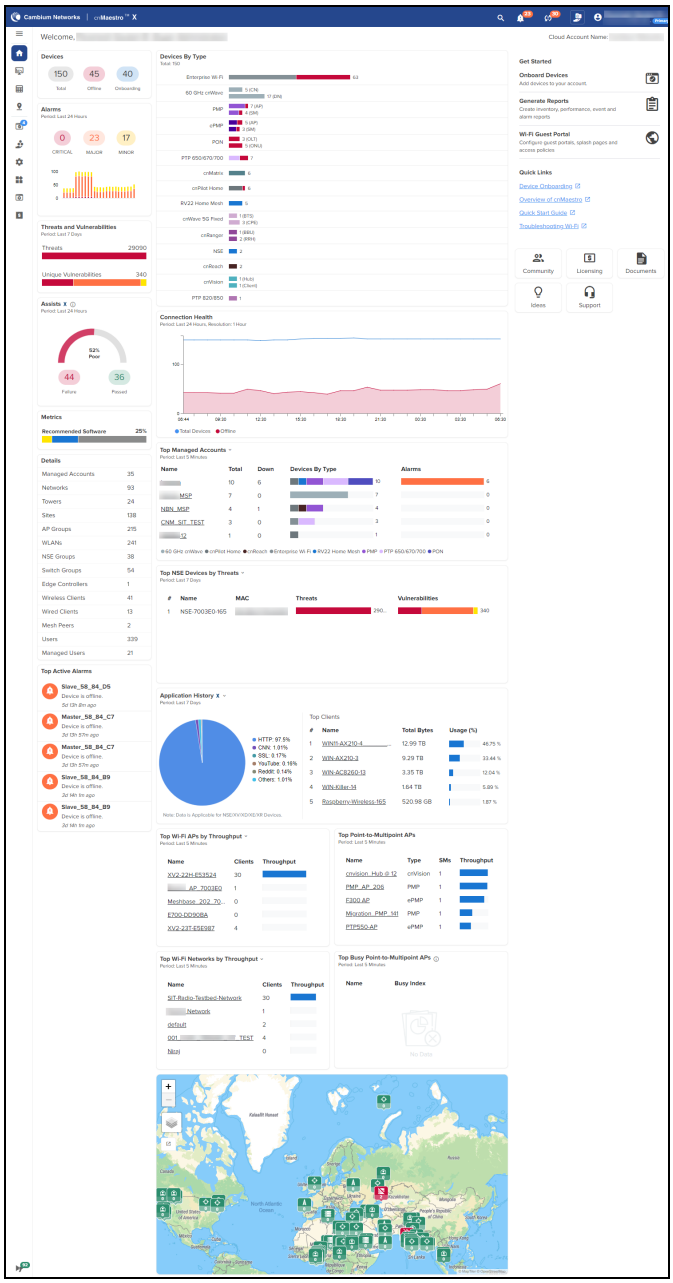


In **Select Account** page you can use search option to search the account.

6. Click the selected account.

   The cnMaestro **Home** page appears, as shown in Figure 10.

Figure 10 cnMaestro Home page



Claim and onboard devices

To manage devices in cnMaestro, it is necessary to claim and onboard them.

Claiming specifies who owns a device. After a device is claimed, it is listed in the Onboarding Queue, where it can be pre-provisioned or approved. Once devices are approved, they are managed by cnMaestro.

Claim devices by serial number

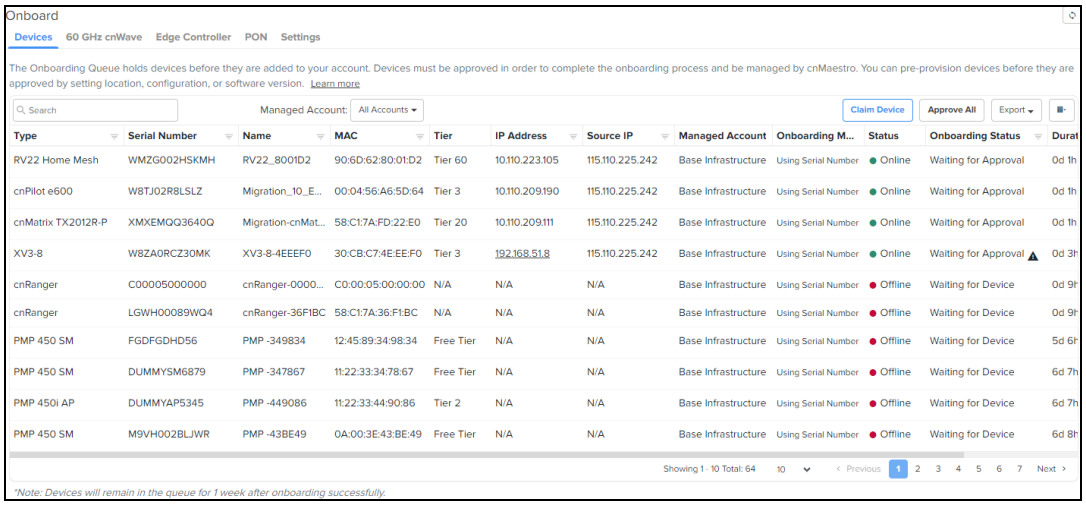
You can claim a device by using the Manufacturer Serial Number (MSN). The system prompts the user to validate the devices before applying them. After being claimed, devices are placed into the Onboarding Queue, where they can be pre-provisioned to update software or configuration before onboarding.

To claim and onboard a device, perform the following steps:

1. From the Home page of cnMaestro, navigate to **Onboard > Device** tab.

   The Onboard page appears with details of the devices and their serial numbers, as shown in Figure 11.

Figure 11 Onboard page



2. Click **Claim Devices** located at the right side of the Onboard page (as shown in Figure 11).

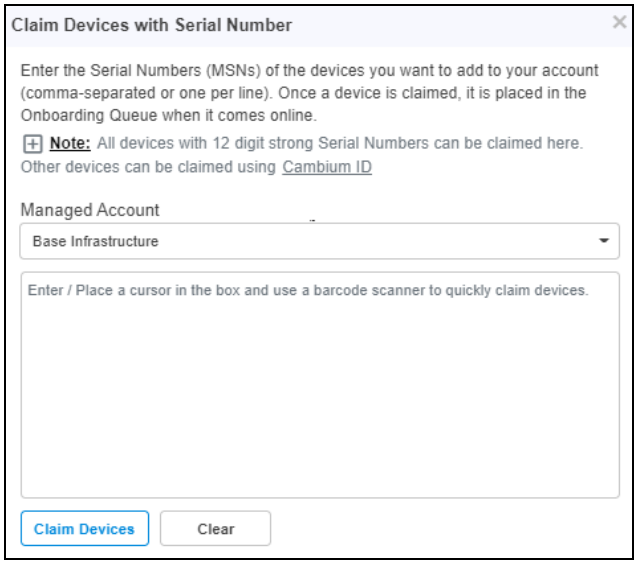
   The **Claim Devices with Serial Number** page appears, as shown in Figure 12.

3. Enter the Serial Number(s) of the device(s) in the text box, as shown in Figure 12.

   If MSP is enabled, select the **Managed Account** from the drop down and Enter the Serial Number(s) of the device(s) in the text box.

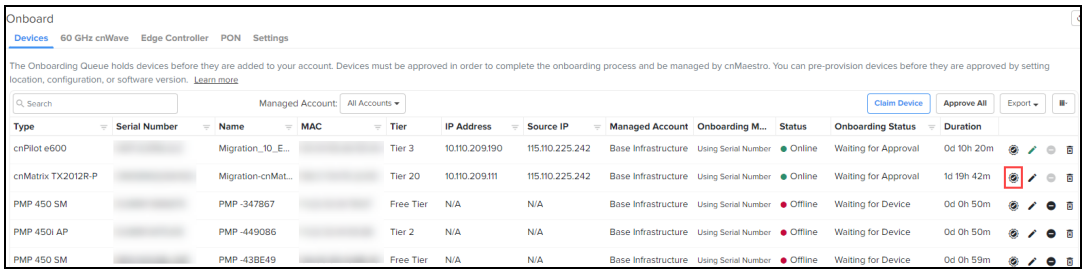
	**Note** You can also place a cursor in the text box and use a barcode scanner to quickly claim the devices.

Figure 12 Claim Devices with Serial Number page



4. Click **Claim Devices.**
5. To onboard the device when it contacts cnMaestro, click the **Approve Device** ( ) icon or **Approve All** at the right side of the Onboard page, as shown in Figure 13.

Figure 13 Onboarding Queue

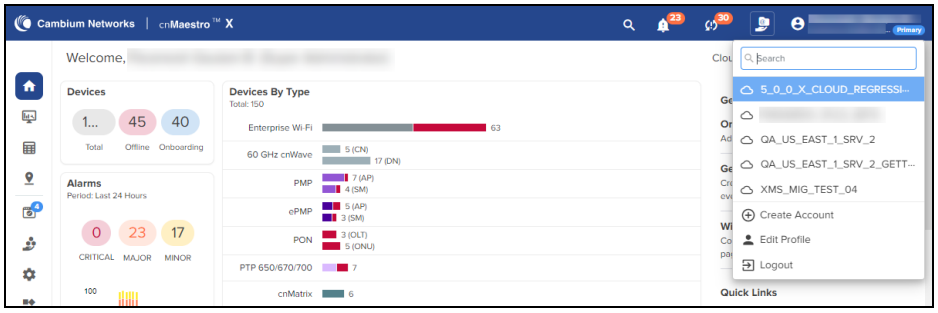


	Note If you do not click the **Approve Device** button, the device remains in the Onboarding Queue.

Claim devices by Cambium ID

The Cambium ID, set during the Cloud account creation can also be used to claim devices. You can see the Cambium ID on the user drop-down, as shown in Figure 14.

Figure 14 Cambium ID



A Cambium ID with an Onboarding Key is:

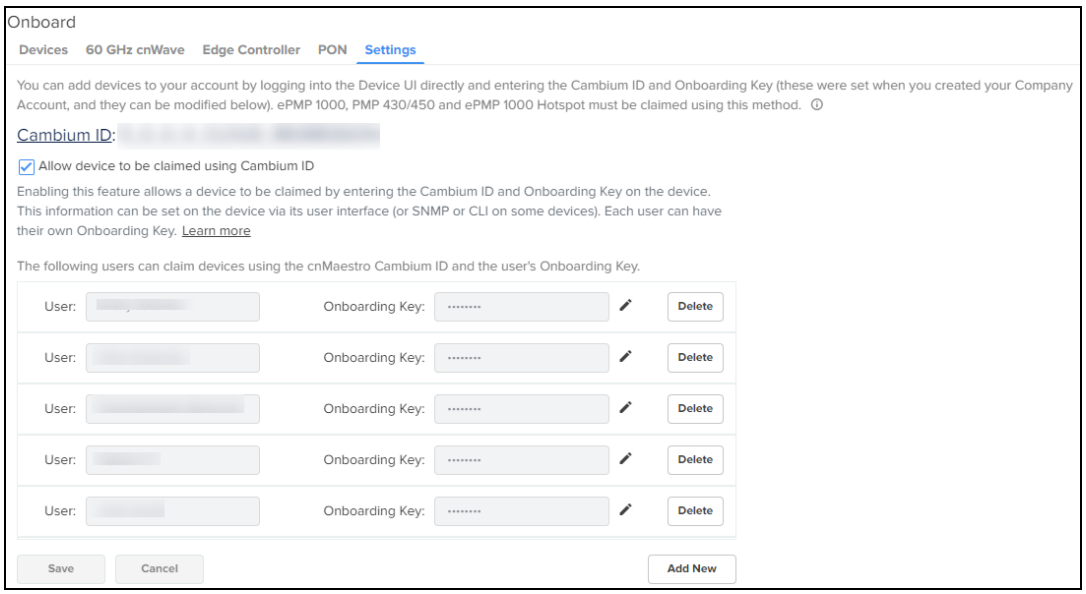
- Required to claim legacy devices that do not have a 12-character serial number (these devices are usually 5+ years old).
- Optional for devices that have 12-character serial numbers (though generally not used).

The administrator must approve all devices added to the Onboarding Queue using the Cambium ID.

Cambium ID configuration

You must configure the Onboarding Key in order to claim devices with Cambium ID, as shown in Figure 15.

Figure 15 Cambium ID configuration



Onboarding Key configuration

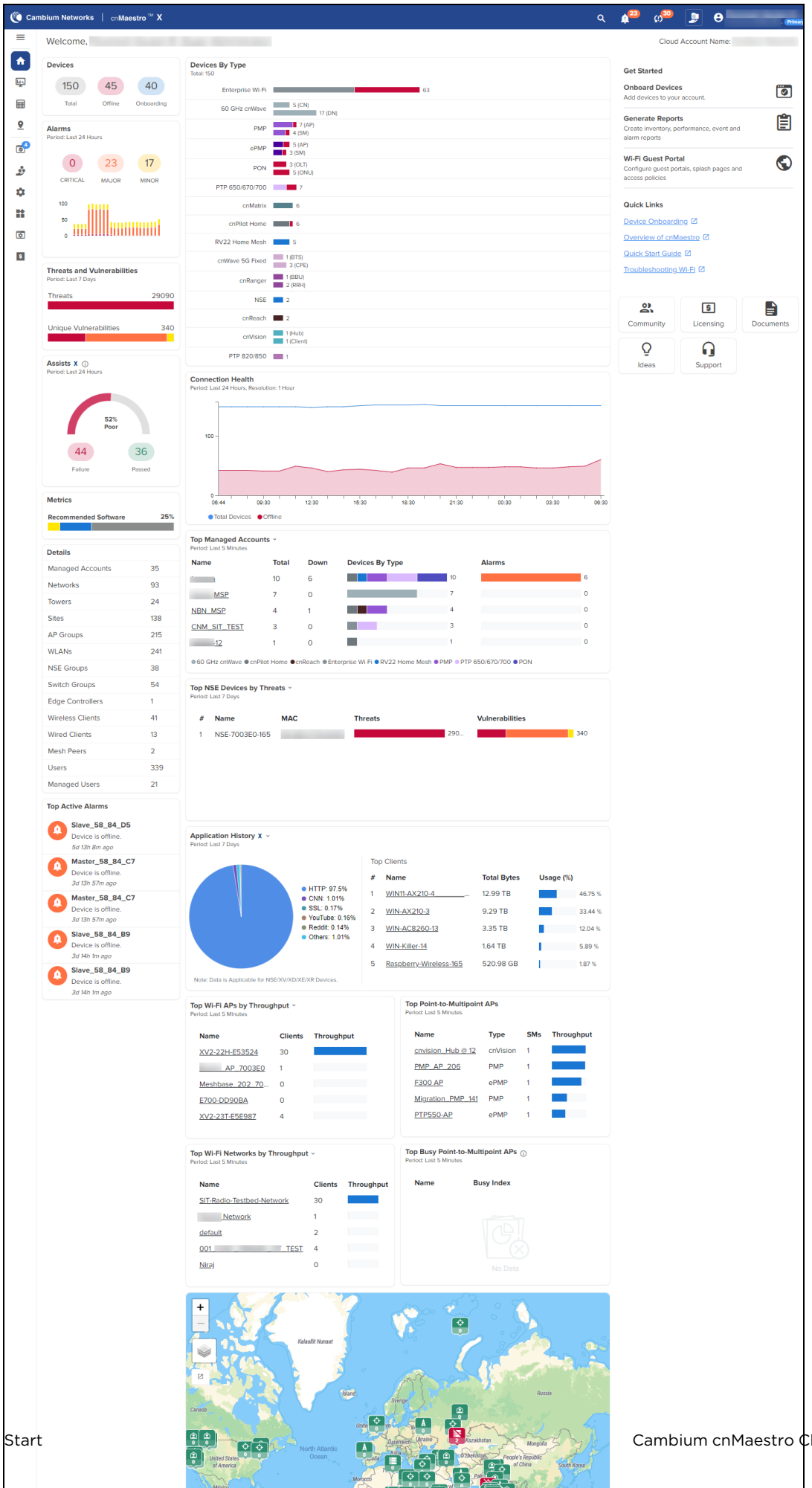
Each Onboarding Key is mapped to an individual User account. This mapping allows Cambium Cloud to know who is onboarding a device, and the key can be revoked if needed.

To configure the Onboarding Key, perform the following steps:

1. Log on to your cnMaestro account.

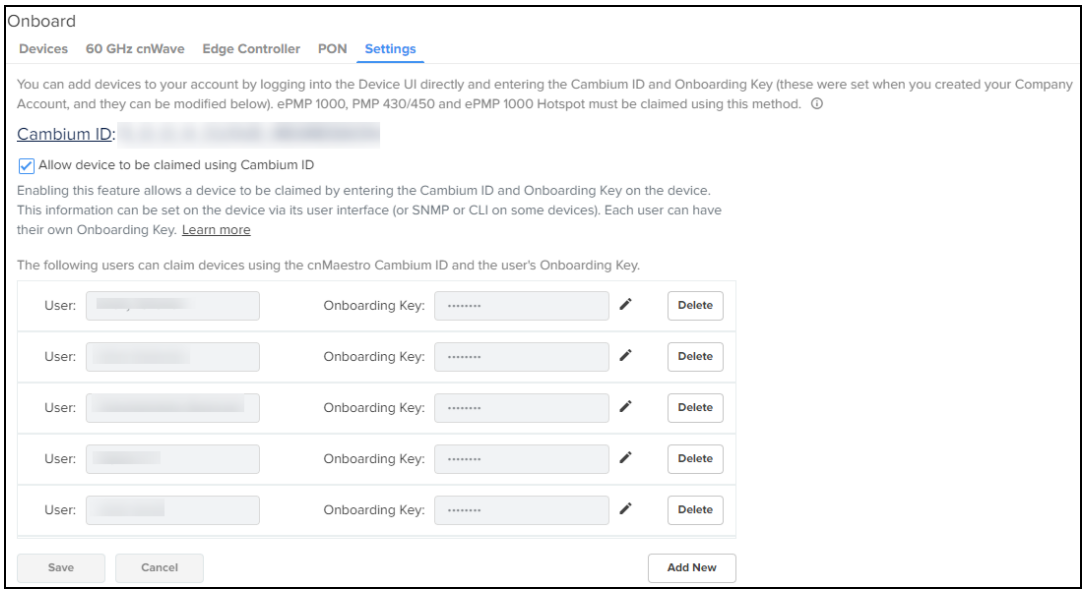
   The Home page appears, as shown in Figure 16.

Figure 16 Home page


Cambium Networks | cnMaestro™ X
Welcome,
Cloud Account Name:
Devices
150 Total
45 Offline
40 Onboarding
Alarms
Period: Last 24 Hours
0 CRITICAL
23 MAJOR
17 MINOR
Threats and Vulnerabilities
Period: Last 7 Days
Threats 29090
Unique Vulnerabilities 340
Assists X
Period: Last 24 Hours
52% Poor
44 Failure
36 Passed
Metrics
Recommended Software 25%
Details
Managed Accounts 35
Networks 93
Towers 24
Sites 138
AP Groups 215
WLANs 241
NSE Groups 38
Switch Groups 54
Edge Controllers 1
Wireless Clients 41
Wired Clients 13
Mesh Peers 2
Users 339
Managed Users 21
Top Active Alarms
Slave_58_84_D5
Device is offline.
5d 13h 8m ago
Master_58_84_C7
Device is offline.
3d 13h 57m ago
Master_58_84_C7
Device is offline.
3d 13h 57m ago
Slave_58_84_B9
Device is offline.
3d 14h 1m ago
Slave_58_84_B9
Device is offline.
3d 14h 1m ago
Devices By Type
Total: 150
Enterprise Wi-Fi 63
60 GHz cnWave 5 (CN) 17 (DN)
PMP 7 (AP) 4 (SM)
ePMP 5 (AP) 3 (SM)
PON 3 (OLT) 5 (ONU)
PTP 650/670/700 7
cnMatrix 6
cnPilot Home 6
RV22 Home Mesh 5
cnWave 5G Fixed 1 (BTS) 3 (CPE)
cnRanger 1 (BBU) 2 (RRH)
NSE 2
cnReach 2
cnVision 1 (Hub) 1 (Client)
PTP 820/850 1
Connection Health
Period: Last 24 Hours, Resolution: 1 Hour
Total Devices
Offline
Top Managed Accounts
Period: Last 5 Minutes
Name Total Down Devices By Type Alarms
MSP 7 0
NBN_MSP 4 1
CNM_SIT_TEST 3 0
Top NSE Devices by Threats
Period: Last 7 Days
Name MAC Threats Vulnerabilities
1 NSE-7003E0-165
Application History X
Period: Last 7 Days
HTTP: 97.5%
CNN: 1.01%
SSL: 0.17%
YouTube: 0.16%
Reddit: 0.14%
Others: 1.01%
Note: Data is Applicable for NSE/XV/XD/XE/XR Devices.
Top Clients
Name Total Bytes Usage (%)
1 WIN11-AX210-4 12.99 TB 46.75 %
2 WIN-AX210-3 9.29 TB 33.44 %
3 WIN-AC8260-13 3.35 TB 12.04 %
4 WIN-Killer-14 1.64 TB 5.89 %
5 Raspberry-Wireless-165 520.98 GB 1.87 %
Top Wi-Fi APs by Throughput
Period: Last 5 Minutes
Name Clients Throughput
XV2-22H-E53524 30
AP_7003E0 1
Meshbase_202_70... 0
E700-DD90BA 0
XV2-23T-E5E987 4
Top Point-to-Multipoint APs
Period: Last 5 Minutes
Name Type SMs Throughput
cnvision_Hub_@_12 cnVision 1
PMP_AP_206 PMP 1
F300 AP ePMP 1
Migration_PMP_141 PMP 1
PTP550-AP ePMP 1
Top Wi-Fi Networks by Throughput
Period: Last 5 Minutes
Name Clients Throughput
SIT-Radio-Testbed-Network 30
Network 1
default 2
Niraj 0
Top Busy Point-to-Multipoint APs
Period: Last 5 Minutes
Name Busy Index
No Data
Get Started
Onboard Devices
Add devices to your account.
Generate Reports
Create inventory, performance, event and alarm reports
Wi-Fi Guest Portal
Configure guest portals, splash pages and access policies
Quick Links
Device Onboarding
Overview of cnMaestro
Quick Start Guide
Troubleshooting Wi-Fi
Community
Licensing
Documents
Ideas
Support

2. From the Home page, navigate to the **Onboard > Settings** tab.

Figure 17 Onboard settings page



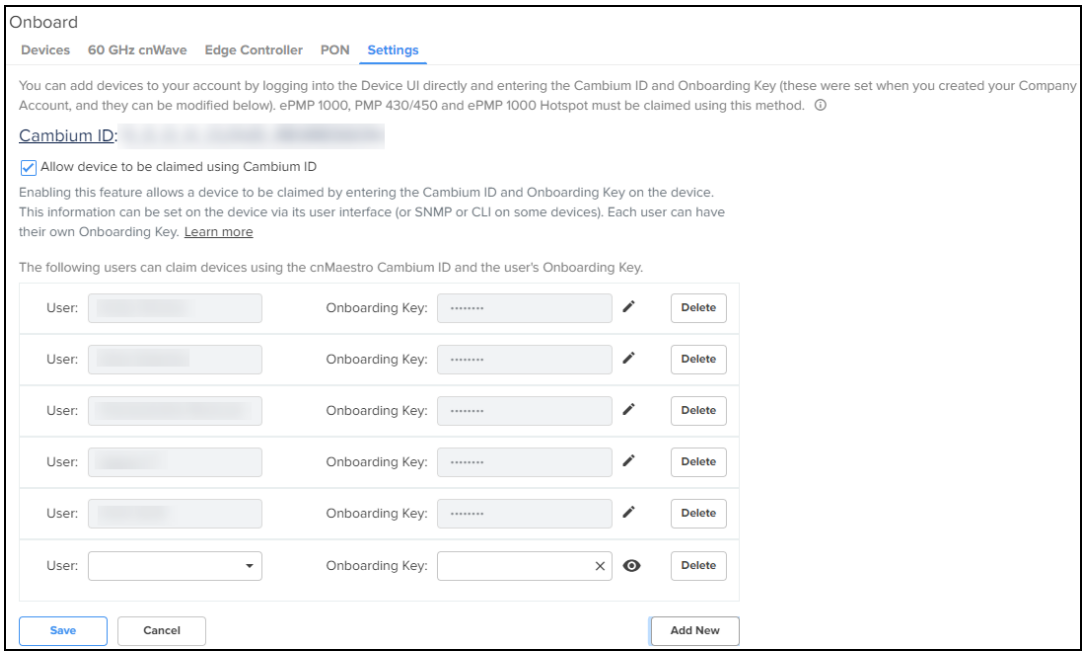
3. Select the **Allow device to be claimed using Cambium ID** checkbox.

   Enabling this feature allows one to add Onboarding Keys mapped to individual Users.

4. Click **Add New** to add a User and Onboarding Key.

   A new row appears as shown in Figure 18.

Figure 18 New onboarding key



5. Select the **User** from the drop-down.
6. Enter the **Onboarding Key**.
7. Click **Save.**

Onboard device using Onboarding Key

The Cambium ID and Onboarding Key are entered into the Device UI (see the User Guide for the individual devices to determine where; the section below demonstrates the process for cnPilot). Once entered, the Device sends these credentials to Cambium Cloud, where it is mapped to the Onboarding Queue of the Cambium ID account.

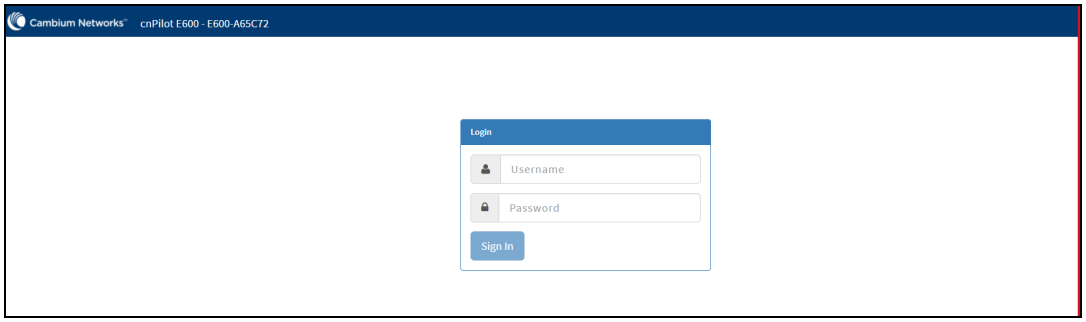
Device UI

To configure the Onboarding Key using cnPilot Device UI, perform the following steps:

1. Log on to the Device UI.

   The **Sign In** page appears, as shown in Figure 19.

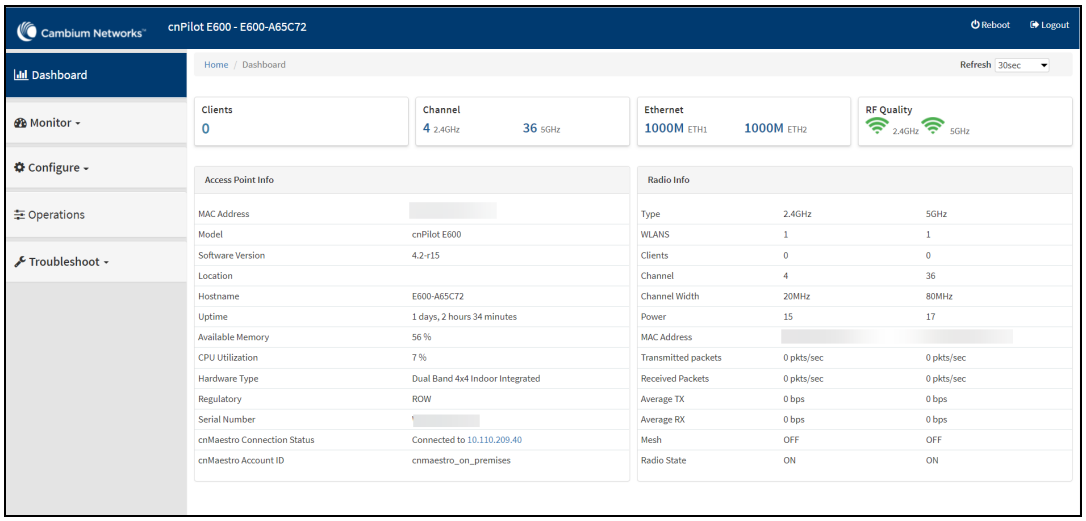
Figure 19 Login page



2. Enter your **Username** and **Password**.
3. Click **Sign In.**

   The device home page appears, as shown in Figure 20.

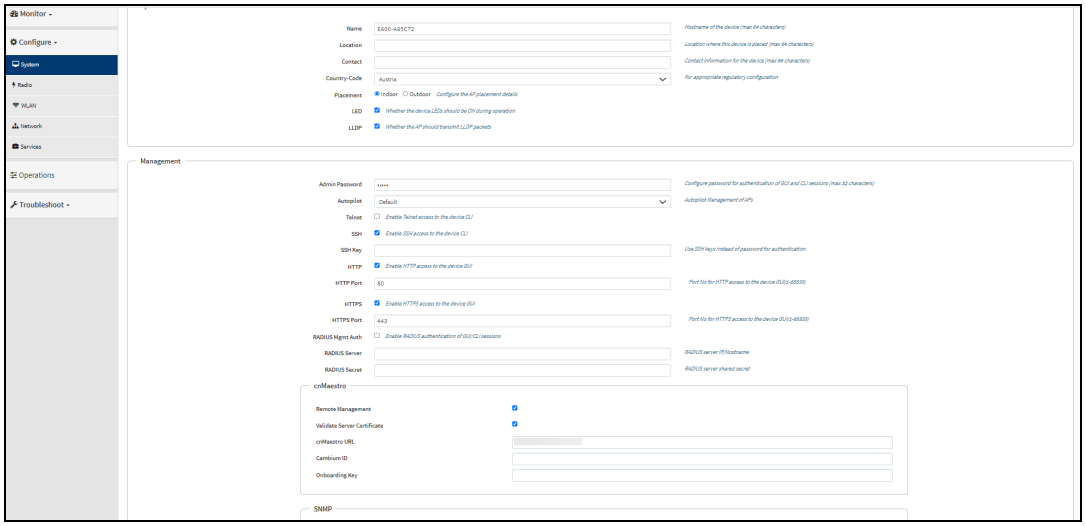
Figure 20 Device home page



4. From the Home page, navigate to **Configure > System > Management.**

   System configuration page appears, as shown in Figure 21.

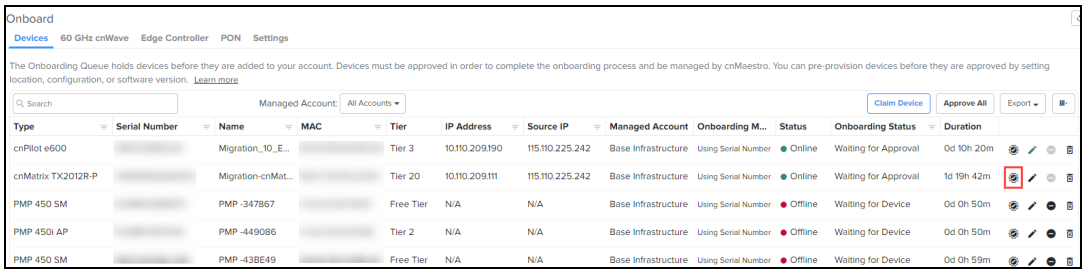
Figure 21 cnMaestro configuration



5. Enter URL in **cnMaestro URL** to connect the server (by default it will be cloud.cambiumnetworks.com), as shown in Figure 21.
6. Enter the **Cambium ID**.
7. Enter the **Onboarding Key.**
8. Click **Save.**

Once in the Onboarding Queue, the devices can be provisioned and managed by clicking the **Approve Device** button, as shown in Figure 22.

Figure 22 Device approval



Creating a Cloud Account

This section provides an overview of cnMaestro Cloud Accounts. This section includes the following:

- Overview
- Creating a Support Center User ID
- Creating a Cloud NMS Account
- Creating an Anchor Account
- Multiple Cloud Accounts

Overview

There are two types of accounts for cnMaestro cloud management.

Table 6: Account types

Account	Description
Cloud NMS	Cloud NMS accounts allow users to manage their devices through https://cloud.cambiumnetworks.com. Devices can be claimed, onboarded, and fully managed through the cloud service.
Cloud Anchor	Cloud Anchor Accounts are needed for on-premises installations of cnMaestro. After cnMaestro is deployed in a local data center, it connects to a Cloud Anchor Account. See the following section for more details on Creating an Anchor Account.

Both Cloud NMS and Cloud Anchor Accounts require a Support Center ID to login.

Creating a Support Center User ID

New Cambium Cloud users need to register with Cambium Support Center to create a Support Center ID.

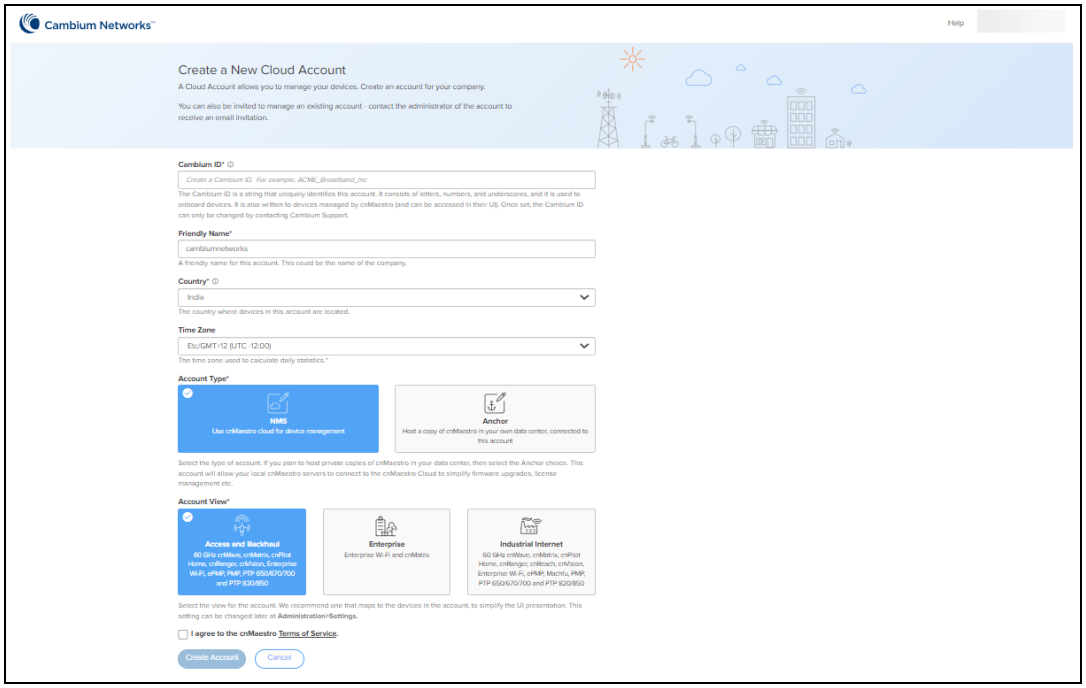
1. Navigate to https://cloud.cambiumnetworks.com and click **Sign In**.
2. In the **Sign In** page, click **Register**.
3. Enter your email address in the text box and click **Register**.
4. An email will be sent to the address provided. Open the email and click the link.
5. Fill in details on the registration completion form, such as your name, the name of your company, and a password.
6. Click **Sign in** to log into the UI.

Creating a Cloud NMS Account

If you do not have a Cloud NMS Account, you will be asked to create one after logging in and accessing cnMaestro Cloud. The NMS Account allows you to access cnMaestro functionality and start claiming devices.

1. Log in to the cnMaestro UI https://cloud.cambiumnetworks.com.
2. Click **Add New Account**. You will be redirected to the **Create a New Cloud Account** page.
3. Enter details such as **Cambium ID**, **Friendly Name**, **Country**, **Time Zone**, **Account Type**, and **Account View**. The **Account Type** should be set to **NMS**.
4. Enable **I agree to the cnMaestro Terms of Service**.
5. Click **Create Account**.

Figure 23 Create Cloud NMS account



The required fields are defined below:

Table 7: NMS Cloud management fields

Parameter	Description
Account Type	The **Account Type** is either **NMS** or **Anchor**. Select **NMS** to manage devices through cnMaestro Cloud. Select **Anchor** if installing cnMaestro On-Premises.
Account View	Select the **Account View** based on the devices you intend to manage. Select **Enterprise** if only cnMaestro Enterprise devices will be managed (these include the cnMatrix, Enterprise Wi-Fi (E-Series and XE/XV-Series) and cnPilot Enterprise (ePMP 1000 Hotspot), Enterprise Wi-Fi (Xirrus-Series), and NSE). The **Account View** can be changed later by navigating to **Administration** > **Settings > General**.
Cambium ID	The **Cambium ID** identifies this account externally. Once created, it can only be changed by contacting Cambium Support.
Friendly Name	The **Friendly Name** is generally the same as the Company that owns the devices. It is informational.
Country	The **Country** determines where to store the device data. Cambium has data centers in North America, Europe, and Asia. If your devices are located in more than one region, you should create a separate account for a country in each region.
Time Zone	The **Time Zone** aggregates daily device statistics. Daily statistics are collected starting at 12:00 AM in the time zone selected.

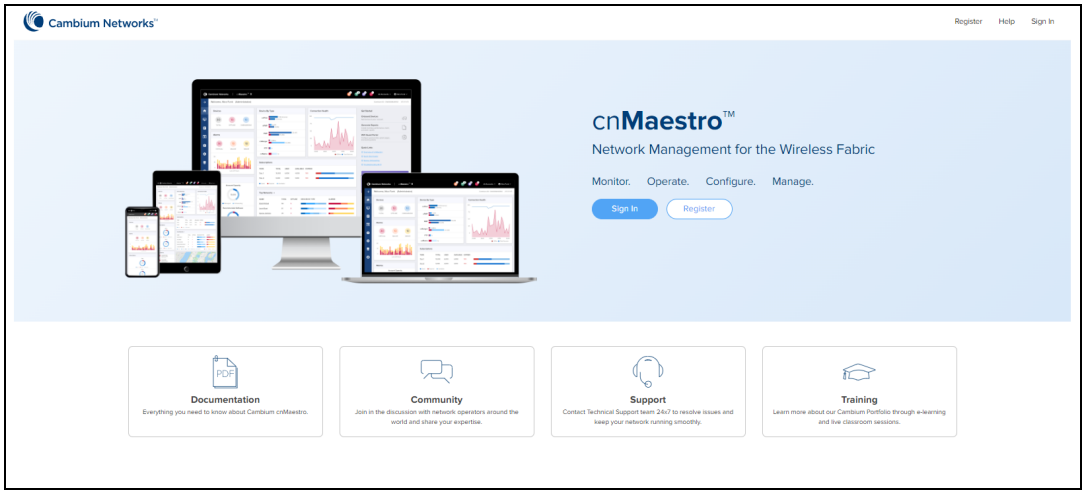
6. Click the drop-down next to the username or search option to view the created Cloud account.

Once you have created a Cloud NMS Account, you will be directed to the home page on subsequent login.

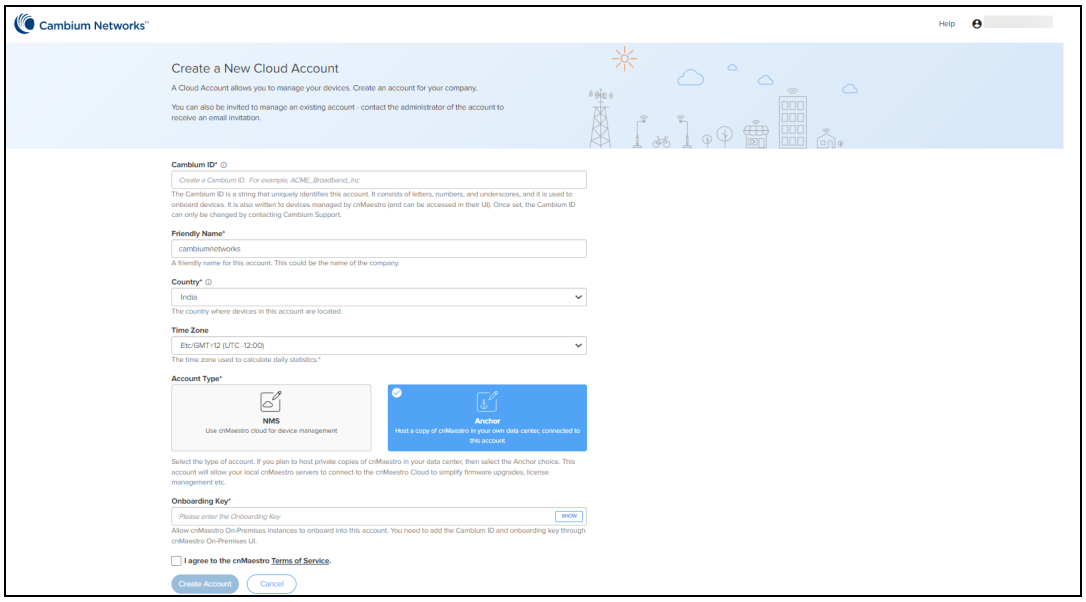
Creating an Anchor Account

An Anchor Account is required only if installing cnMaestro On-Premises.

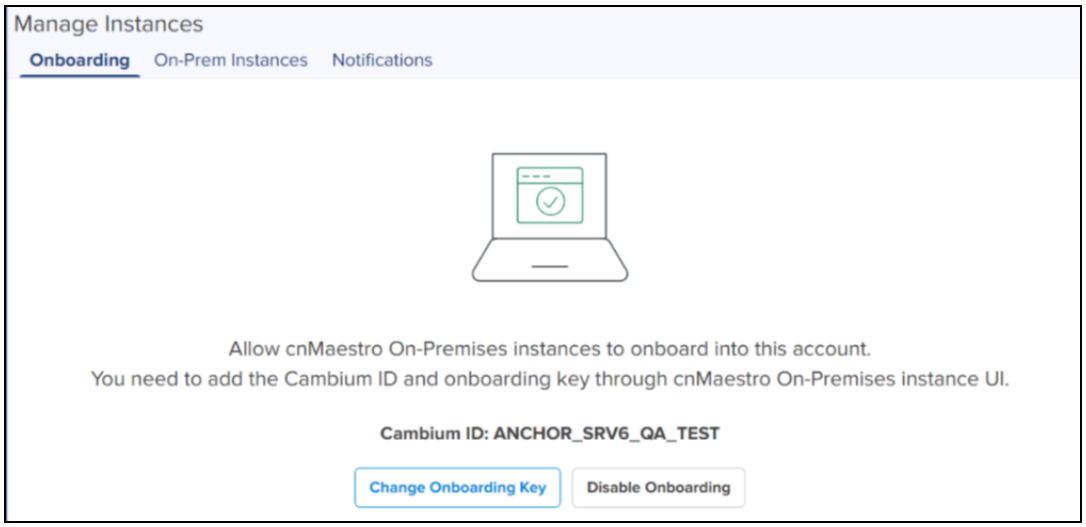
1. Log in to the cnMaestro UI https://cloud.cambiumnetworks.com.



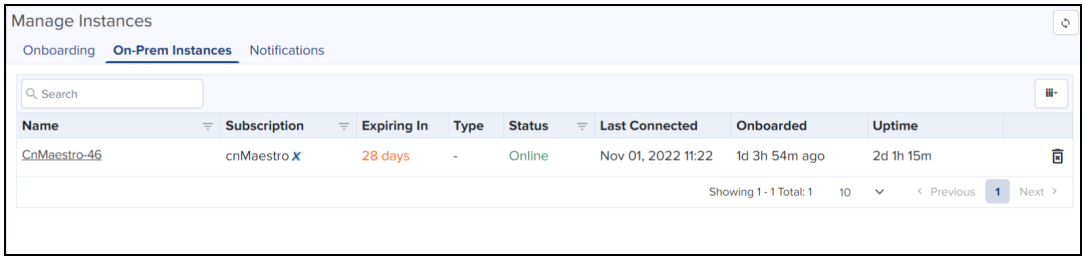
2. In **Account Type**, select **Anchor**.



3. Once the Anchor Account is created, an Onboarding Key must be set to allow On-Premises instances to connect.
4. Navigate to the **Manage Instances** page as shown below and edit the **Onboarding Key**. This key needs to be entered in the cnMaestro On-Premises UI to connect to the Anchor Account.



5. Once the On-Premises server has been onboarded with the Key, it will be included in the **Instances** page. Multiple On-Premises installations can be added to a single Anchor Account.

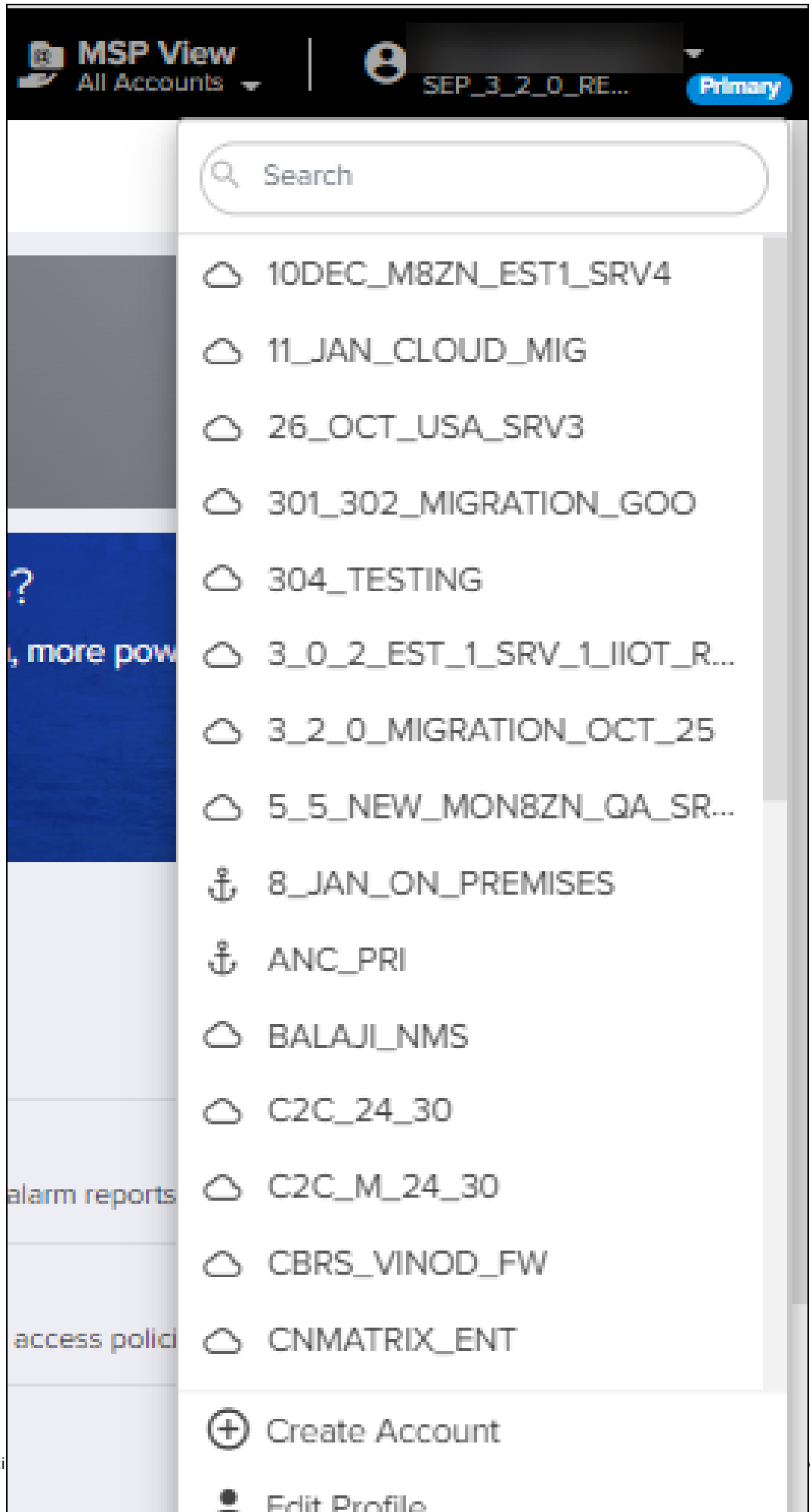


Clicking the instance host name displays the server information collected.

Multiple Cloud Accounts

Individuals can belong to multiple Cambium Cloud accounts. To create another Cloud Account (NMS or Anchor), select **Create Account** from the drop-down in the top-right corner. Enter the ID name in the **Search** field to filter the particular ID.

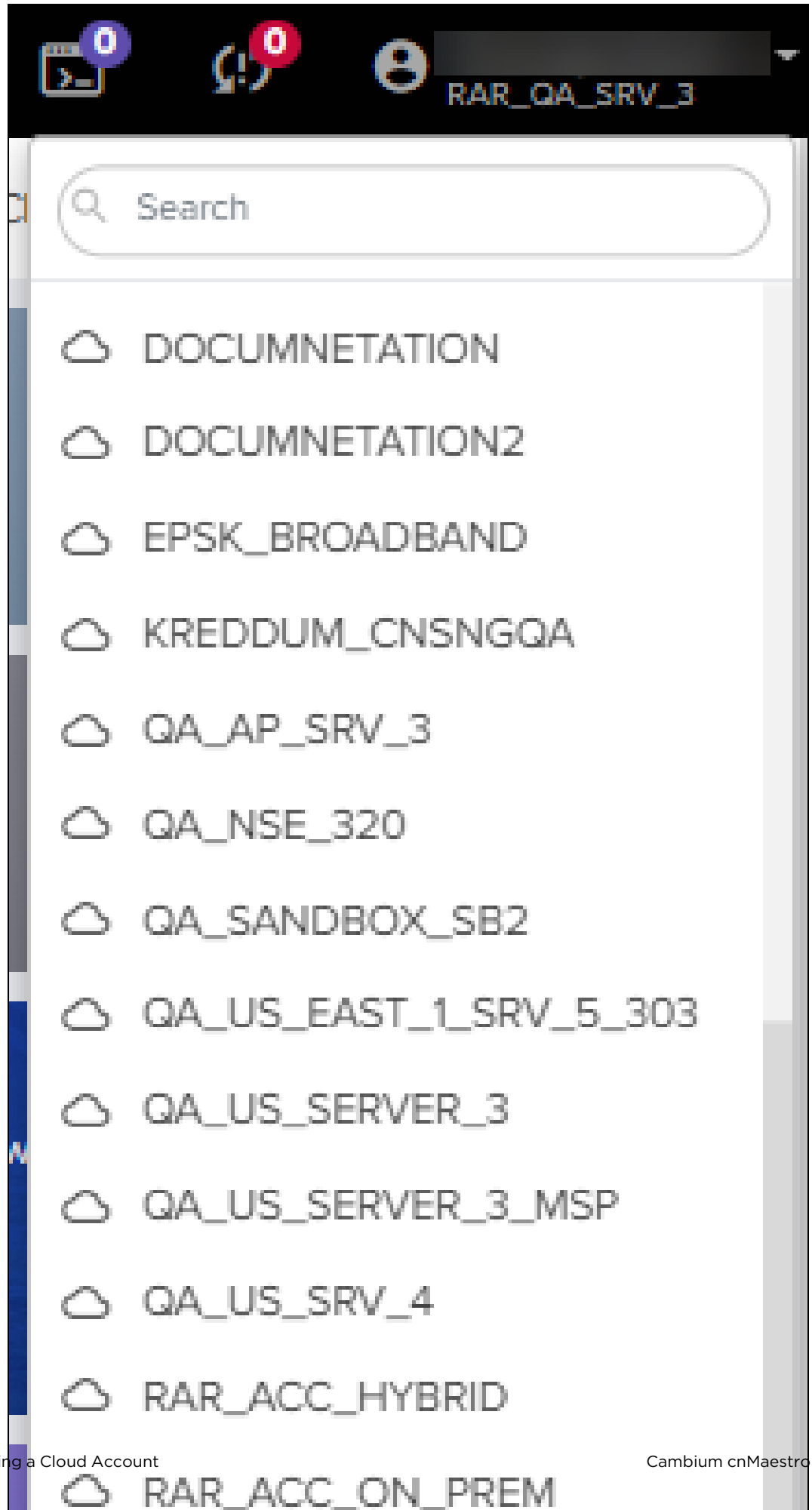
Figure 24 Multiple Cloud Management Accounts


MSP View
All Accounts
SEP_3_2_0_RE...
Primary
Search
10DEC_M8ZN_EST1_SRV4
11_JAN_CLOUD_MIG
26_OCT_USA_SRV3
301_302_MIGRATION_GOO
304_TESTING
3_0_2_EST_1_SRV_1_IIOT_R...
3_2_0_MIGRATION_OCT_25
5_5_NEW_MON8ZN_QA_SR...
8_JAN_ON_PREMISES
ANC_PRI
BALAJI_NMS
C2C_24_30
C2C_M_24_30
CBRS_VINOD_FW
CNMATRIX_ENT
Create Account
Edit Profile
, more pow
alarm reports
access polici

Account selection

To switch between accounts, use the drop-down in the top-right corner of the UI. It displays all accounts to which the user has access.

Figure 25 Account selection


0
0
RAR_QA_SRV_3
Search
DOCUMNETATION
DOCUMNETATION2
EPSK_BROADBAND
KREDDUM_CNSNGQA
QA_AP_SRV_3
QA_NSE_320
QA_SANDBOX_SB2
QA_US_EAST_1_SRV_5_303
QA_US_SERVER_3
QA_US_SERVER_3_MSP
QA_US_SRV_4
RAR_ACC_HYBRID
RAR_ACC_ON_PREM

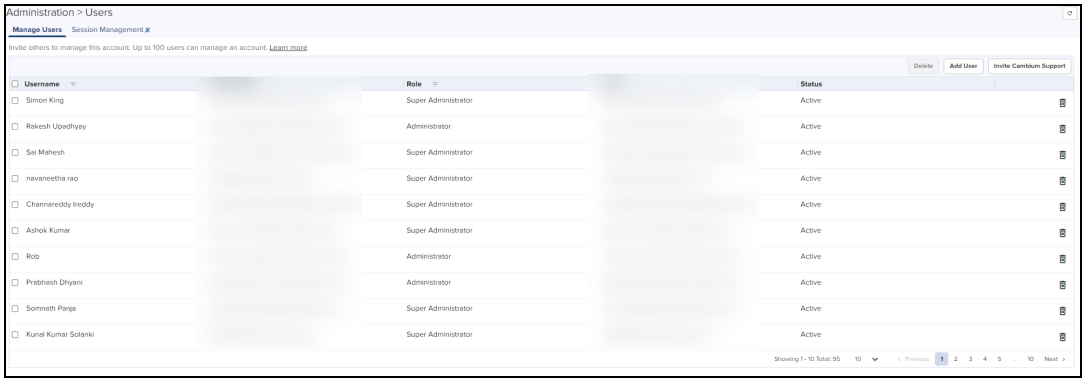
Concurrent access

The same user can access multiple accounts simultaneously; however, each account needs to be opened in a separate browser window or tab.

Managing users

A user can add additional administrators to their cloud management accounts and assign roles such as **Super Administrator, Administrator, Operator, Monitor,** and **CPI**.

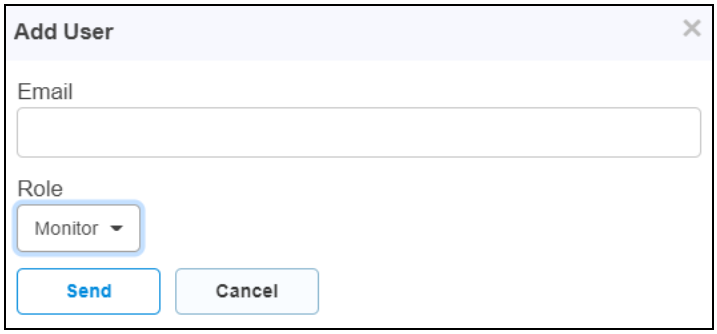
Figure 26 Managing users



Creating Users and Configuring User Roles

To add a user:

1. Navigate to **Administration** > **Users Page** > **Manage Users**.
2. Click **Add User**.



3. Enter the Email address in the **Email** text box.
4. To configure user role, select from the **Role** drop-down:
   - Super Administrator
   - Administrator
   - Operator
   - Monitor
   - CPI

For more details on user Roles, refer to Role-Based Access .

5. Click **Send**.
6. Cambium Cloud sends an email with directions on how to access the Cloud management account.

	Note The email does not need to match the email address of an existing Cambium user.

7. The email contains a link that directs you to the Cambium Cloud website https://cloud.cambiumnetworks.com.
8. Login using an existing Cambium Support Center account or create a new Cambium Support Center account.

Organization

Organizations allow multiple Cloud NMS Accounts and Anchor Accounts to consolidate CBRS billing into one Primary Account.

- Primary Account: provides services such as Shared SAS ID and Unified Payments to multiple accounts.
- Secondary Account: shares services such as CBRS billing SAS ID; the Secondary Account is linked with the Primary Account.

Organizations are currently only used with CBRS. Refer CBRS on how they can simplify CBRS management across multiple accounts.

General details of Organizations include:

1. One Organization can include accounts created in different countries and regions.
2. The maximum number of accounts managed by an Organization is 5.
3. There is one required Primary Account in an Organization and optionally multiple Secondary Accounts.
4. Removing the Primary Account will dissolve the Organization.
5. Both NMS and Anchor Accounts can be included in an Organization, and either can be Primary.

cnMaestro X

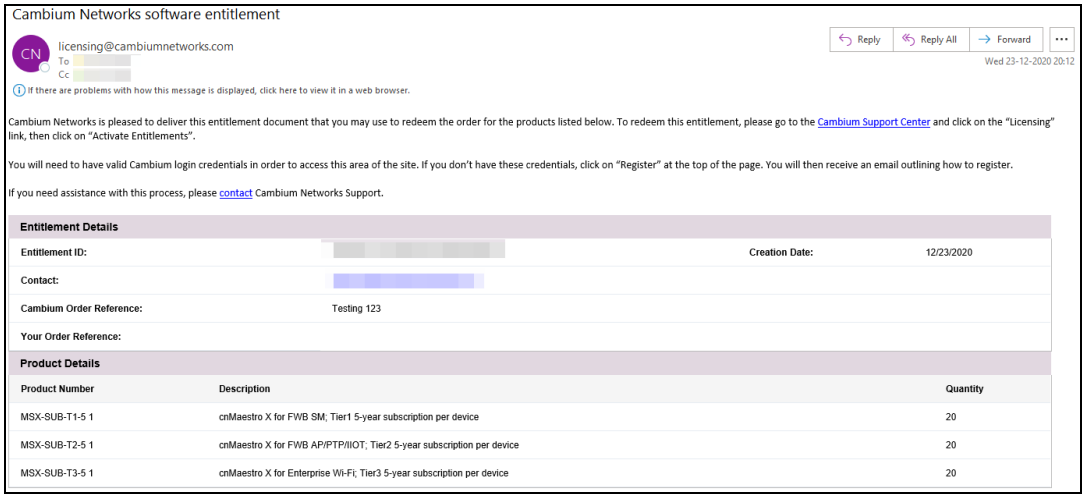
cnMaestro works in two different modes: Essentials, and X. cnMaestro Essentials is free and supports basic network management functionality. cnMaestro X is paid and requires subscriptions.

New accounts are created with cnMaestro Essentials capabilities. cnMaestro X features can be activated with the **Entitlement ID** provided by Cambium Networks. For more details, refer to cnMaestro Features. You can purchase the **Entitlement ID** from an authorized **Cambium Reseller or Distributor**. The subscriptions available for 1 year, 3 years, and 5 years per device type and device count. Pricing is based on Device Tiers. You need an **Entitlement ID** with equal or more device counts for each tier shown in the Device Summary.

cnMaestro X part numbers are available at https://www.cambiumnetworks.com/products/software/cnmaestro-x/. Once your order is processed, you will receive an email from Cambium containing your **Entitlement ID**.

	Note: • Some features are tagged **XA** which indicate that cnMaestro will have a different subscription mode for them in upcoming releases.

Figure 27 Example of Entitlement ID



Cambium Networks software entitlement

licensing@cambiumnetworks.com

To

Cc

Reply | Reply All | Forward

Wed 23-12-2020 20:12

If there are problems with how this message is displayed, click here to view it in a web browser.

Cambium Networks is pleased to deliver this entitlement document that you may use to redeem the order for the products listed below. To redeem this entitlement, please go to the Cambium Support Center and click on the "Licensing" link, then click on "Activate Entitlements".

You will need to have valid Cambium login credentials in order to access this area of the site. If you don't have these credentials, click on "Register" at the top of the page. You will then receive an email outlining how to register.

If you need assistance with this process, please contact Cambium Networks Support.

Entitlement Details

Entitlement ID:		**Creation Date:**	12/23/2020
Contact:			
Cambium Order Reference:	Testing 123		
Your Order Reference:			

Product Details

Product Number	Description	Quantity
MSX-SUB-T1-5 1	cnMaestro X for FWB SM; Tier1 5-year subscription per device	20
MSX-SUB-T2-5 1	cnMaestro X for FWB AP/PTP/IIOT; Tier2 5-year subscription per device	20
MSX-SUB-T3-5 1	cnMaestro X for Enterprise Wi-Fi; Tier3 5-year subscription per device	20

Note:

- If you are creating new accounts after cnMaestro 3.0.0, then you can request a 90-day free trial either through the link available on the cnMaestro home page or https://www.cambiumnetworks.com/cnmaestro-x/.
- The 90 days free trial gets activated automatically for the accounts created before cnMaestro 3.0.0.

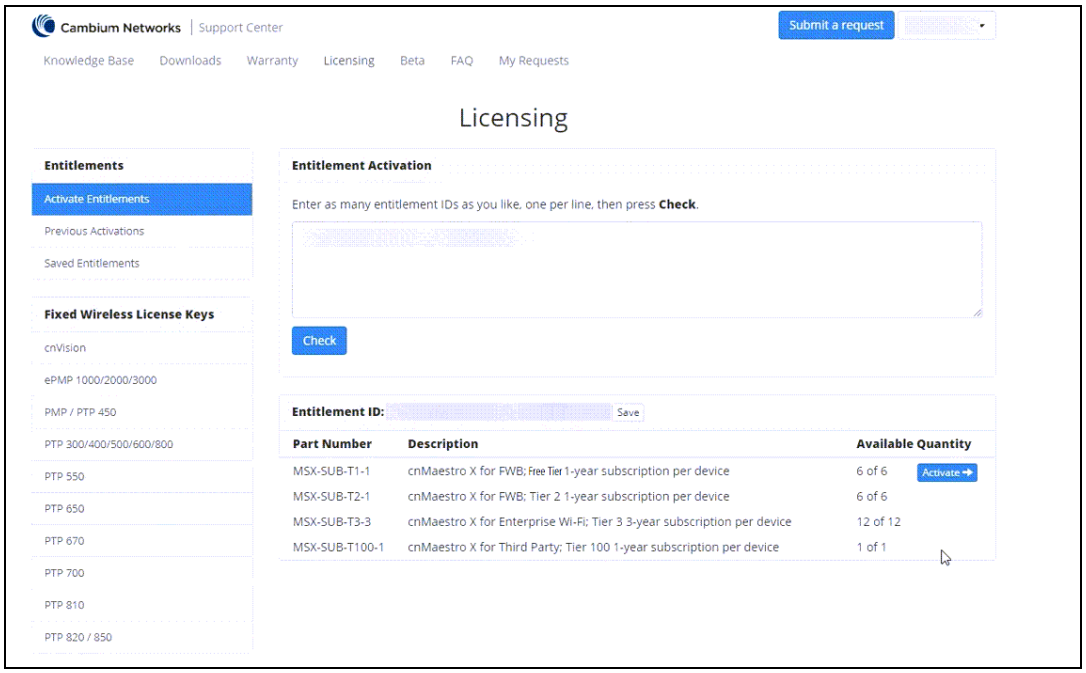
NSE Subscription:

- The NSE device subscription is supported in cnMaestro Essentials as well as cnMaestro X in the cnMaestro Cloud deployment.
- You can avail the Entitlement ID for NSE with the required device slots according to the Device Tiers by contacting the reseller or distributor.
- When you move other devices from cnMaestro Essentials to cnMaestro X, you can continue to use the same NSE subscription.
- When you have only Free Tier devices and a subscription for NSE, you can manually upgrade to cnMaestro X and downgrade to Essentials on your own.

cnMaestro X Activation

To activate the cnMaestro X account, perform the steps below:

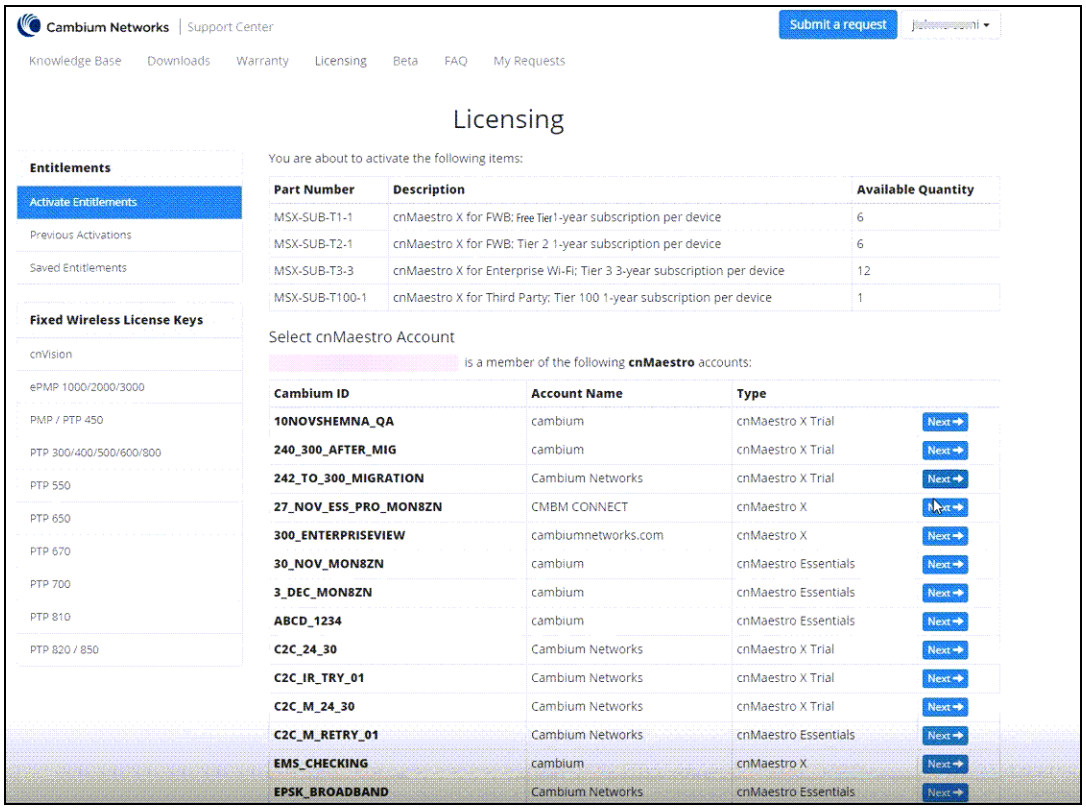
1. Navigate to https://support.cambiumnetworks.com/entitlements, or from the cnMaestro home page click the **Licensing** tile.
2. In the Licensing page under **Entitlements** select **Activate Entitlements**.
3. Enter the **Entitlement ID** received from licensing@cambiumnetworks.com.
4. Click **Check.**



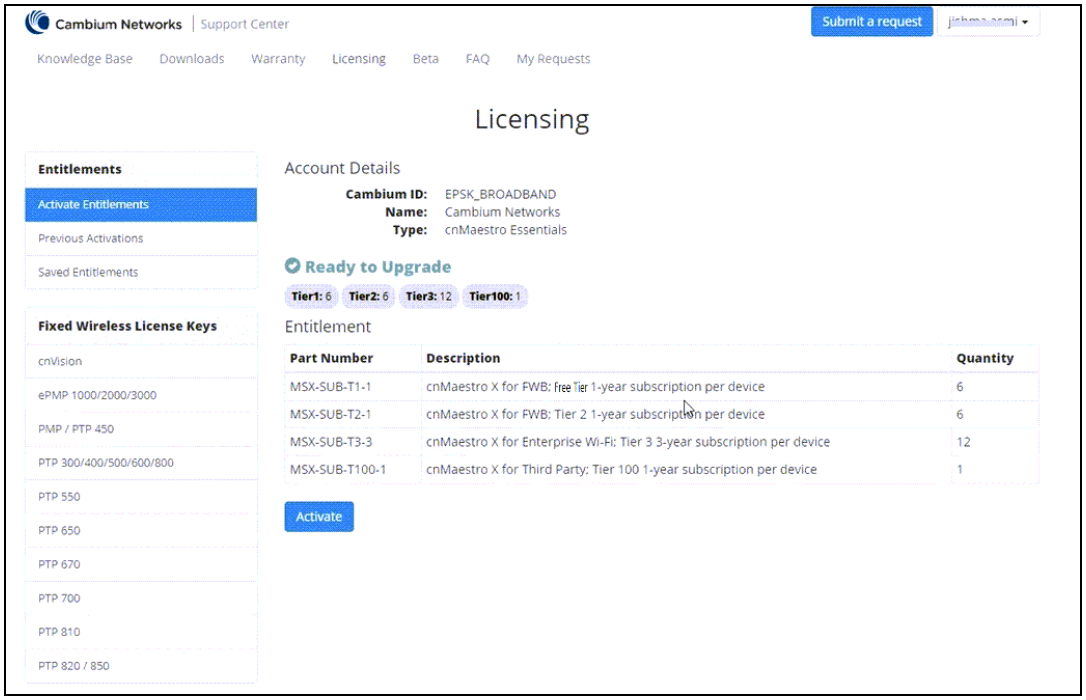
5. Once the **Entitlement ID** is validated, the **Activate** button is enabled.

	Note: All subscribed part numbers must be activated under each **Entitlement ID**. The part numbers subscribed with **MSX** must be activated together.

6. Click **Activate**.
7. Select the Cambium ID from the list and click **Next.**



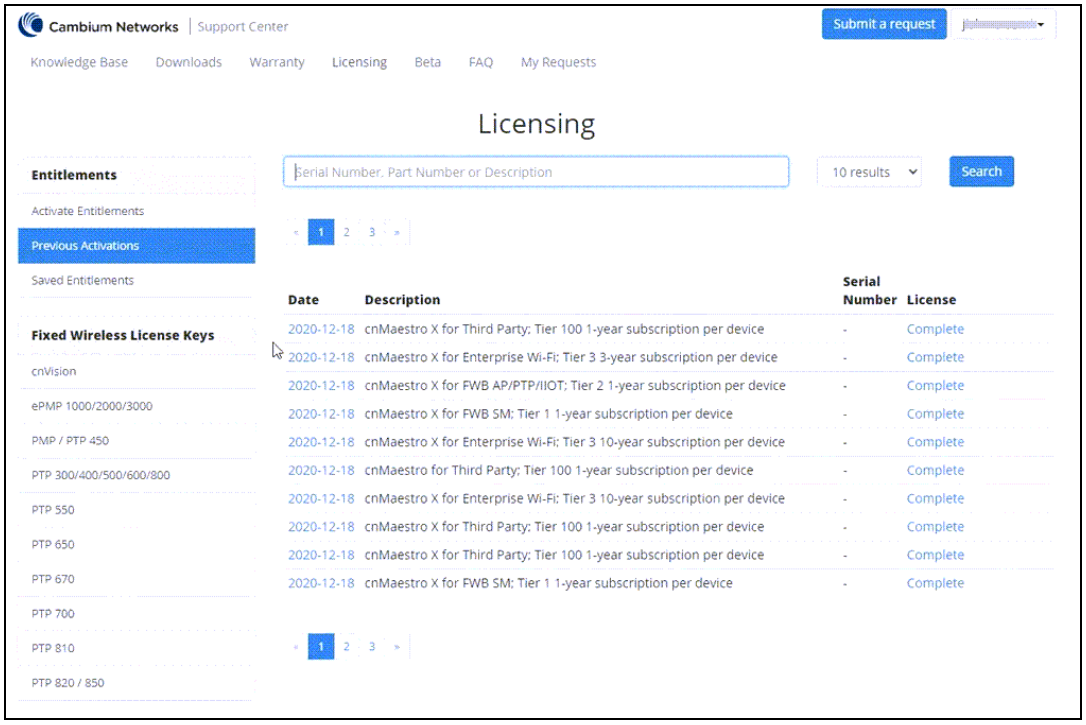
8. The **Ready to Upgrade** page displays.



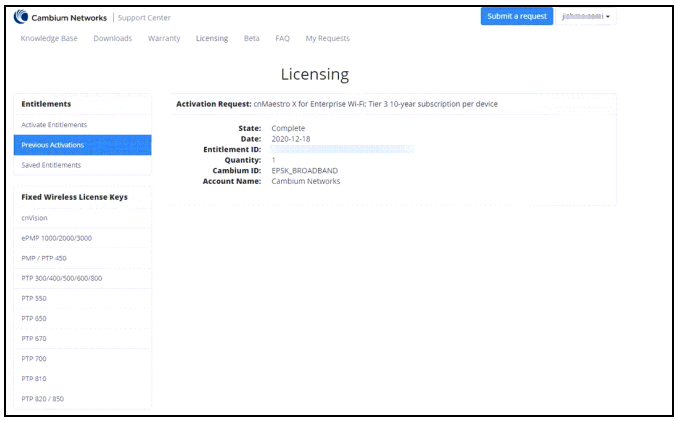
9. Click **Activate**.

	Note: If a Slot Deficit error occurs (meaning there are more devices than slots available) occurs, refer to Slot Deficit.

10. The **Previous Activations** page displays the **Complete** activation list.

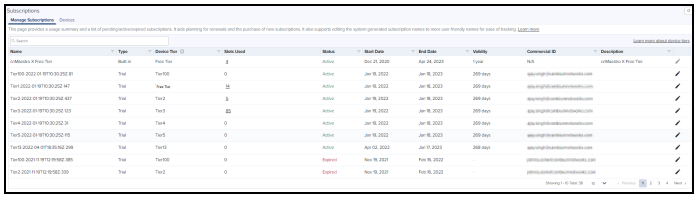


11. Click any licensed description which is marked **Complete**.

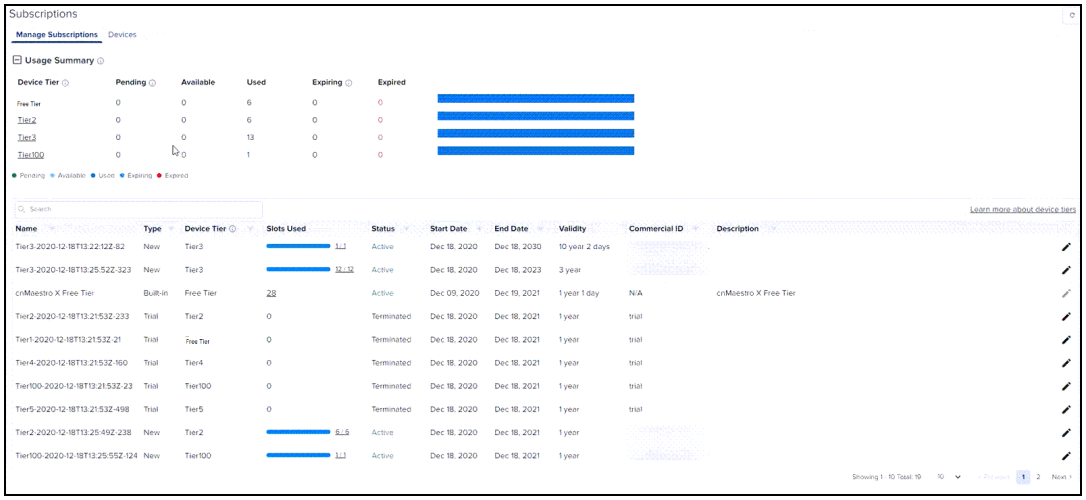


The Subscription is activated with the number of requested slots.

In the cnMaestro page, a notification displays for a successful update, and the user is asked to wait for 15 minutes.



The user account upgrades to a cnMaestro X account.

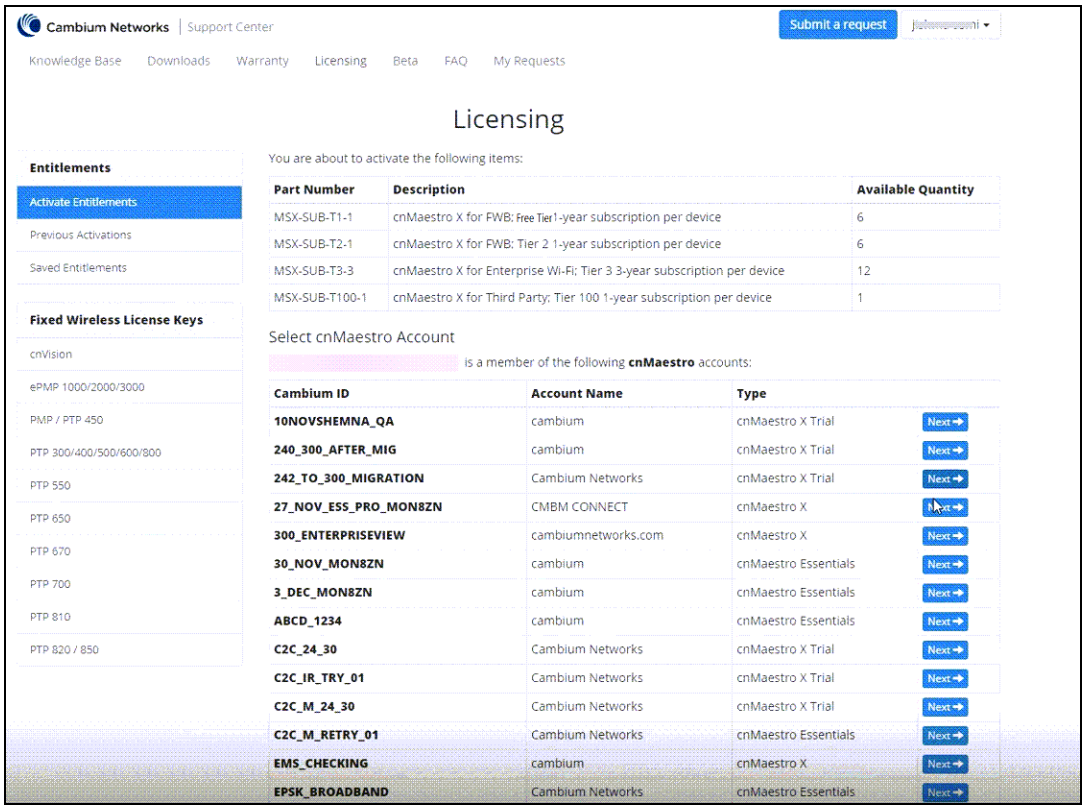


Slot Deficit

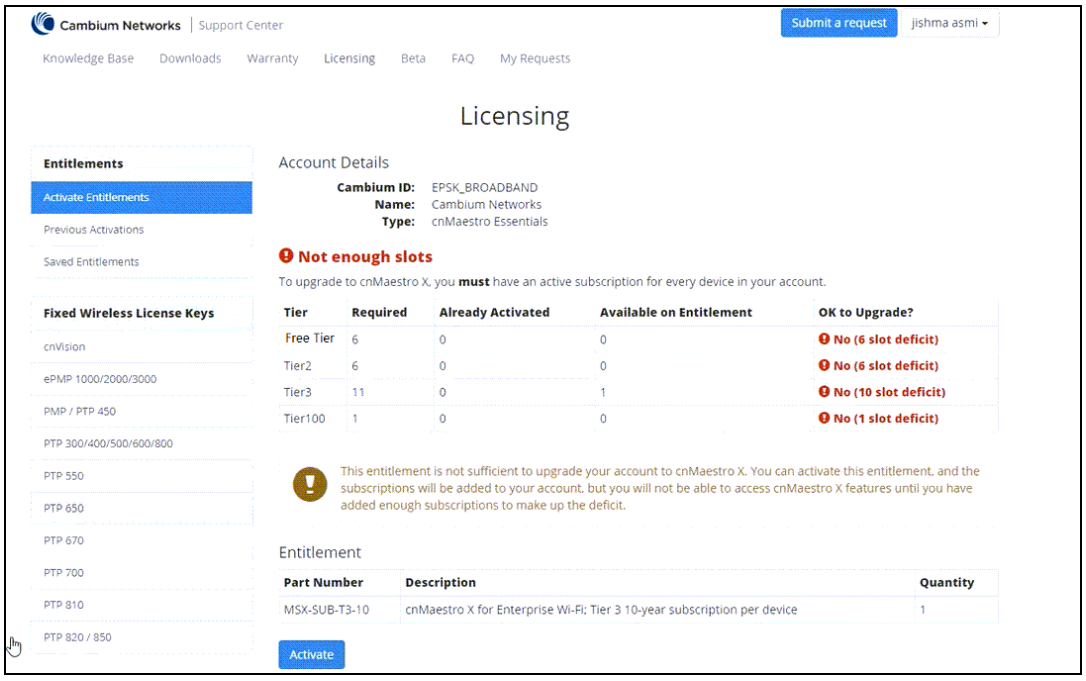
A Slot Deficit occurs when the number of slots (one for each device) activated from the entitlement is less than the slots required. This can occur if there are more devices in the account than slots.

Upgrading to cnMaestro X will be pending until either devices are removed to match the available slots or more slots are added to cover the deficit.

1. Select the **Cambium ID** from the list and click **Next**.

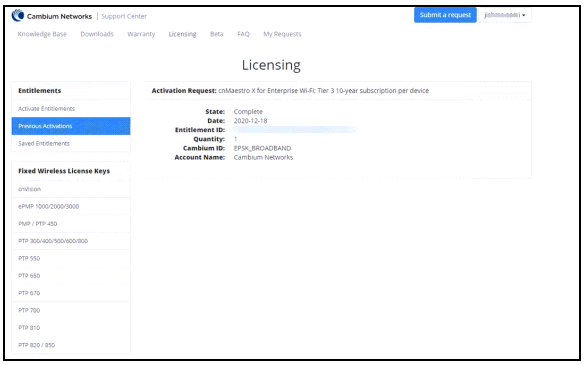


2. The **Active Entitlement** page displays **Not enough slots** when there is a slot deficit.

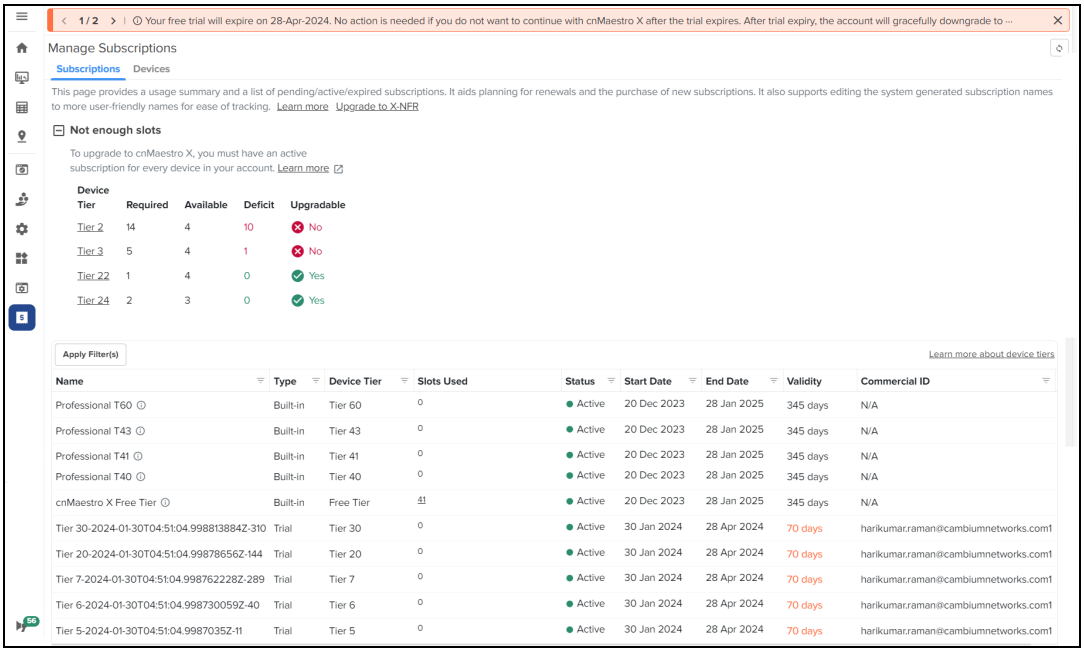


3. If the user activates even with the slot deficit warning.

    - Activation process completes.



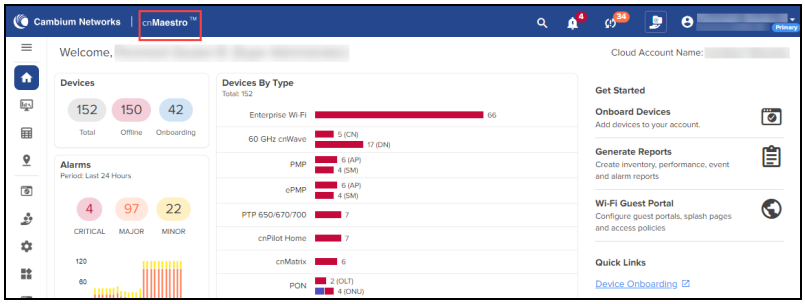
- cnMaestro X upgrade will be pending, since there are not enough slots to match the devices in the account. Refer to **Not enough slots** in the **Manage Subscriptions** tab to identify the slot deficit.
- It also displays the notification message shown below.



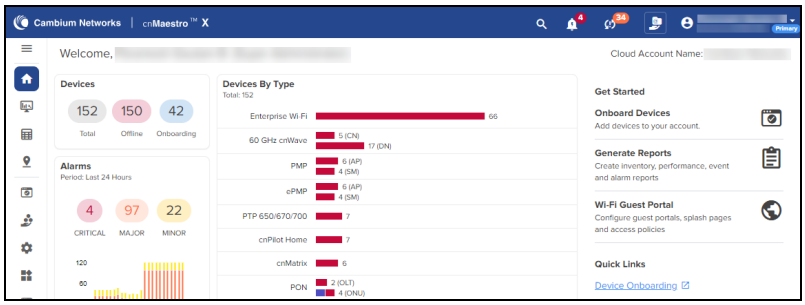
4. Once the user removes the deficit, the account automatically upgrades to cnMaestro X.

Subscription Management

A cnMaestro Essentials account can be identified as shown below.



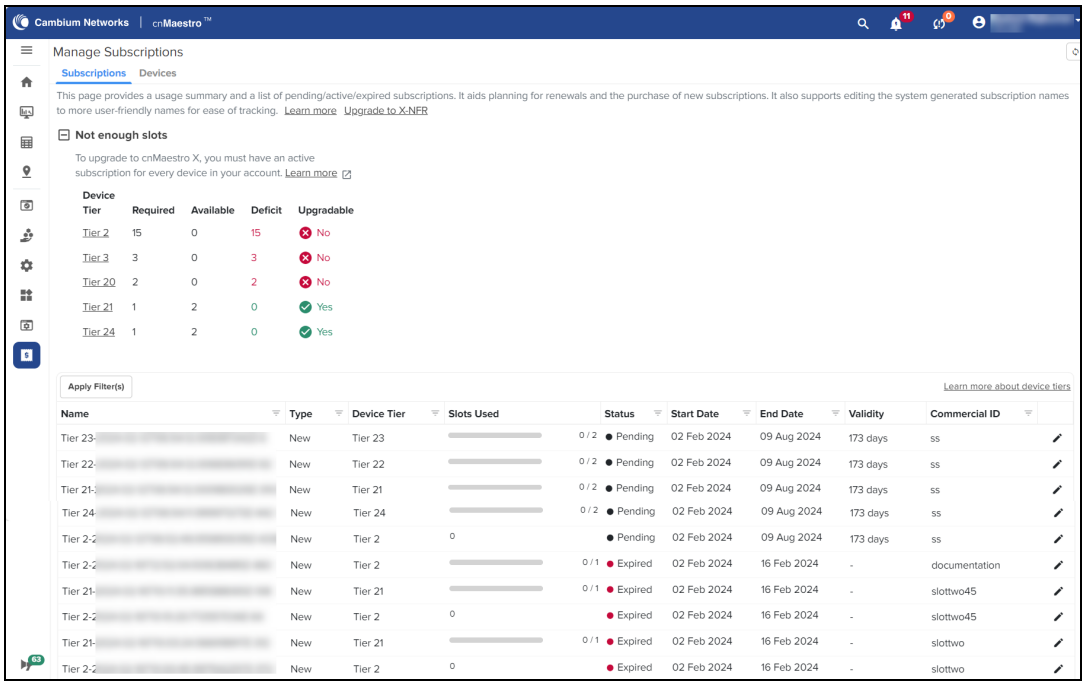
If a subscription is active, the cnMaestro X banner will display.



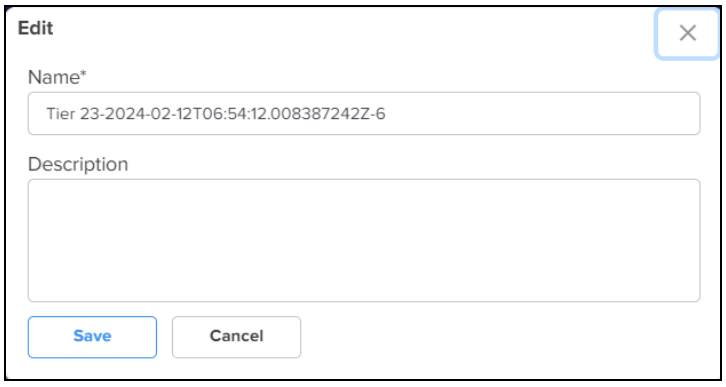
Manage Subscriptions

Users can view, edit, check the validity and status of subscriptions.

1. Navigate to the **cnMaestro > Manage Subscriptions** > **Subscriptions** page.

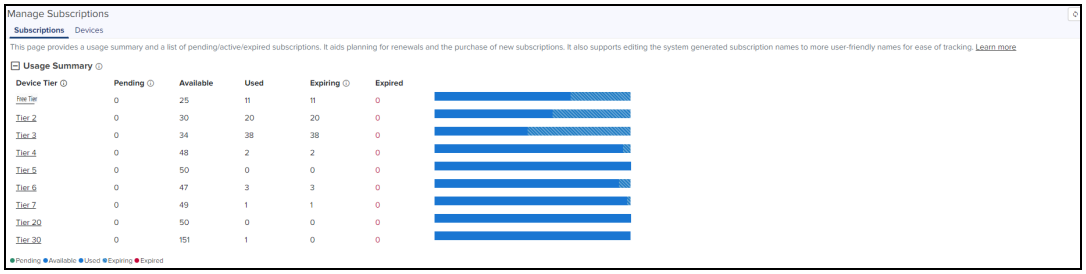


2. Click the **Edit** icon to edit the subscription **Name** and **Description** and click **Save.**



- Onboard devices according to the allotted slots.
- New devices are added to the subscription with the earliest expiration.

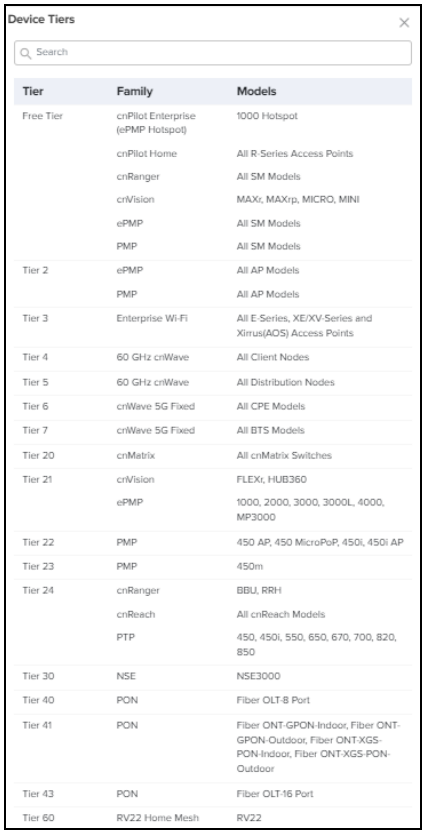
Usage Summary



Usage summary displays the number of slots that are **Pending**, **Available**, **Used**, and **Expired**.

Device Tiers

Device Tiers display the classifications allotted for each device.



Tier	Family	Models
Free Tier	cnPilot Enterprise (ePMP Hotspot)	1000 Hotspot
	cnPilot Home	All R-Series Access Points
	cnRanger	All SM Models
	cnVision	MAXr, MAXrp, MICRO, MINI
	ePMP	All SM Models
	PMP	All SM Models
Tier 2	ePMP	All AP Models
	PMP	All AP Models
Tier 3	Enterprise Wi-Fi	All E-Series, XE/XV-Series and Xirrus(AOS) Access Points
Tier 4	60 GHz cnWave	All Client Nodes
Tier 5	60 GHz cnWave	All Distribution Nodes
Tier 6	cnWave 5G Fixed	All CPE Models
Tier 7	cnWave 5G Fixed	All BTS Models
Tier 20	cnMatrix	All cnMatrix Switches
Tier 21	cnVision	FLEXr, HUB360
	ePMP	1000, 2000, 3000, 3000L, 4000, MP3000
Tier 22	PMP	450 AP, 450 MicroPoP, 450i, 450i AP
Tier 23	PMP	450m
Tier 24	cnRanger	BBU, RRH
	cnReach	All cnReach Models
	PTP	450, 450i, 550, 650, 670, 700, 820, 850
Tier 30	NSE	NSE3000
Tier 40	PON	Fiber OLT-8 Port
Tier 41	PON	Fiber ONT-GPON-Indoor, Fiber ONT-GPON-Outdoor, Fiber ONT-XGS-PON-Indoor, Fiber ONT-XGS-PON-Outdoor
Tier 43	PON	Fiber OLT-16 Port
Tier 60	RV22 Home Mesh	RV22

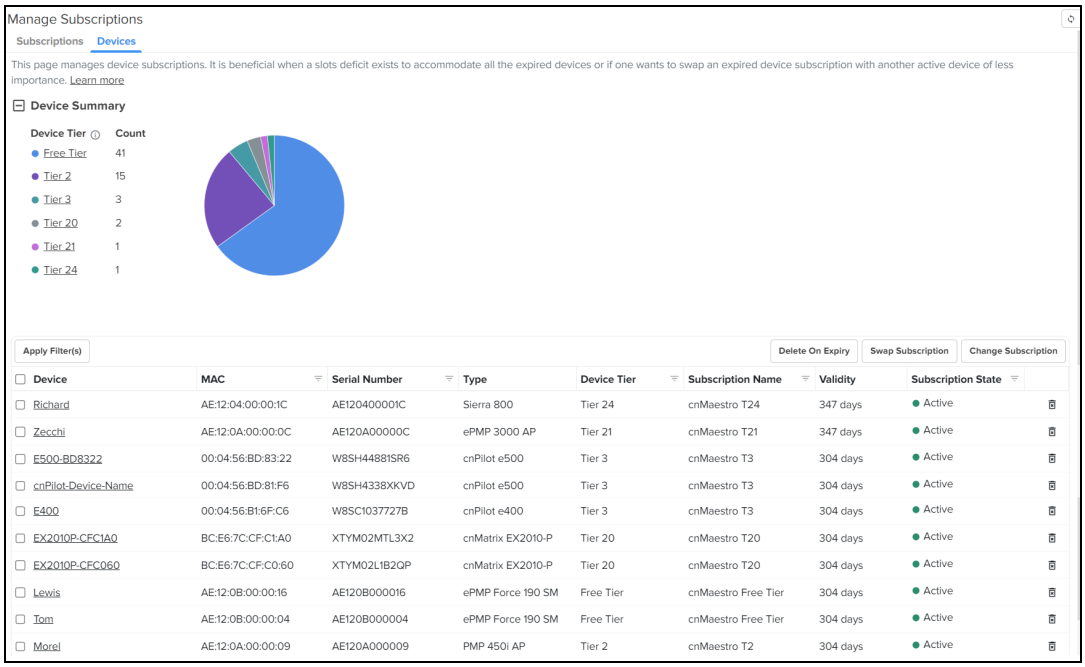
Unlisted devices do not require paid subscription. They are part of the Free Tier (Tier 0). All Tier 0 through Tier 7 devices can be used with an Essentials account. Tier 20 and Tier 30 require paid subscription even in Essentials mode.

NOTE:

To manage NSE devices under Essentials account, you need a subscription. If your account is upgraded to cnMaestro X, the Essentials NSE subscription will automatically be transferred to cnMaestro X. You will not need any additional subscription for NSE again.

Devices

The Devices page displays devices mapped to their subscription, and it allows changing or swapping a subscription. **Device Summary** displays device counts per tier.



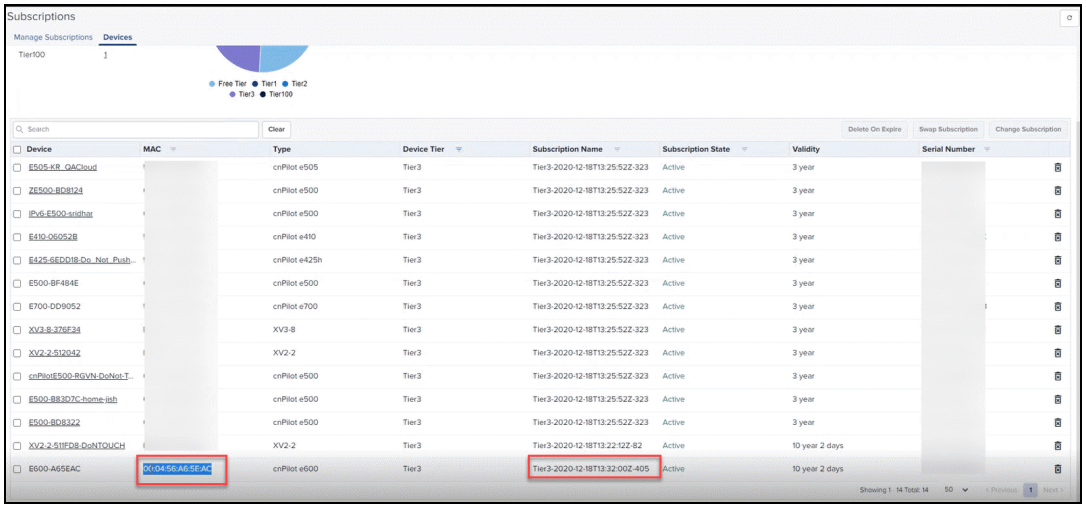
Swap Subscription

Swap Subscription allows the user to swap one device subscription with another device of the same tier. It can be performed at any time.

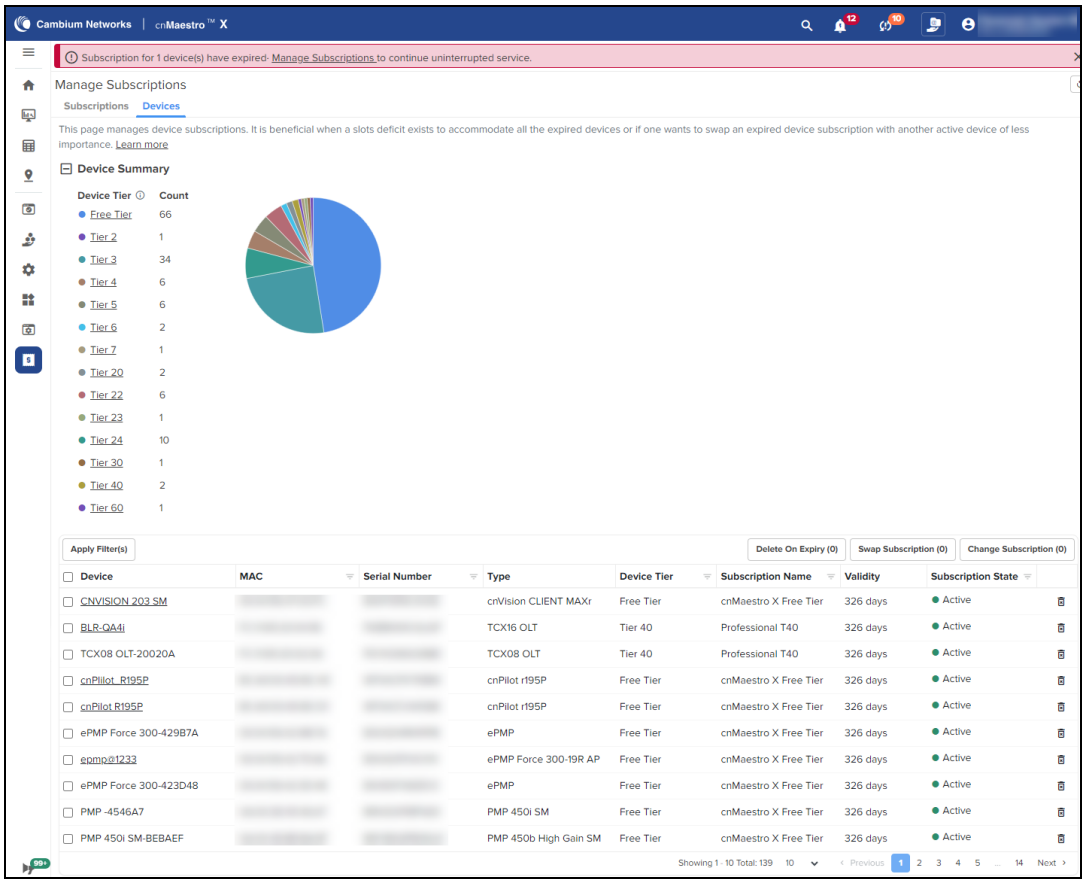
	NOTE: Swap subscription operation is not allowed for devices belonging to Free Tier, Tier 40, Tier 41, Tier 43, and Tier 60.

To swap subscriptions:

1. Navigate to the **Subscriptions > Devices** and copy the **MAC address** to which the device subscription needs to be swapped.

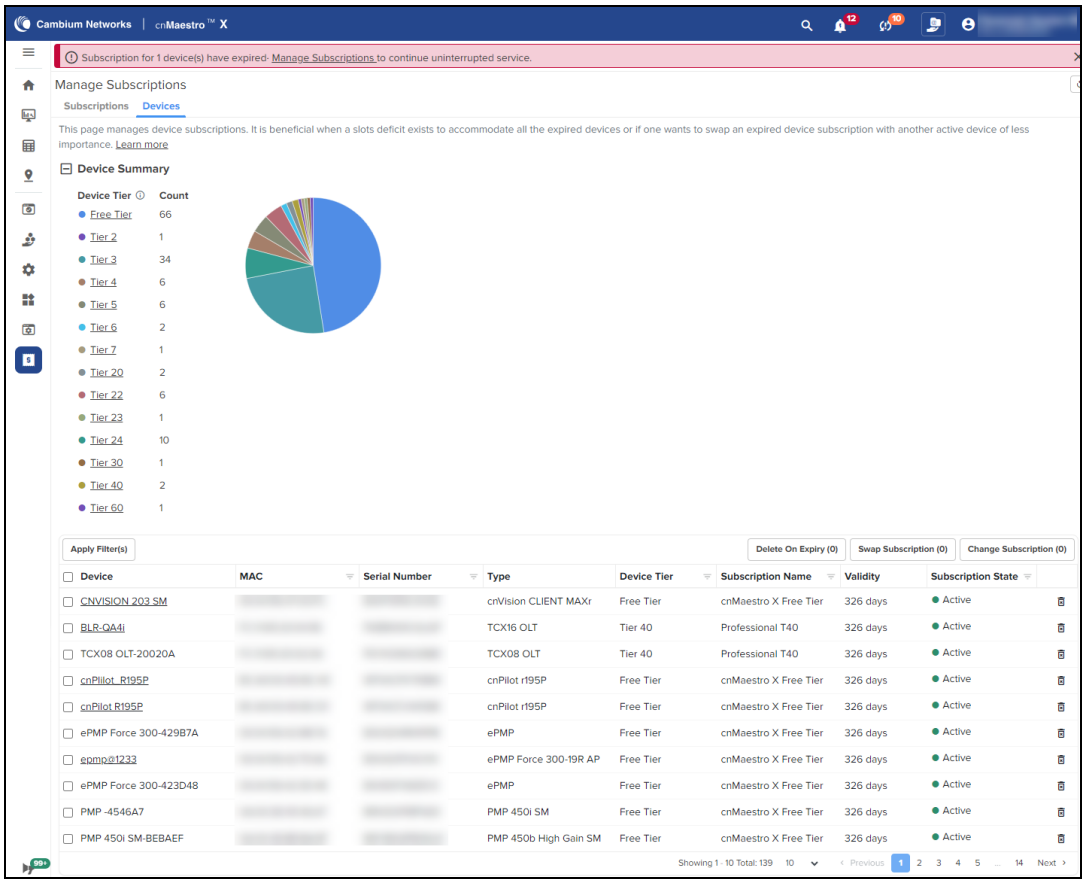


2. Select the device to be swapped to another subscription.



3. Click **Swap Subscription.** Enter the **MAC Address** and click **Swap.**

Device updated successfully message displays on success.



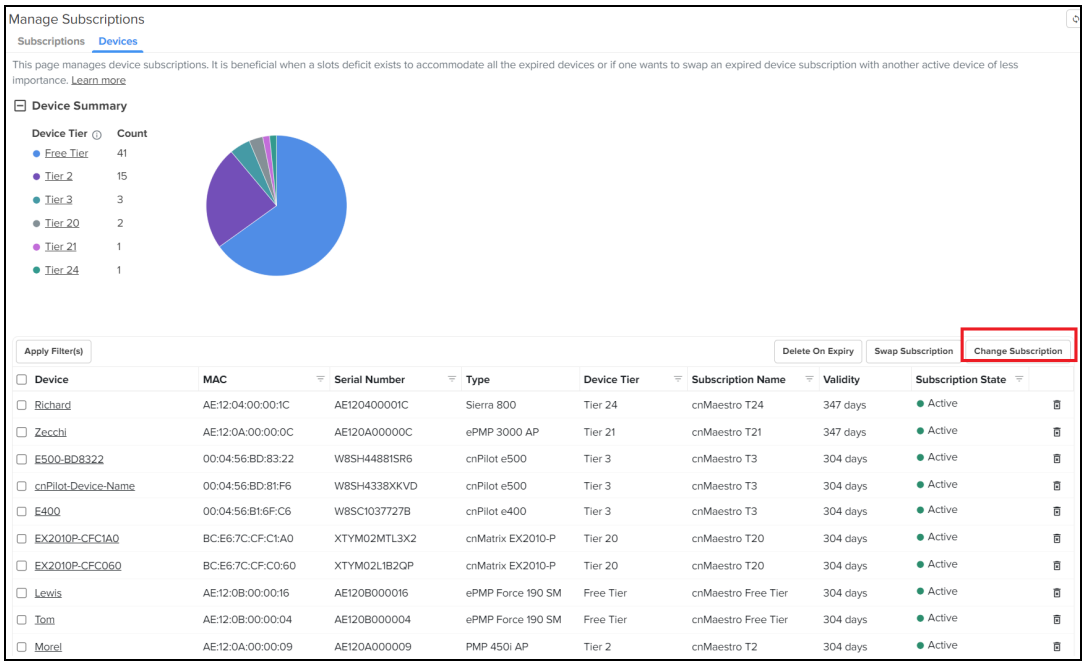
Change Subscription

Change Subscription changes the device from one subscription to another of the same tier when slots are available.

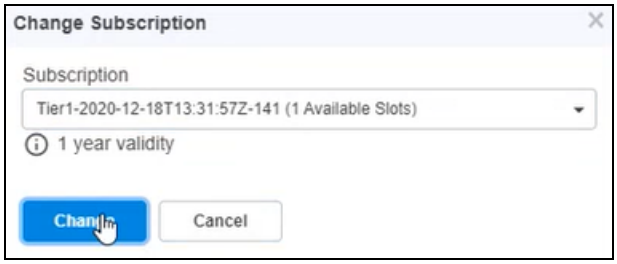
	NOTE: Change subscription operation is not allowed for devices belonging to Free Tier, Tier 40, Tier 41, Tier 43, Tier 60.

To change subscription:

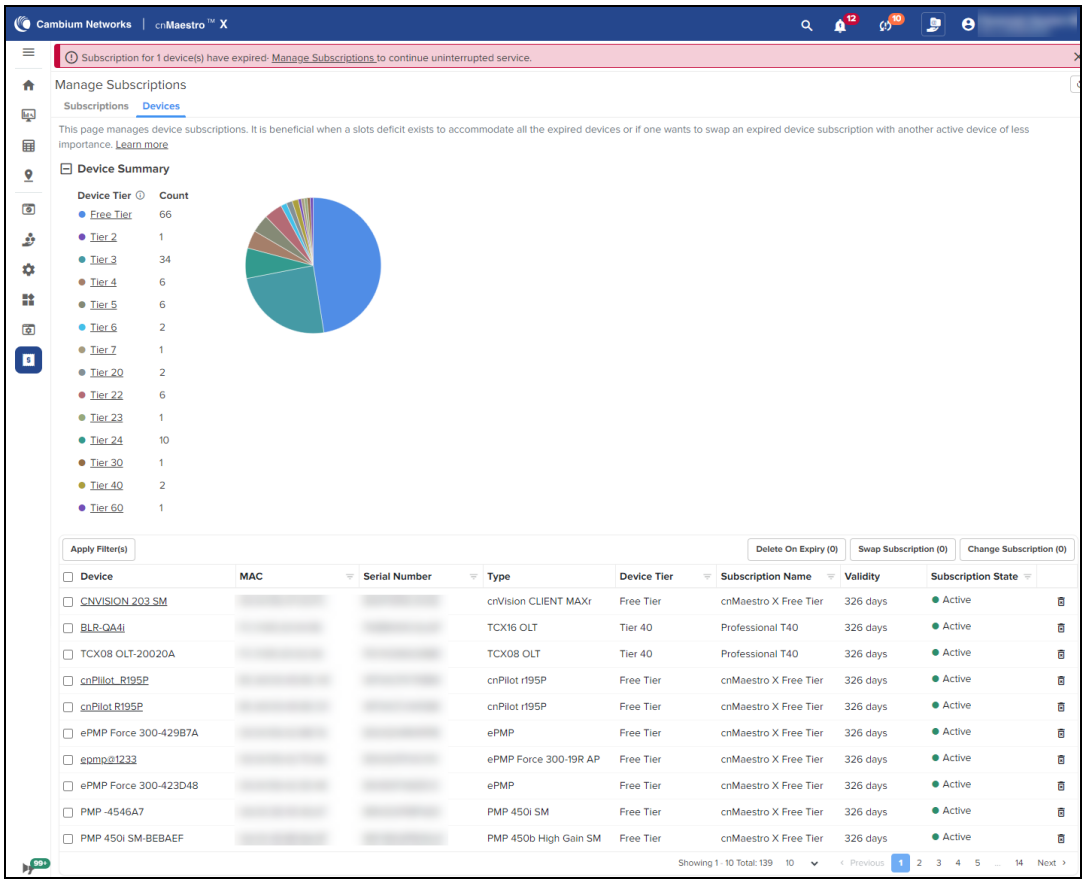
1. Navigate to the **Subscriptions** > **Devices** and select the device and click **Change Subscriptions.**



2. **Change Subscription** window pops up, select the **Subscription** from the drop-down.



3. Click **Change**. Success notification pops up.



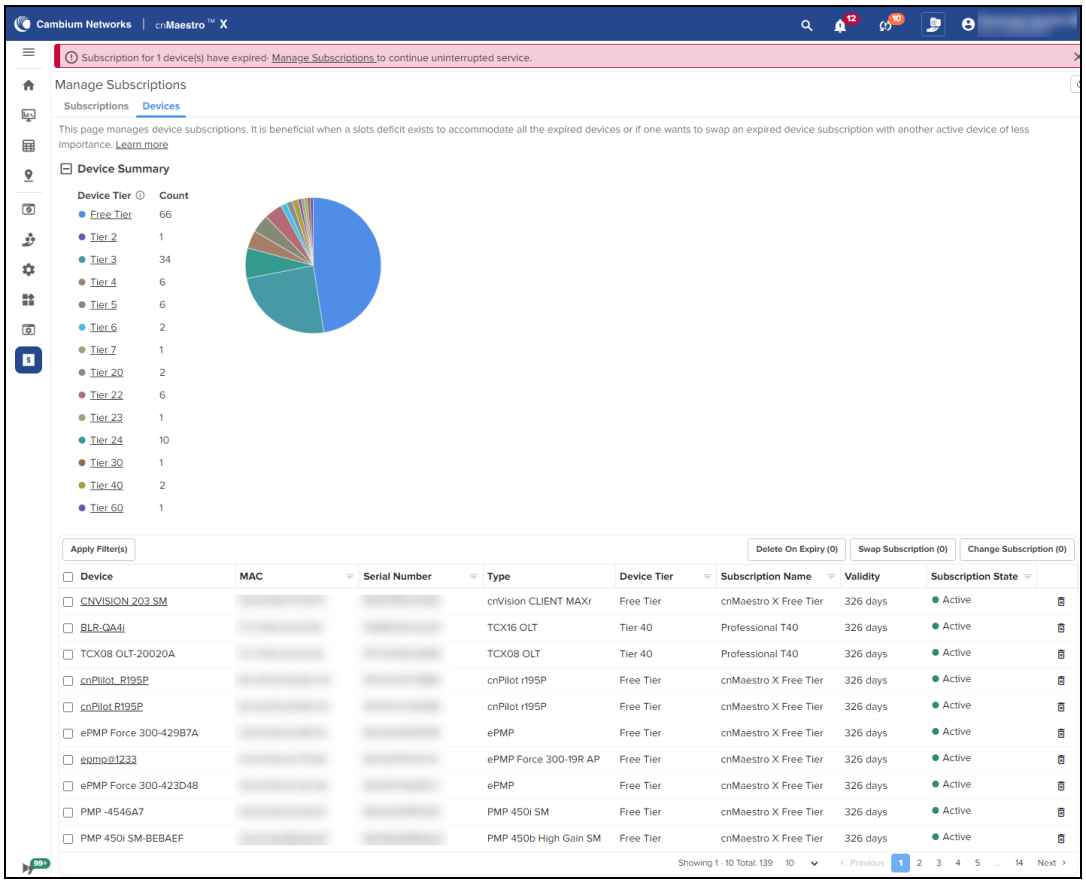
Delete on Expiry

	**Note:** • Once a device state is changed to **Delete on Expiry**, this action cannot be undone. • Tier 30 (NSE) devices also support **Delete on Expiry** in cnMaestro Essentials.

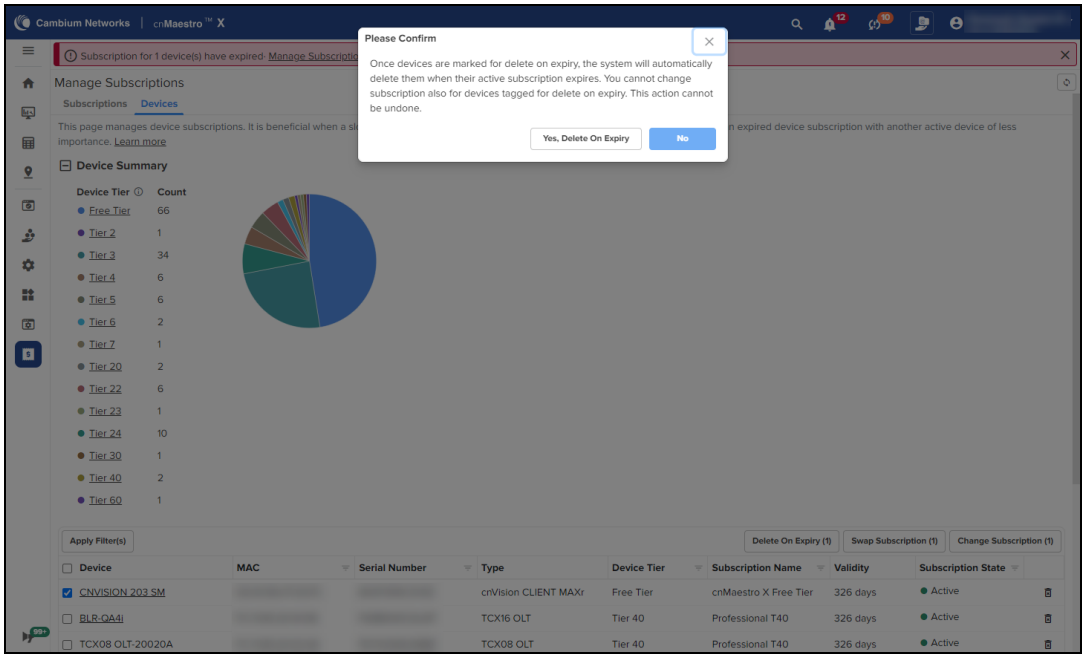
User can select the device and set the subscription state to **Delete on Expiry**, once the device is expired, it automatically is deleted from the device list.

To set the Delete on Expiry:

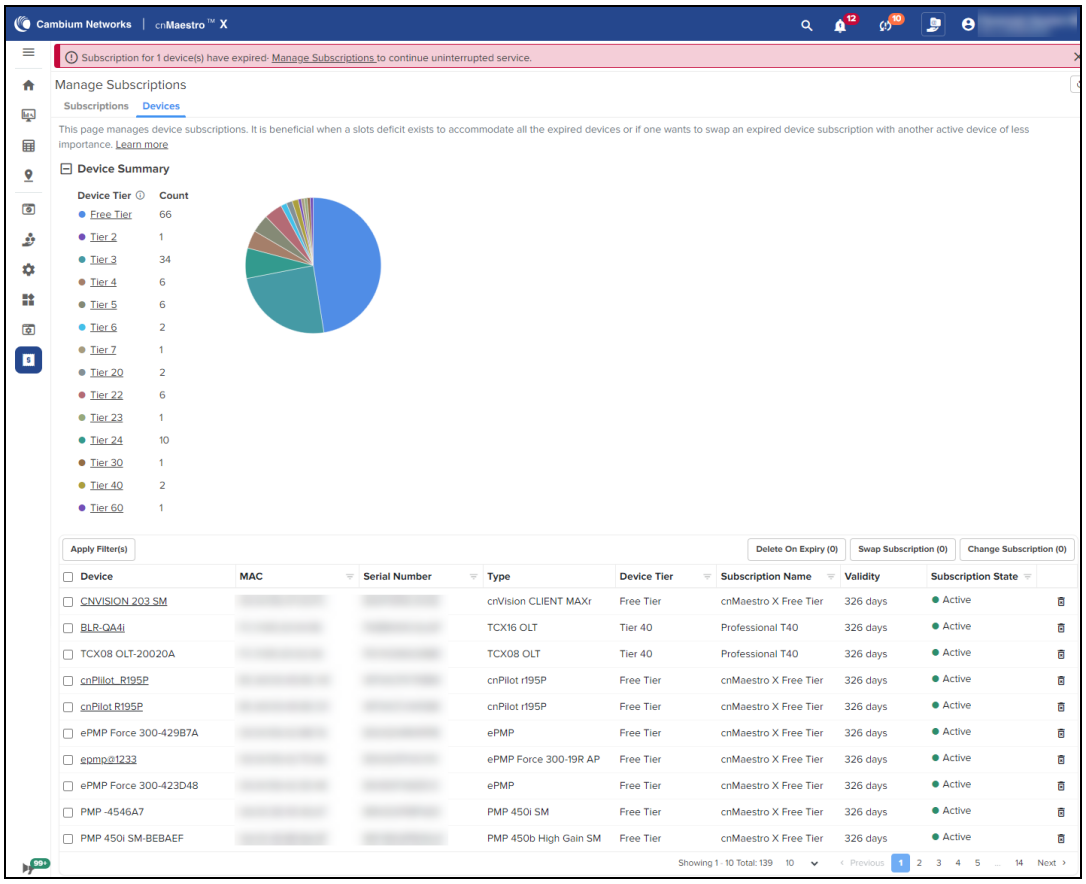
1. Navigate to the **Subscriptions** > **Devices** and select the device.



2. Click **Delete on Expiry.**
3. **Please Confirm** window pops up.

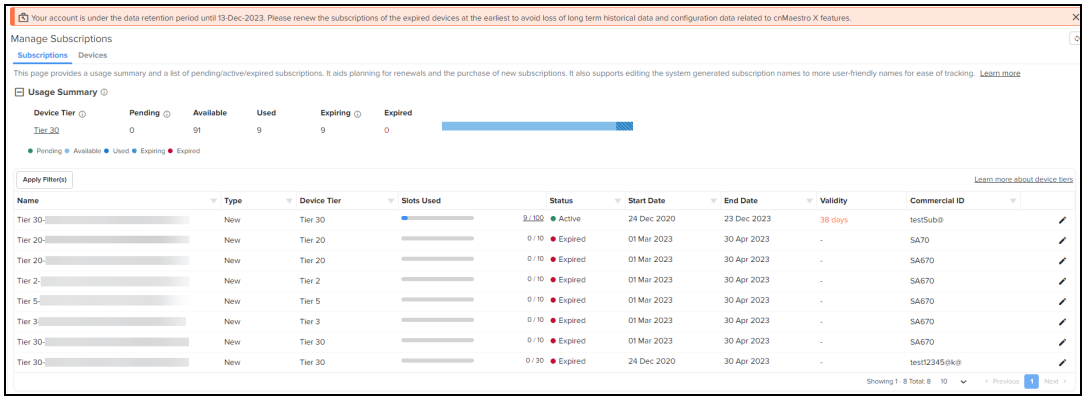


4. Click **Yes Delete On Expiry**.
5. Subscription state changes to **Delete on Expiry** from **Active**.



Expiry Notification

If the subscription validity is less than 90, in the **Validity** column the number of days left are highlighted in red color. Also, a notification message will be displayed as shown below.



The expired subscription slots are automatically moved to the active subscription, if the number of expired subscription slots is equal to or less than the number of available subscription slots.

Expired Device

Once the device expires, all device level features become inaccessible. The device should either be deleted from the account or added to a new subscription as shown below:

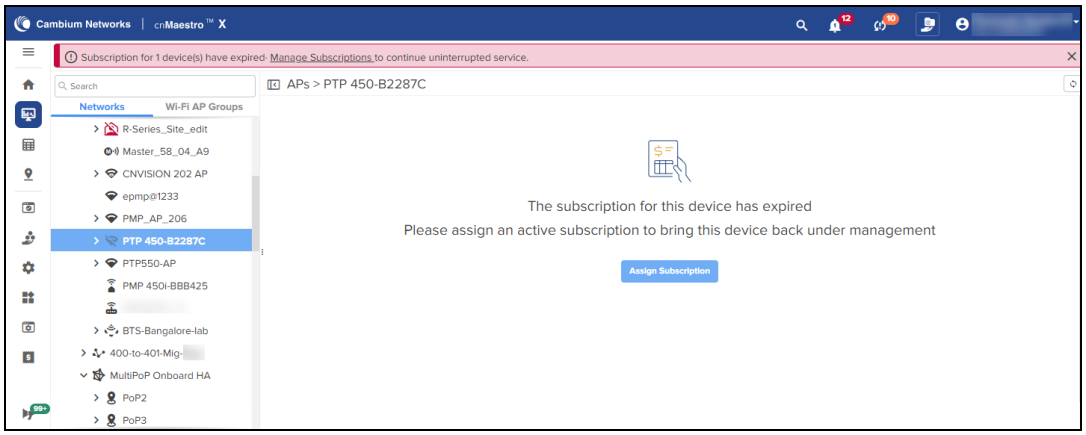
Note:

In the expired device dashboard:

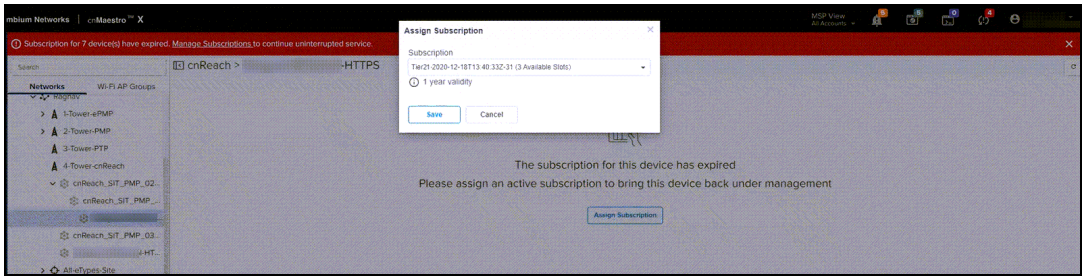
- If any free slots are available Change Subscription will be enabled.
- If free slots are not available Swap Subscription will be enabled with the specific device MAC address.
- If you have an X account with expired devices, you can downgrade to Essentials and manage all devices without X features. The activated subscriptions will be moved to pending state.

Change Subscription at device level

1. Navigate to **Manage** > **Network >** and select the expired device.



2. Click **Assign Subscription** and select the **Subscription** from the list.

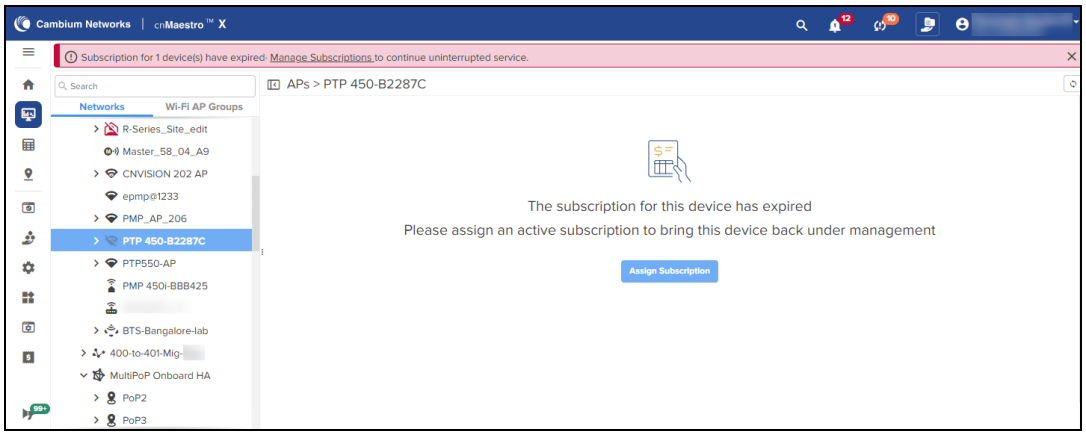


3. Click **Save**.

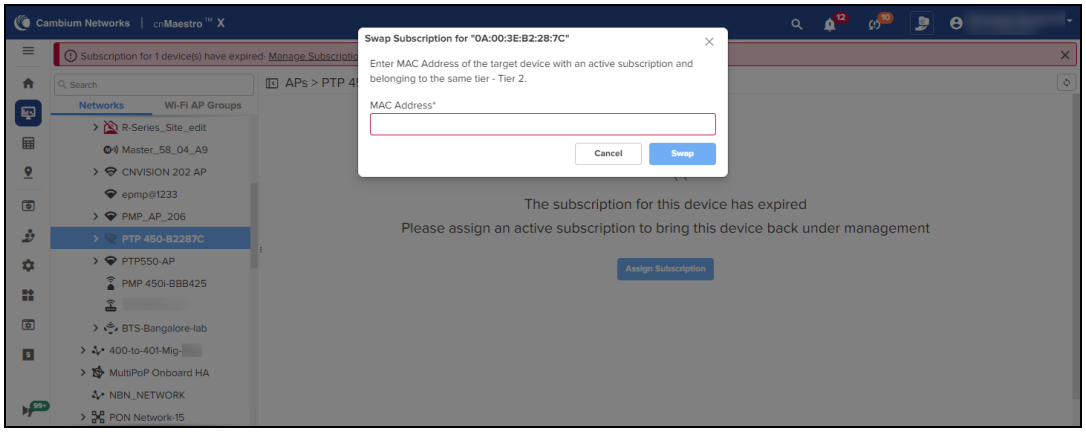
The following message displays if successful and the device becomes active.

Swap Subscription at device level

1. Navigate to **Manage** > **Network** > and select the expired device.



2. Click **Assign Subscription.** The **Swap Subscription** window pops up.



3. Enter the **MAC address** and click **Swap.**

Retention of Data After Expiry and Reinstatement of Service

If subscriptions are not renewed in time, devices under those subscriptions will expire and are no longer managed by cnMaestro. Once all subscriptions are expired, the account transitions to cnMaestro Essentials with a data retention period for historical data of 90 days. All historical data beyond one week, and cnMaestro X specific configuration, will be retained until the data retention period of 90 days, after which it will be deleted. This is done to ensure no data loss if subscriptions are renewed before the data retention period ends.

cnMaestro X features behavior state

cnMaestro X subscriptions can be purchased for 1 year, 3 years, and 5 years. Pricing is based on device tiers. Device slots are purchased for each device tier needed for a deployment. Devices require free slots in order to onboard.

	NOTE: To manage NSE devices under Essentials account, you need a subscription. If your account is upgraded to cnMaestro X, the Essentials NSE subscription will automatically be transferred to cnMaestro X. You will not need any additional subscription for NSE again.

The following table describes about the cnMaestro feature behavior state in different modes such as cnMaestro X, data retention period, and after data retention period.

Table 8: cnMaestro X Feature behavior state matrix

Feature	cnMaestro X	On Downgrading cnMaestro X to Essentials and Data Retention Period	After Data Retention Period
60 GHz cnWave	**Link Events** • Maintains link events data up to 30 days. **Maps** • Channel and Polarity in Device Overlay. • Golay, SNR, MCS, RSSI, Throughput(Mbps), Airtime % and Link Fade Margin in Link Overlay. • Auto Refresh option allows to add up to 10 devices. • Topology Scan • Node Throughput test • Link Throughput test • Current Best Route(s)	**Link Events** • Only 7 days link events data is exposed • Data will still be collected in retention period **Maps** • Status and Sectors in Device Overlay	**Link Events** • Not accessible **Maps** • Status in Link Overlay • Status and Sectors in Device Overlay
Administrator Count	Administrator limit increased from 10 to 200.	New users cannot be added if the current count is 10 or more.	Deletes cnMaestro users with the lower privileges in **Super Administrator** > **Administrator** > **Operator** > **Monitor** to maintain 10 users.
Application Visibility			
Assists	Assists helps to isolate configuration issues in a deployment.	Not accessible	Not accessible
Audit Logs	Audit Logs record user activity.	Audit log generation continues through the data retention period, but users cannot access the logs.	Not accessible
Bulk Edit	• Allows bulk edit of device configuration for Enterprise Wi-Fi devices. • Allows bulk edit through import and	Not accessible	Not accessible

Feature	cnMaestro X	On Downgrading cnMaestro X to Essentials and Data Retention Period	After Data Retention Period
	export of CSV files.		
Client Dashboard	• Displays Wi-Fi Client application and network statistics. • Application statistics are only available for NSE, XV, XD, XE, and XR series devices.	Not accessible	Not accessible
cnArcher Installation Summary	Installation Summary for PMP and ePMP SMs installed using the cnArcher Mobile Application	Not accessible	Not accessible
Configuration Lock	Prevents changes to Wi-Fi AP, cnMatrix, and NSE device configuration, even if the device is updated directly.	The lock is no longer enforced.	Not accessible
ePSK Limit	ePSK limit increased from 300 to 2000.	New ePSK entries cannot be added if the current count is 300 or more.	Only 300 entries will be retained, and the rest will be deleted.
Email Notifications	Maximum up-to 10 email recipients can be added per scope (All Accounts, Base Infra and per MSP)	• All the configured email recipients are retained • None of the email recipients are deleted. • Only the 2 earliest added subscribers per scope would receive email notifications.	Only the 2 earliest added recipients are retained. The remaining email recipients are deleted automatically.

Guest Portal—Access	Connect a wireless service through following access methods:
	• Paid access
	• Enterprise:
	  ▪ Microsoft Azure
	  ▪ Sponsored Guests
		Configuration will be retained, but the feature will no longer be available.	Not accessible

Feature	cnMaestro X	On Downgrading cnMaestro X to Essentials and Data Retention Period	After Data Retention Period
	▪ Self Registration ▪ Google • Guests page— Allows to view details of self registered guests connecting to the wireless network.		
Guest Portal—Design	Allows to create email templates to send email confirmation and password for enterprise self registration and sponsored guests.	Configuration will be retained, but the feature will no longer be available.	Not accessible
Guest Portal	Allows 500 guest portals, 10,000 sessions, and 20,000 login event session records for a maximum of 1 year.	• If the count is more than 4 then, all portals are read-only. • Only portal delete option is available to the user. • All existing client sessions will continue without any disruption.	Only 4 portals will be retained and rest will be deleted.
Long term Historical Data	Displays the devices performance graph: • Performance graphs for Wi-Fi APs and cnMatrix support historical data for 14 months. • Performance graphs for Fixed Wireless Broadband devices support historical data for 26 months. • All performance graphs for IIoT devices support historical data for 14 months.	Only 7 days of statistics will be exposed, but existing data will be maintained. During the retention period, data will be maintained.	Removes data beyond 7 days.

Feature	cnMaestro X	On Downgrading cnMaestro X to Essentials and Data Retention Period	After Data Retention Period
Managed Service Provider (MSP)	MSP provides separate Managed Accounts – each with independent administration and configuration.	• Managed Account users are logged out. • Managed Services tab is hidden. • Managed Account configuration changed to read-only. • **Managed Accounts** > **Users** tab hidden. • Managed Accounts are changed to read-only.	All Managed services are deleted, and they will no longer be associated with any managed accounts.
Multi-Floor Site Plan	Allows to create 50 floor plan per Site.	• All floor plans are viewable as read-only. Cannot create additional floor plans or edit any existing floor plans if more than one configured in a Site. • Edit is available only when all additional floor plans are deleted.	• Additional floor plans is deleted and devices on those floors is unmapped. • Only the latest floor is available.
NBI API	Allowed to create API clients and access token.	• Delete all access token Block all APIs to do actions on API client • Block API to generate access token • Email out/alarm for the deletion of API clients	Remove the API client Clear alarm
Reports	Schedule Devices, Performance, Active Alarms, Alarm History, Events, Clients, Mesh Peers, and Guest Access Login Events Reports.	Reports tab will not be accessible, and all previously scheduled reports will be skipped.	All jobs will be terminated and Reports are not accessible.
Graphical Reports	6E Clients by Radio, Client Count by Manufacturers, Client Capability Trend, Client Count over Time, Top Applications by Usage, Top Category by	Graphical Reports Template option will not be accessible.	Graphical Reports Template option will not be accessible.

Feature	cnMaestro X	On Downgrading cnMaestro X to Essentials and Data Retention Period	After Data Retention Period
	Usage, Client Count by Band, Client Count by Types, Peak and Unique Clients, Top APs by Unique Clients, Client Traffic over Time		
Satellite View	It allows to view maps in Satellite view.	Not accessible	Not accessible
Session Management	Tracks the current cnMaestro user sessions and optionally allows to logout cnMaestro user sessions.	Not accessible	Not accessible
Spectrum Analyzer	Analyzes and monitors the wireless spectrum for optimizing network performance on PMP devices.	Not accessible	Not accessible
Terrain View	It allows to view maps in Terrain view.	Not accessible	Not accessible
WIDS	WIDS data is processed APIs are supported	Statistics is not available through API.	Not accessible
Webhooks	Webhooks provide real-time streaming for alarms using a push notification.	Not accessible	Not accessible

Navigating the cnMaestro UI

cnMaestro provides a number of ways to navigate the UI.

This section includes the following topics:

- Account View
- Home page
- Page structure
- Page navigation
- Access and Backhaul View
- Enterprise Account view
- Side menu
- Section tabs

- System status
- Data Tables and Chart UI controls
- Logout

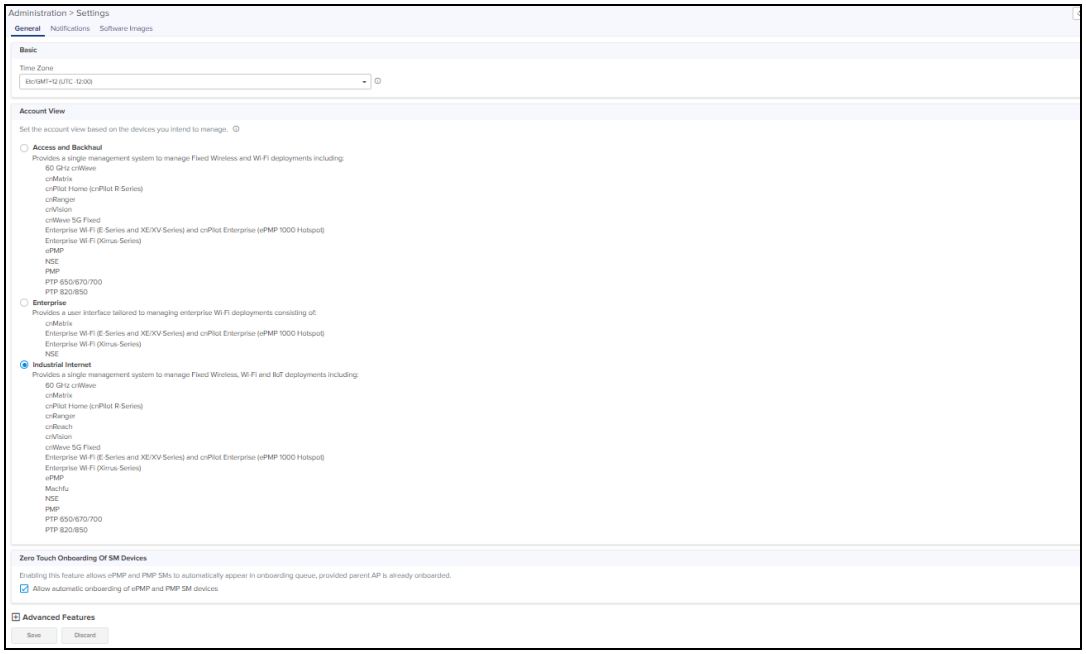
Account View

cnMaestro supports three different account views, based upon the composition of devices.

- Access and Backhaul view
- Enterprise view
- Industrial Internet view

The account view is selected when the account is created but it can be changed later through the **Administration** > **Settings** page.

Figure 28 Account View



Access and Backhaul View

The Access and Backhaul View supports all Fixed Wireless and Wi-Fi devices. The device types include 60 GHz cnWave, cnMatrix, cnPilot Home (cnPilot R-Series), cnRanger, cnVision, cnWave 5G Fixed, Enterprise Wi-Fi (E, XE, and XV-Series) and Enterprise (ePMP 1000 Hotspot), Enterprise Wi-Fi (Xirrus-Series), ePMP, NSE, PMP, PTP 650/670/700, PTP 820/850, RV22 Home Mesh, and PON.

Enterprise View

The Enterprise View supports the Enterprise Wi-Fi portfolio, which includes the cnPilot Enterprise APs (ePMP 1000 Hotspot), cnMatrix, and Enterprise Wi-Fi APs (E, XE, and XV-Series), and Enterprise Wi-Fi (Xirrus-Series), and NSE. It provides a simplified UI for Wi-Fi components (hiding fixed wireless features such as Towers).

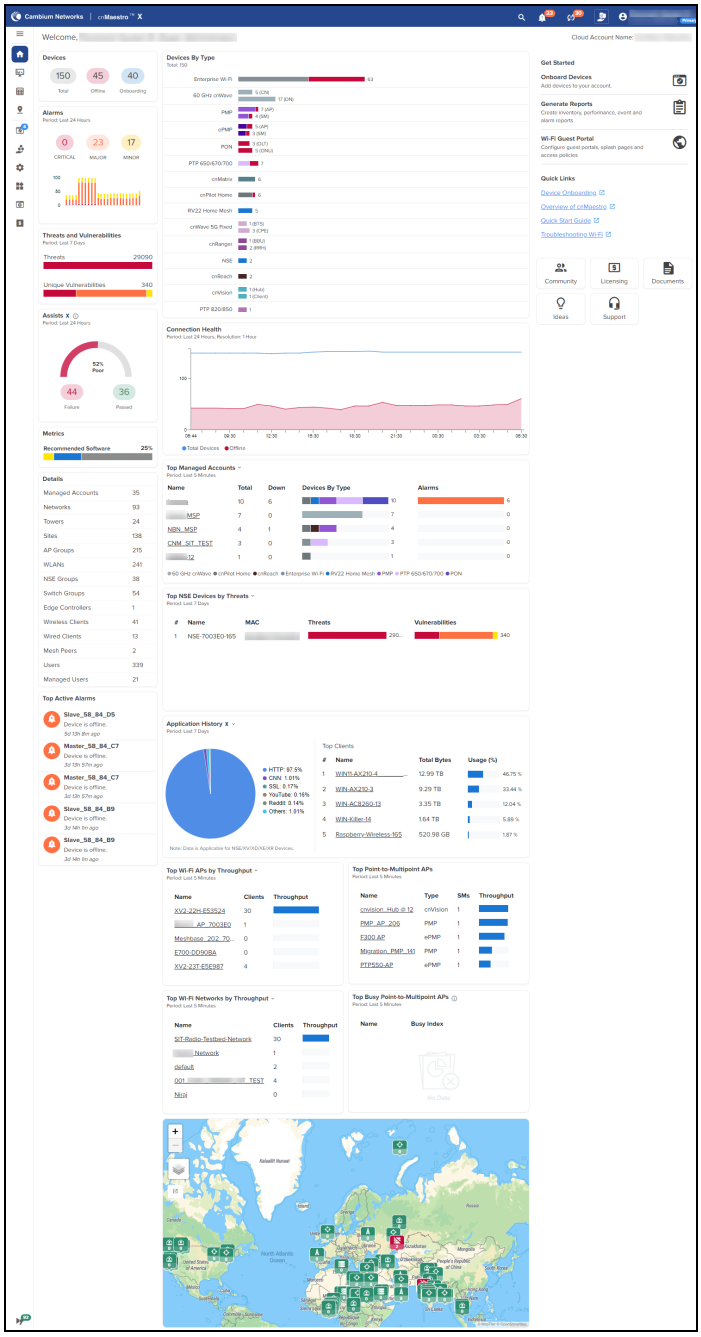
Industrial Internet View

Industrial Internet View provides a single interface for Fixed Wireless, Wi-Fi, and IIoT deployments. The device types include 60 GHz cnWave, cnMatrix, cnPilot Home(R-Series), cnRanger, cnVision, cnWave 5G Fixed, ePMP, PMP, cnReach, PTP 650/670/700, PTP 820/850, Enterprise Wi-Fi (E, XE, and XV-Series) and cnPilot Enterprise (ePMP 1000 Hotspot), Enterprise Wi-Fi (Xirrus-Series), Machfu, NSE, RV22 Home Mesh, and PON.

Home page

The **Home** page is displayed when the user logs into the cnMaestro. It provides links to the core functional areas in the UI, such as Cambium **Support Center**, **Community**, **Documents**, and **Licensing**. It can be accessed from any page in the UI by clicking the **Home** tab.

Figure 29 cnMaestro Home page



Page structure

cnMaestro follows a standard page structure, which consists of a left-side menu and a content area. In many pages, tabs provide additional content navigation.

Figure 30 cnMaestro page structure

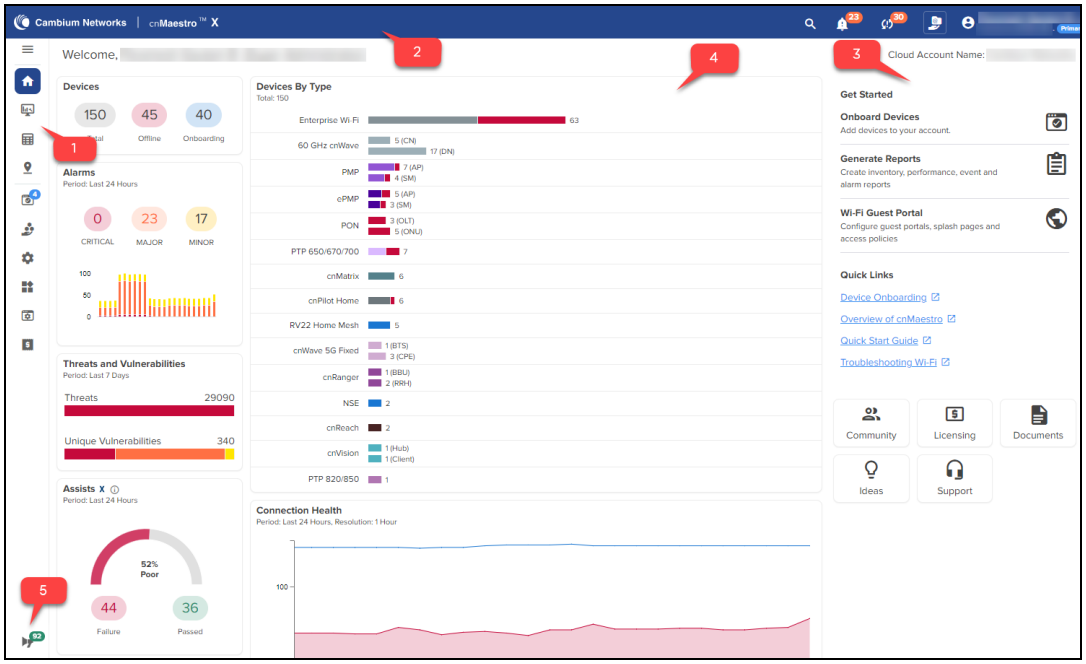
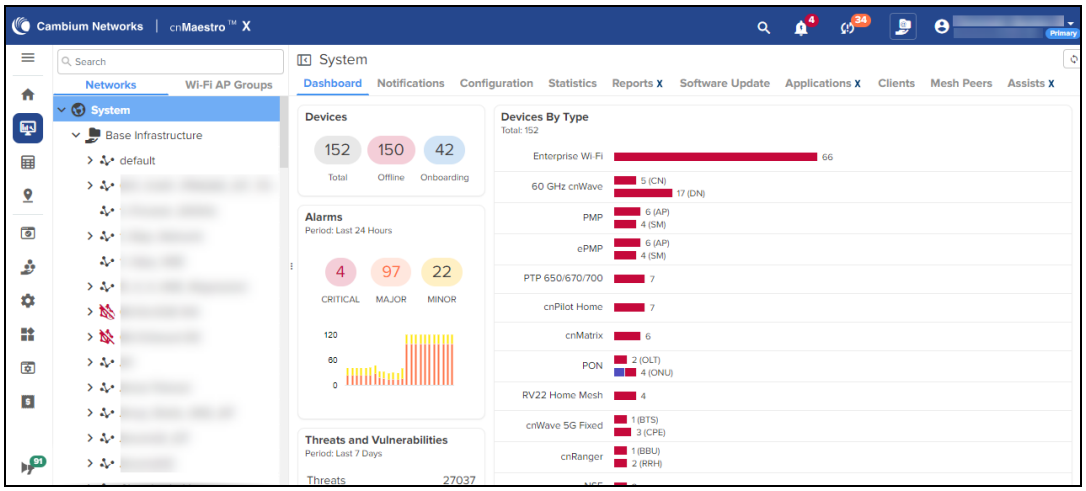


Table 9: UI description

Number	Elements	Description
1.	Left menu	Shows the functional areas of the UI. This menu can be expanded or collapsed to view the submenu by clicking the top arrow.
2	Header	Shows the basic counters for **Major Alarms**, **Devices Awaiting for Approval**, **Software Updates Jobs**, and **Out of Sync Devices**.
3	Right menu	Provides links to Cambium **Ideas**, **Support**, **Community**, **Documents**, and **Licensing** .
4	Functional area	Shows the detailed view of the section selected in the left menu.
5	Announcements	Displays announcements about availability of newer firmware versions of devices.

Page navigation

The cnMaestro pages include items such as **Dashboard**, **Notifications, Configuration**, **Statistics**, **Report**, **Software Update**, **Applications, Clients**, **Mesh Peers,** and **Assists.** The content of a page differs depending upon its context. For example, a **Dashboard** page will be different at the **System/Network/Tower/Site/Device** levels. The context, or level in the hierarchy, is selected in the Device tree as shown in Table 12.



Access and Backhaul View

Overview

The Access and Backhaul view leverages a hierarchical tree to display device installations. In this view, customers can group their fixed wireless devices into Networks, and display their Point-to-Multipoint devices in Tower-based sectors. Navigation is performed using the tree. The device tree is segmented into two tabs: Network and Wi-Fi AP Groups.

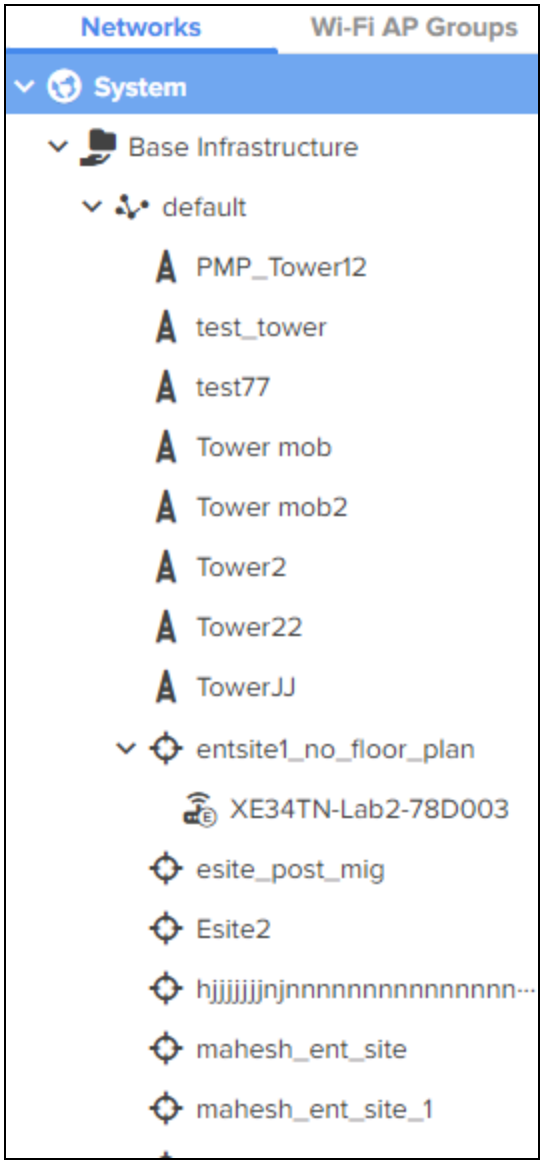
Networks tab

The **Network** tab displays a hierarchical view of the devices. It consists of Systems, Networks, Towers, Sites, and Devices. There is a strict ordering for how nodes can fit in the hierarchy, and as one navigates through and selects nodes, the pages display the node chosen.

Selecting an arrow icon will expand the node and display the next level of hierarchy.

	NOTE 1. Towers are only visible in the Fixed Wireless view and 60 GHz cnWave devices are only visible in the 60 GHz cnWave E2E Network. cnMatrix devices are visible only in Access and Backhaul and Industrial Internet view 2. Japanese characters name is supported in Network, Tower, and Site. 3. Select a node in the hierarchy tree and expand to open the node. 4. Opening the node does not automatically select a node in the new hierarchy, instead the desired node needs to be clicked.

Figure 31 Networks



The structured hierarchy has the following nodes:

Table 10: Structured hierarchy nodes

Icon	Name	Description
	60 GHz cnWave CN	CN is mapped to a **Site** in E2E Network.
	60 GHz cnWave DN	DN is mapped to a **Site** in E2E Network.
	60 GHz cnWave Onboard E2E Network	60 GHz cnWave devices are located within a **Network** deployed through the Onboard E2E controller.

Table 10: Structured hierarchy nodes

Icon	Name	Description
	60 GHz cnWave External E2E Network	60 GHz cnWave devices are located within a **Network** deployed through the external E2E controller.
	60 GHz cnWave PoP	PoP is mapped to a **Site** in E2E Network and deployed through the External E2E controller.
	60 GHz cnWave PoP Onboard E2E Network	PoP is mapped to a **Site** in E2E Network and deployed through the Onboard E2E controller.
	60 GHz cnWave Unmanaged Node	60 GHz cnWave Unmanaged Node
	60 GHz cnWave Site	**Sites** are located within E2E Networks. A site maps to a single area and represents a location on a map that has 60 GHz cnWave devices.
	cnMatrix	cnMatrix devices are located within a **Network**. Optionally they can also be mapped standalone to a **Tower** or a **Site**.
	cnRanger RRH	cnRanger RRH access points are located in a **Network** and are mapped to a **BBU**.
	cnRanger Sierra 800	cnRanger Sierra 800 are located in a **Network** and are optionally mapped to a **Tower**.
	cnRanger SM	cnRanger SM devices are located in a **Network** and are optionally mapped to a RRH.
	cnReach	cnReach device which could have zero, one, or two radios, and support one or two roles, including Point-to-Point (PTP), Point-to-Multipoint (AP or EP) (PTMP), or IO Expander.
	cnPilot Home	Wi-Fi devices are generally matched to a local SM and inherit its **Network**. They can also be mapped standalone to a **Network** or a **Site**.
	cnVision Client	cnVision Client Subscriber Modules are located in a **Network** (if they are standalone, which is only used for bootstrapping) or they are associated with an AP. The SM will inherit the **Network** and **Tower** of the AP to which it is associated.
	cnVision Hub	cnVision Hub are located in a **Network** and are optionally mapped to a **Tower**.
	cnWave 5G Fixed BTS	cnWave 5G Fixed BTS devices are located within a Network.
	cnWave 5G Fixed CPE	cnWave 5G Fixed CPE devices connected through cnWave 5G Fixed BTS device in a Network.

Table 10: Structured hierarchy nodes

Icon	Name	Description
	Enterprise Wi-Fi	Enterprise Wi-Fi devices are generally matched to a local SM and inherits its **Network**. They can also be mapped standalone to a **Network** or to a **Site**.
	ePMP AP	ePMP Access Points are located in a **Network** and are optionally mapped to a **Tower**.
	ePMP SM	ePMP Subscriber Modules are located in a **Network** (if they are standalone, which is only used for bootstrapping) or they are associated with an AP. The SM inherits the **Network** and **Tower** of the AP to which it is associated.
	Home Site	Home sites are located within networks and contain RV22 Home Mesh routers.
	Machfu	Machfu devices are located within a **Network**. Optionally they can also be mapped standalone to a **Network** or to a **Tower**.
	Network	All devices are placed within **Networks**. Networks represens the geographical regions or collections of devices with a shared responsibility. Accounts can have one network or many networks. Networks allow one to provide structure to accounts with many devices and also provides aggregation buckets for cnMaestro statistics (essentially the system pre-calculates statistics, so they are displayed quickly).
	NSE 3000	NSE device located in the **Network.**
	OLT	Optical Line Terminal (OLT) device located in the PON network
	ONU	Optical Network Unit (ONU) device located in the PON network.
	PMP AP	Point-to-Multipoint Access Points (PMP AP) are located in a **Network** and are optionally mapped to a **Tower**.
	PMP SM	Point-to-Multipoint Subscriber Modules (PMP SM) are located in a **Network** (if they are standalone, which is only used for bootstrapping) or they are associated with an AP. The SM will inherit the **Network** and **Tower** of the AP to which it is associated.
	PON Network	All PON devices are placed within PON networks.
	PON Site	PON sites are located within PON networks and hold OLT and ONU devices.
	PTP Master	Point-to-Point (PTP) Master device located in a network and optionally mapped to a Tower.
	PTP Slave	Point-to-Point (PTP) Slave device located in a network and optionally mapped to a Tower.
	PTP 820/850	Point-to-Point (PTP 820/850) device located in a network.

Table 10: Structured hierarchy nodes

Icon	Name	Description
	RV22 Home Mesh Router—Base	RV22 Home Mesh routers (deployed as a standalone or the base in a mesh setup) located in the network and are mapped to a home site.
	RV22 Home Mesh Router—Node	RV22 Home Mesh routers (deployed as the node in a mesh setup) located in the network and are mapped to a home site.
	Enterprise Site	**Enterprise Sites** are located within networks and hold Wireless Access Points. A site maps to a single area and represents a location on a map that has APs or a building.
	System	The **System** node is at the top level of the hierarchy, though it does not have an explicit node in the tree. It's pages are displayed when the user logs in for the first time, when one selects the **System** button in the hierarchical tree (displayed when Networks are shown) or selects the **System** node in the breadcrumbs. The System level aggregates data from all devices within the account.
	Tower	**Towers** are located within networks and hold cnRanger, cnReach, PTP, or Point-to-Multipoint APs. All the devices on a Tower are mapped to the same Network, and all their children devices such as Subscriber Modules or Home APs are also mapped to the same network.
	GPON port	GPON port of the PON OLT device. PON ONU devices are connected.
	XGSPON port	XGSPON port of the PON OLT device. PON ONU devices are connected.

Default network

cnMaestro has a default network into which unmapped devices will be placed. These can remain in the default network or moved to a named network. The default network cannot be deleted.

Tree menu

Each node in the device tree has a menu icon (⋮) that supports node-specific actions.

For example, the system node lets you to **Add Network** or launch the **Update Software** page, while individual devices allow you to **Edit** their cnMaestro settings, **Reboot**, or even **Delete** the device from management (so it can be transferred to another account). The actions supported across the tree include the following:

Table 11: Tree menu

Action	Node	Description
All Devices		
Add Network	System	Add a new Network as a child to the System node.
Add Site	Network	Add a new Site as a child to the Network node.
Add Tower	Network	Add a new Tower as a child to the Network node.
Claim Devices	Site	Claim devices in a site

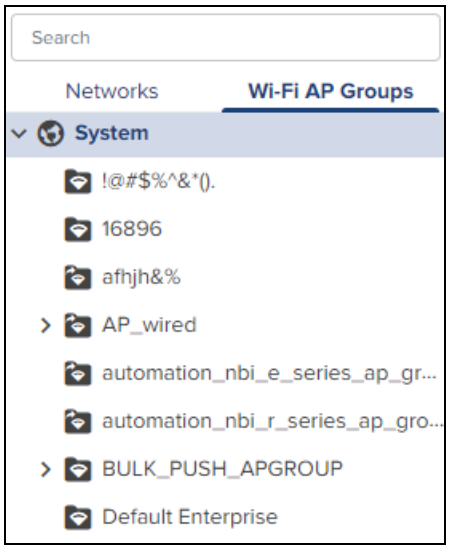
Table 11: Tree menu

Action	Node	Description
Delete	Most Nodes	Delete a node from the tree. This is available for all nodes except System and the default network. Deleted devices will be removed entirely from the management system (along with their historical statistics). In order to delete a container, such as Network or Site, all nodes inside the container must be deleted first.
Edit	Most Nodes	Edit the cnMaestro settings, including node name and location. This is available for all nodes except System. For 60 GHz cnWave, edit option applies for E2E Network and nodes. Node name can be edited.
Flash LEDs	Enterprise Wi-Fi	The LEDs of the device enables to identify and locate the device.
Reboot	Devices	Reboot the device.
Refresh	All	Refresh the node in the tree. This refreshes the node and its children only, not the entire tree.
60 GHz cnWave Network		
Add Link	Network and Most Nodes	Add a new link to the System.
Add Node	Site	Add a new Node as a child to the Site.
Add Site	Network	Add a new Site to the E2E Network.
Refresh	Network	Refresh the network details
Download PoP (s) Onboarding Config	Network and PoP Nodes	Download PoP(s) Onboarding Configuration data.
Edit	Network	Edit name of the network
Hide or Show Sites	Network	Allows to hide or show sites in the E2E Controller Network tree menu.
Sync Topology	Network	To sync the Topology of E2E Network and cnWave 60GHz device.
Update Software	Network and Nodes	Allows the user to update the 60 GHz cnWave nodes software.

Wi-Fi AP Groups tab

The **Wi-Fi AP Groups** tab displays the Wi-Fi AP Groups configured in cnMaestro (and the devices mapped to them). AP Groups allow you to share configuration across many access points. They also display the aggregated statistics for the devices managed and present them within the AP Groups dashboard.

Figure 32 Wi-Fi AP Group tab



Map navigation

Maps are presented in Main menu with dedicated Map display. Maps often show Towers and Devices located in proximity. You can double-click the map nodes to navigate to the Device, Site, or Tower. By selecting a node in the map, the Device tree gets updated to reflect that node.

	NOTE: Map view is supported for devices 60 GHz cnWave, cnRanger, cnPilot Home, cnMatrix, cnVision, ePMP, Enterprises Wi-Fi Series, PMP, PTP, and RV22 Home Mesh at the site- and device-levels.

Figure 33 Map navigation

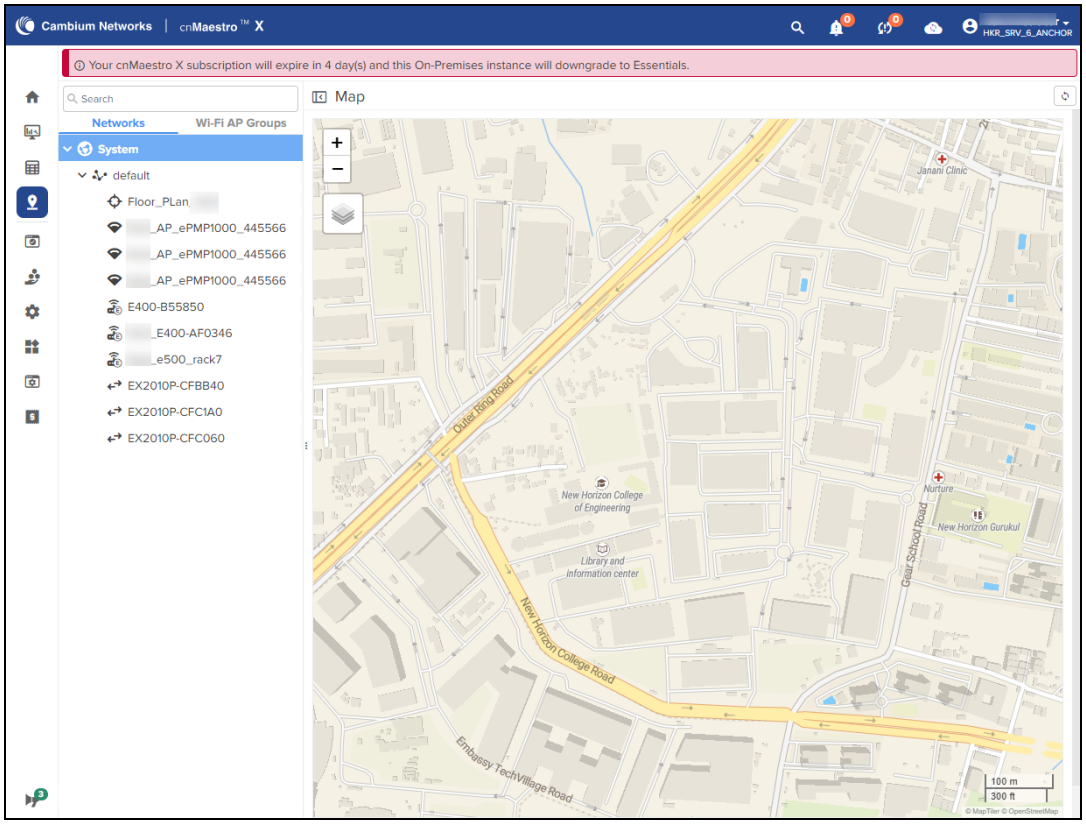


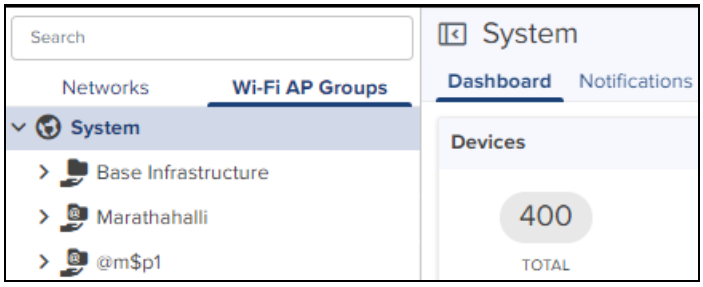
Table navigation

Some tables display **Networks**, **Towers**, **Site**, or **Devices** and allow the user to click the node and navigate to the location of the node in the tree.

Node search

Administrators can search for nodes within the device tree using the **Search** box. It allows the user to search based upon Device Name and MAC Address. Once the node is found and selected, one can navigate to it in the hierarchical tree.

Figure 34 Node search



Enterprise Account view

Overview

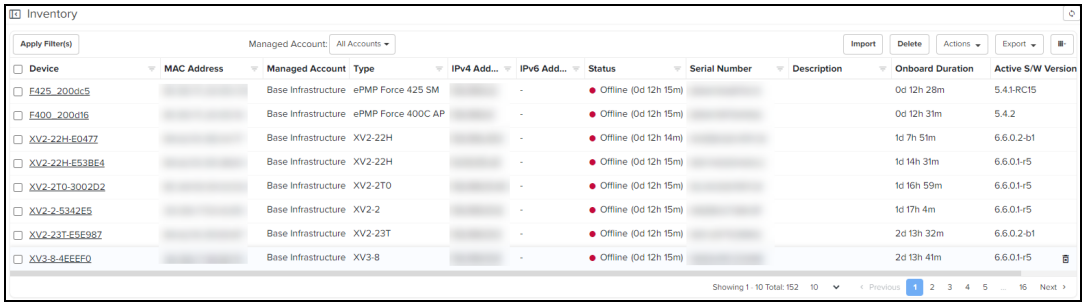
The Enterprise account differs from Access and Backhaul in that it is largely table-driven. It does not have the Quick Buttons or the Device Tree, instead, it has direct navigation for Devices, AP Groups, WLANs, Switch Groups, and Sites. Each of these is presented in tabular form.

System

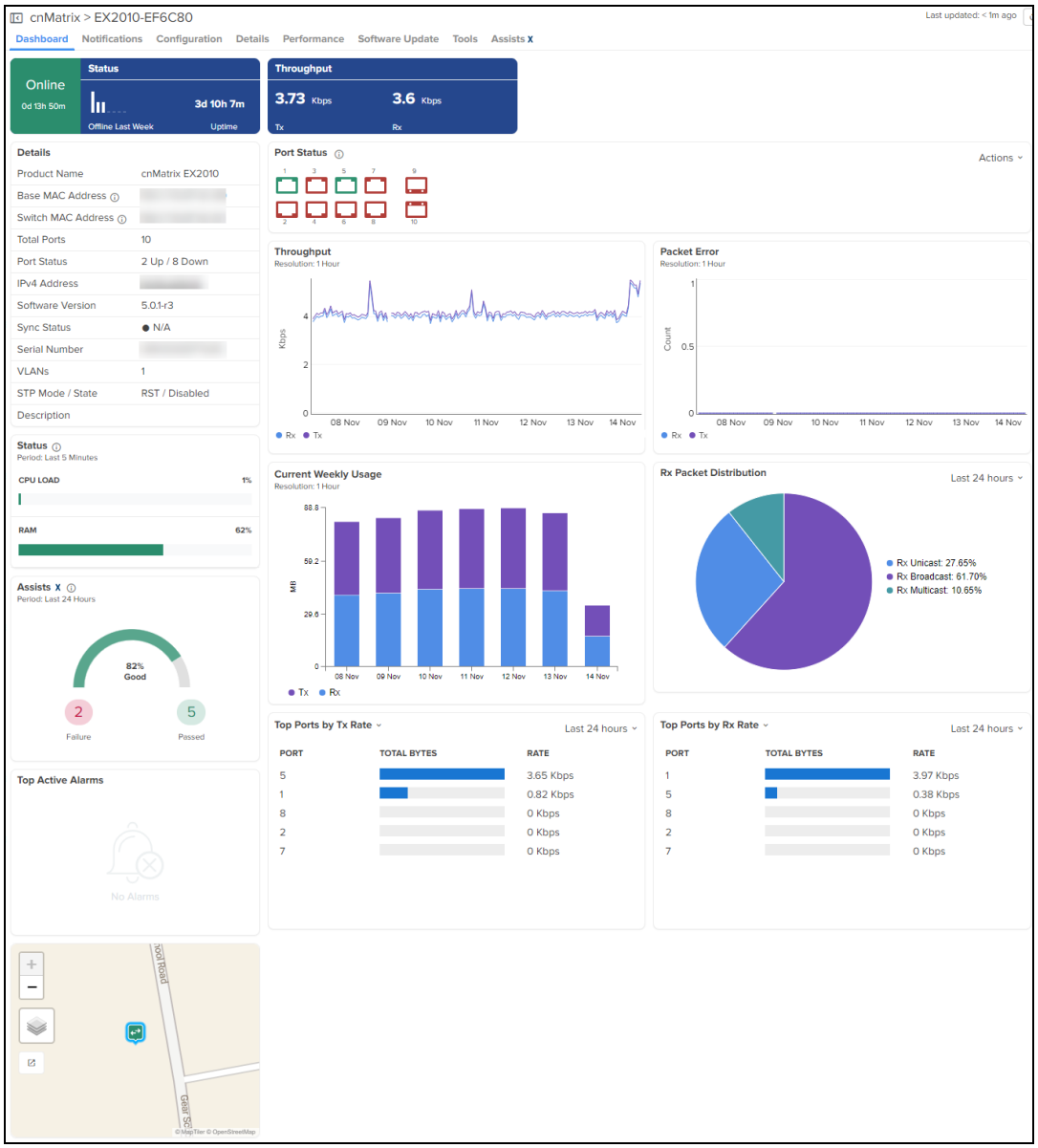
Global functionality is presented in the System menu. It aggregates data across the entire installation.

Devices

The Devices section provides a searchable table listing all the devices in the system.



Selecting a device launches its management page.



AP Groups

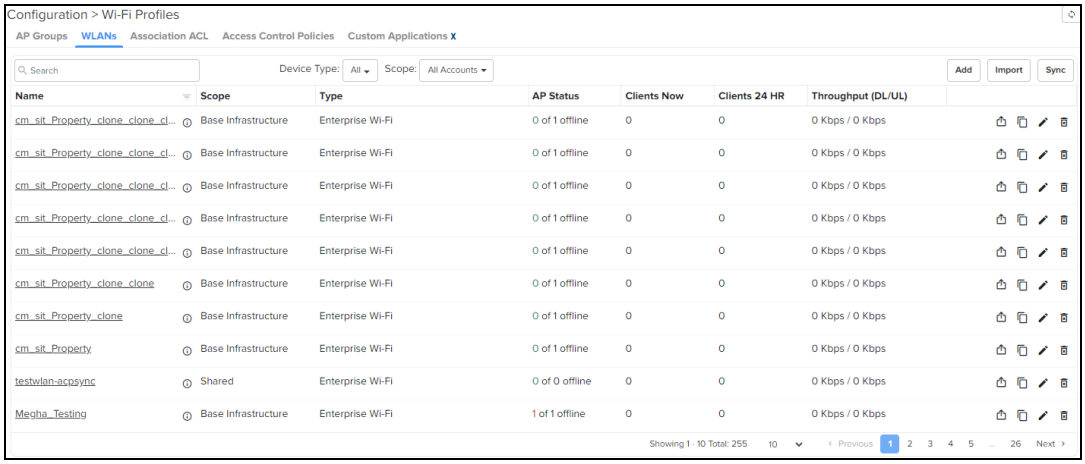
AP Groups manage shared configuration across APs. AP Groups also aggregate data for all the APs that map to them. This includes consolidating statistics and events/alarms and presenting AP Group centered pages for Dashboard, Notifications, Configuration, Statistics, Report, Software Update, Clients, and Mesh Peers.

Figure 35 AP Groups

WLANs

WLANs manage shared configuration across APs.

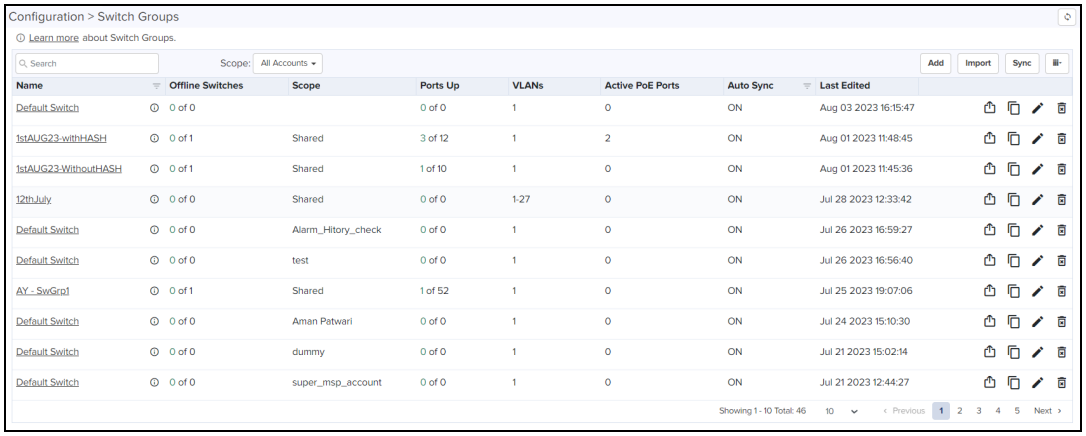
Figure 36 WLANs



Switch Groups

Switch Groups provide shared configuration for cnMatrix devices, and a subset of parameters can be overridden for each device. Administrators can simultaneously edit individual/bulk ports across all physical switches mapped to a Switch Group.

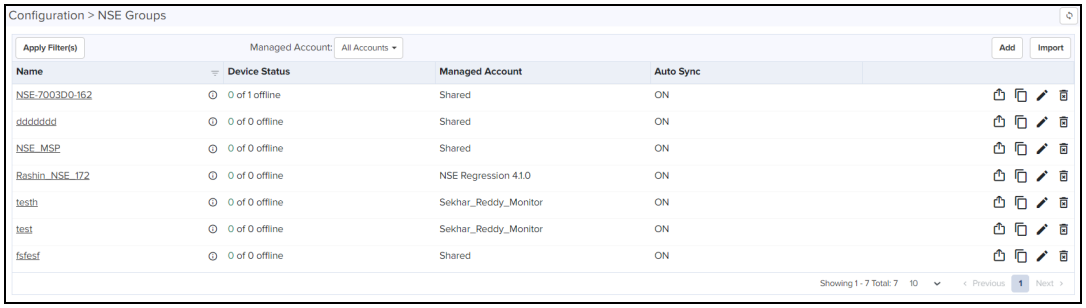
Figure 37 Switch Groups



NSE Groups

NSE 3000s are configured by creating configuration profiles called NSE Groups.

Figure 38 NSE Groups



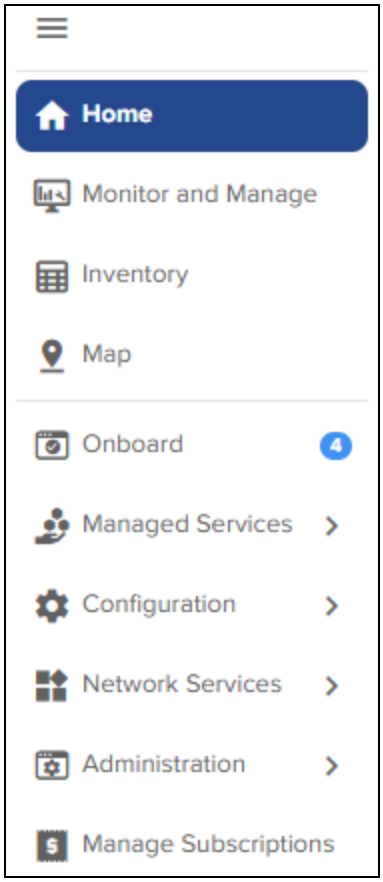
Sites

Sites are similar to AP Groups in that they aggregate statistics from many APs. The difference is a Site represents APs installed at a single physical location (and mapped to a Floor Plan). Sites also have their own Dashboard and aggregation pages.

Side menu

The side menu provides high-level navigation through the cnMaestro UI. Click the menu (☰) icon in the left column to view the side menu names in the page.

Figure 39 Side menu



Section tabs

All management sections are displayed in the context of the managed item, including System, AP, AP Group, Switch Groups, and Site. The options vary depending upon the menu selected. A breakdown is below:

Table 12: Section tabs

Page	Tabs
System	Dashboard | Notifications | Configuration | Statistics | Report |Software Update | Applications | Clients | Mesh Peers | Assists
Enterprise Sites	Dashboard | Notifications | Configuration | Statistics | Reports | Floor Plan | Devices | Applications | Clients | Mesh Peers | WIDS | Analytics | Assists | PON
Home Sites	Dashboard | Notifications | Configuration | Reports | Software Update | Clients | Assists
PON Sites	Dashboard | Notifications | Configuration | OLTs | ONUs | Ports

System status

The UI header has the following System status icons.

Table 13: System status icons

Icon	Name	Description
	Announcements	Notifies the latest Device Software images, Package, or OVA to upload from Cloud.
	Major Alarms	The count of major alarms raised in the system.
	Out-of-Sync Devices	The number of Wi-Fi devices with unsynchronized configuration (which can occur when automatic synchronization is disabled in the AP Group or the configuration is changed directly on the device).

Clicking an icon navigates to the relevant management page.

Data Tables and Chart UI Controls

Familiarize with UI controls required for working with the data tables and chart UI pages. An example of the data tables is displayed below:

NOTE: **Mouse Rollover Behavior**—In the data tables, when some of the columns on the right side are hidden, if you move the mouse pointer over the row, the action icons on the right most side are displayed without having to move the scroll bar to the right.	

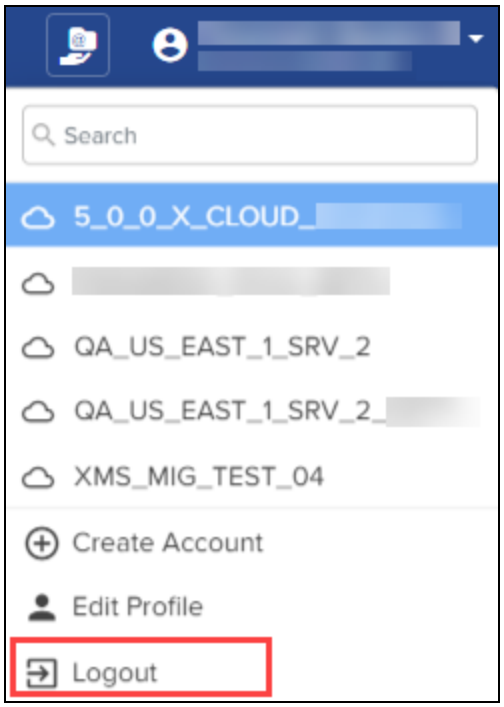
>	Expand the options available under an entity.
⌄	
⋮	
	Refresh the UI page or data table.
⌄	

	Search for the required value in a column.
Apply Filter(s)	set filters for based on different columns or values.
	Select the columns that you want to have in the data table list.
Export	Export the data in an excel or any other format.
	View the data in a table format.
	View the data in a chart format.
	Select widgets from the list.
	View the data in a grid format.
	View the data in a list format.
High (recommended)	Select an option from the list.
Reset Zoom	Reset the zoom in view.
	Export
	Clone
	Update the software
	Edit
	Delete
	View complete details
	Configure
	Terminate

	Show history
	Download
	Block
	Approve device
	Deregister device
	Undo approve
	Go to the dashboard
	Sync

Logout

Log out of cnMaestro by clicking on the user icon in the upper-right corner and selecting **Logout**. You can also navigate to: **Administration** > **Users** > **Session Management** > **Sessions**.



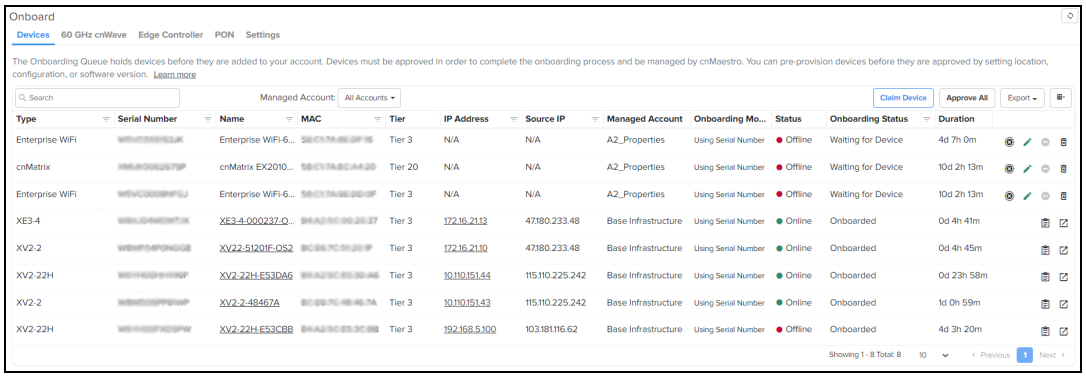
Device Onboarding

Onboarding is the process of adding a device into cnMaestro Cloud management.

This section includes the following:

Onboarding Overview

The Onboarding flow includes claiming the device (which maps it to the correct management account) and optionally pre-provisioning the device by selecting its software image and configuration. It also supports setting Device Name, Location, Software Version, and Configuration. When the onboarding process completes, the device will be under full cloud management.



Claiming Devices

A device is claimed when it is explicitly added to Cloud management using the Serial Number or Cambium ID. The difference between the two is the Serial Number is entered through the Cloud management UI and Cambium ID is entered via the Device UI or through SNMP.

NOTE:

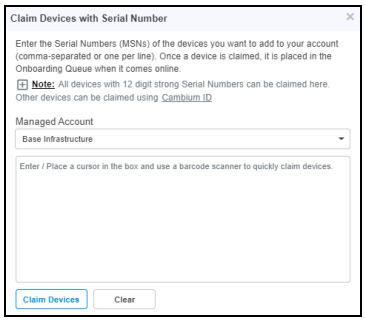
- Only serial numbers with a length of 12 characters can be claimed through the Cloud management UI.
- Devices with serial numbers less than 12 characters for example, 10 or 11 characters, need to be claimed on the device UI using the Cambium ID.

All claimed devices are placed in the Onboarding Queue. The devices need to be approved in order to become fully managed.

Claiming Devices with Serial Number

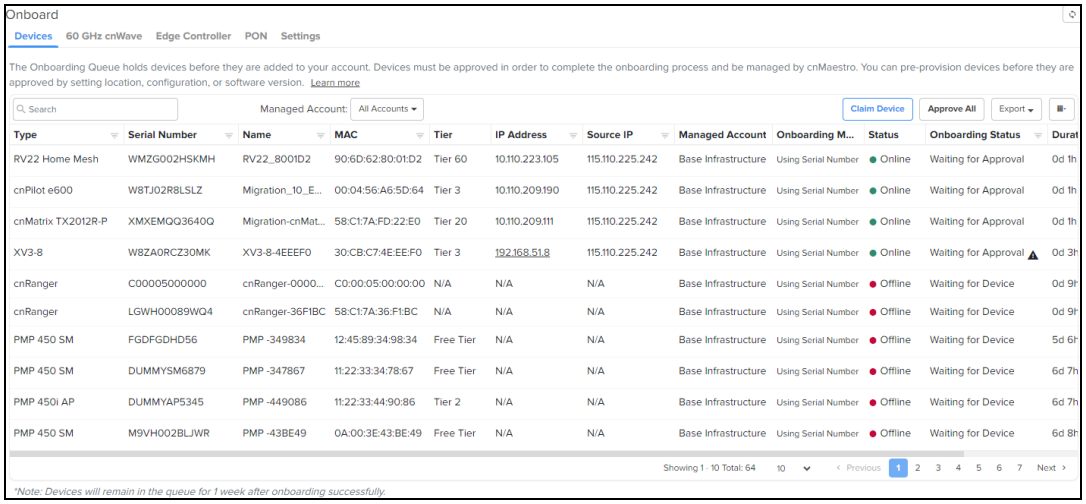
Claiming with Serial Number means entering the serial numbers of devices, one per line, and clicking the **Claim Devices** button. The system prompts the user to validate the devices before applying them. When complete, they will be placed into the Onboarding Queue, where they can be pre-provisioned to update software or configuration before onboarding.

Figure 40 Claiming Devices with Serial Number

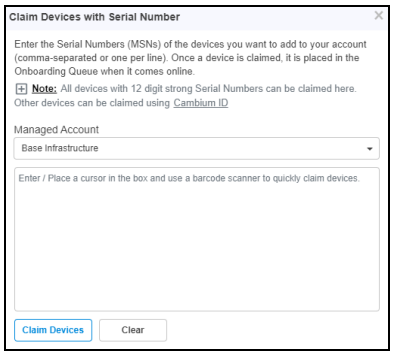


To claim a device using the Serial Number:

1. Navigate to **Onboard** page > click **Claim Device**.



Claim Devices with Serial Number window appears.



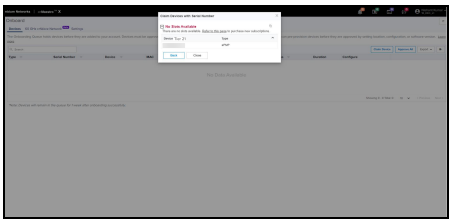
	NOTE: The user should select a PON network manually before approving the device.

2. Enter the Serial Number of the device.
3. Click **Claim Devices.**

	NOTE: Slot Availability is available only for cnMaestro X account users.

- After clicking **Claim Devices** in a cnMaestro X account, if there is any Slot Deficit it displays the following errors:
  - **No Slots Available:**

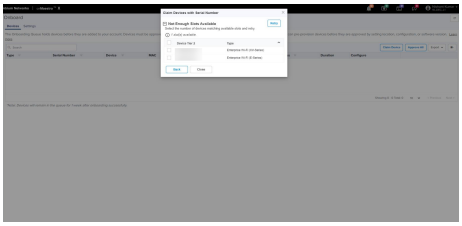
    If there are no slots available while claiming new devices, the **No Slots Available** window displays:

    The user need to purchase a new subscription with the required slots and reclaim the devices.

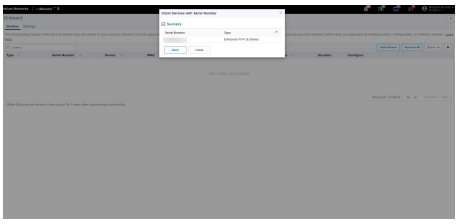
  - **Not Enough Slots Available:**

    If user tries to claim more devices than the available slots, the **Not Enough Slots Available** window displays:

    The user is given an option to select the devices from the list according to the available slots.

    Select the devices and click **Retry**.

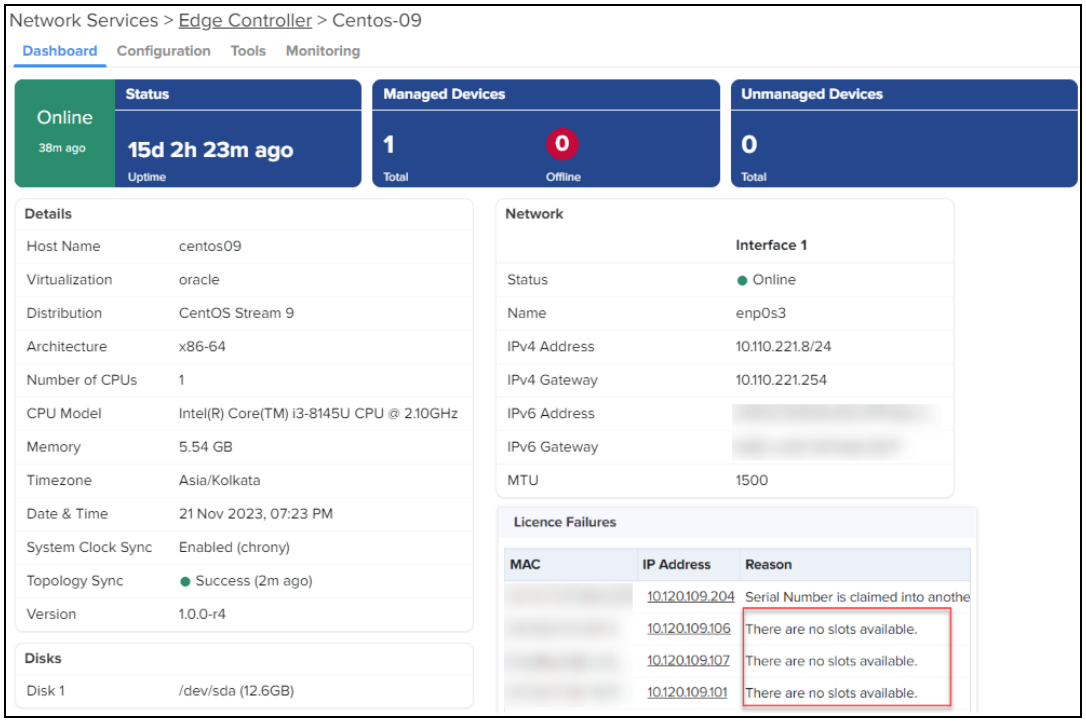
4. The device appears on the Onboarding page.
5. Click **Approve**.

New devices periodically query cnMaestro Cloud to see if they have been claimed (it generally takes between 1 to 15 minutes to show up in an account, depending upon when the device was last rebooted). Once a device has been added to a Cloud management account, it will be visible in the Onboarding Queue.

	NOTE: Devices must be able to access https://cloud.cambiumnetworks.com to be claimed and onboarded. HTTPS proxies are currently not supported. If your device is not showing up in the Cloud management UI, you should verify network connectivity and reboot the device to prompt more frequent connection attempts.

- **Not Enough Slots available in PTP 820/850 devices**

User receive the license failure message in PTP 820/850 device dashboard, when no slots are available.



Approving Devices

Devices in the Onboarding Queue must be approved before they are updated and added to the Cloud Management. Click the approval button in the device to onboard. Unapproved devices will remain in the Onboarding Queue indefinitely.

	NOTE: • Once approved, connected devices are onboarded and added to the account immediately, and all configuration or software updates are applied. Approved devices will be onboarded as soon as they connect. • To pre-provision devices, you should make all your changes before approving them. After devices have been onboarded, additional configuration or software updates must be done through the standard management user interface.

Devices that have completed onboarding remain in the Onboarding Queue for one week.

Claiming Devices with Cambium ID

The Cambium ID is defined when the Cloud management is created. You can view it on the **Home** page; it uniquely identifies the account.

To claim a device with Cambium ID, you need to have access to the device. Cambium ID claiming is required for devices that do not have a 12-character Serial Number, and it is optional for devices with a 12-character Serial Number. There are two ways to claim a device with Cambium ID.

Table 14: Types of Claiming Devices with Cambium ID

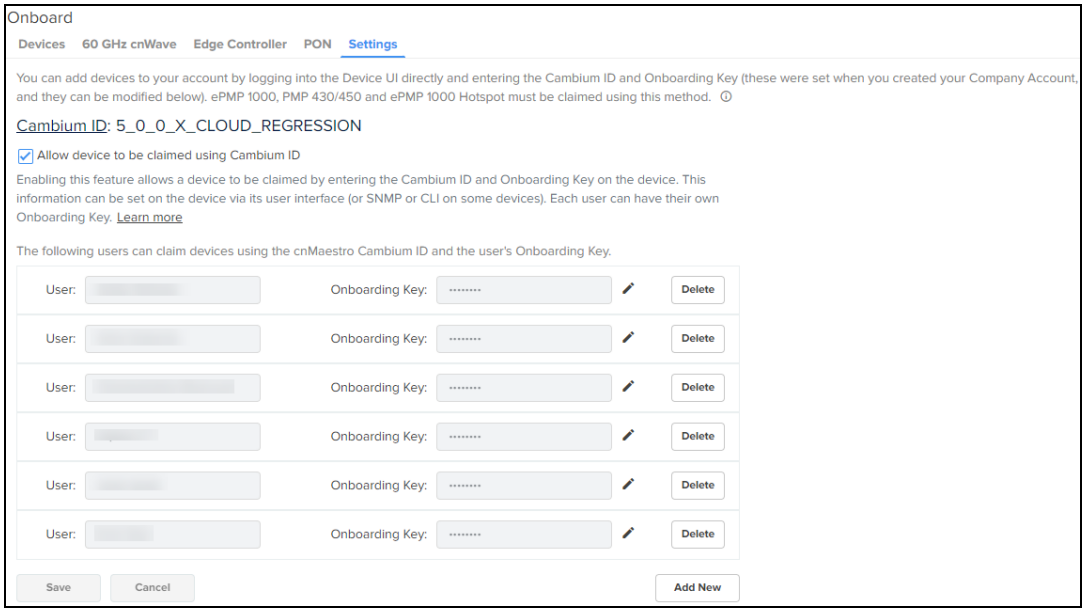
Type	Description
Device UI	Enter the Cambium ID/Onboarding Key directly into the Device User Interface. This prompts the device to access Cambium Cloud and be placed in the Onboarding Queue.
Device SNMP	The Cambium ID/Onboarding Key can also be entered into the device over SNMP. This allows one to quickly onboard existing devices using an SNMP manager. The correct OID will be dependent upon the device type. The string entered into the OID should be of the format "<Cambium ID>:<Onboarding Key>".

The directions for each specific device type are presented later in this chapter. Once devices are added to the Onboarding Queue using Cambium ID, the administrator must approve them prior to them being onboarded.

Cambium ID Configuration

You must configure the Cloud Manager to support Cambium ID onboarding. Once enabled, Cambium ID onboarding will work for all device types.

Figure 41 Cambium ID Configuration



Cambium ID Onboarding Key

An Onboarding Key must be associated with a Cambium ID before onboarding. This provides security and tracking benefits for onboarded devices. The Onboarding Key can be configured at **Onboard** > **Settings**.

Each onboarding key is mapped to an account administrator. This allows Cambium Cloud to know who is onboarding a device. Onboarding Keys can also be revoked if needed.

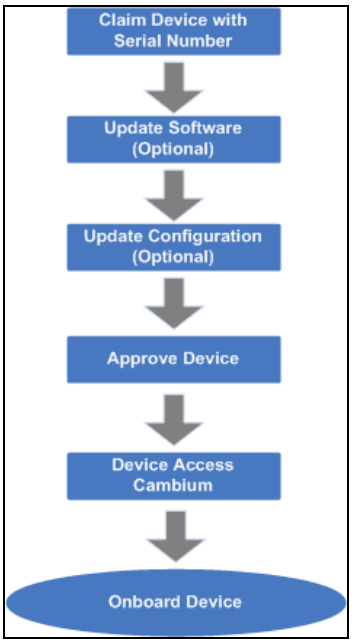
Onboarding Queue

The Onboarding Queue holds a list of pending and recent (last 24 hours) device onboards. It allows the administrator to pre-provision device software and configuration, as well as signal a device is ready to be onboarded. The process flows for how the Onboarding Queue is used are slightly different based upon how the device was claimed.

Serial Number flow

When onboarding with Serial Number, the device can be fully provisioned before it contacts Cambium Cloud and is placed in the Cloud Management. This allows it to be added immediately upon connection.

Figure 42 Serial Number flow

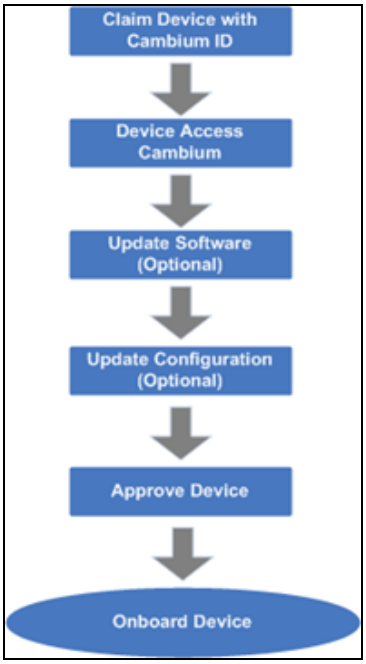


	NOTE: When a user onboards using a Serial Number, the software update and configuration can be defined even before the device physically accesses the account.

Cambium ID flow

The flow is a little different when using Cambium ID. Here devices must connect to Cambium Cloud before they are added to Cloud Management. The administrator needs to then approve them in the Onboarding Queue after optionally updating the software version and device configuration.

Figure 43 Claiming Devices Using Cambium ID



Onboarding fields

The following table details the columns in the Onboarding Queue. Some of these fields will be unknown or uncertain until the physical device has contacted Cloud Management.

Table 15: Onboarding fields

Parameter	Description
Actions	Before a device is onboarded, it must be approved. There are two buttons available: • **Approve**: Click **Approve** to enable the device for onboarding. If the device is connected, it will be onboarded immediately. • **Delete:** If the device has been added in error, you can delete it from the Onboarding Queue. This also disconnects the device and allows it to be added to another account. The Delete button is only enabled before the device has started the onboarding process.
Added By	The user who added this device for onboarding. **Note**: If the Device is claimed by a tenant user, the user information is not shown on the Onboarding page.
Configure	This highlights configuration that is applied to the device before onboarding. It is presented as a set of icons that represent: software update, configuration update, and map placement. The icons have the following colors: • Gray: Indicates that nothing is applied. • Green: Indicates that the parameter is set and applied when onboarded.
Device	The name of the device. This is set manually, or, if unset, it will be read from the device.
Duration	Displays when the status last changed for the device.

Table 15: Onboarding fields

Parameter	Description
IP Address	The IP address of the device. This is only available after the device contacts cnMaestro.
MAC Address	The MAC address of the device (if known).
Serial No	The Serial Number of the device.
Status	The current status of onboarding: **Waiting for Approval:** The device has contacted cnMaestro, but it has not been approved, so it is in a waiting state. **Waiting for Devices:** The user has claimed the device, but the device has not connected. **Onboarded:** The device has completed onboarding and must now be managed through normal Configuration and Software Update processes.
Type	The type of the device (if known or manually configured).

Onboarding Configuration

Before a device has been approved, the administrator can pre-provision the device. This is presented through a set of icons (depicted below), which represent configuration update, software download, and device map position.

The color icon indicates the following:

- **Gray**: no changes are made to the device configuration [].
- **Green**: changes are applied successfully [].

NOTE:

Onboarding configuration can be modified until the onboarding process has begun. The approval however needs to be turned off before any changes can be made.

Basic Details

The basic configuration includes Serial Number, MAC, Device Name, Mode, and Description. A Comment can also be specified to provide additional context to the device.

Configure Device

Configure Device follows the standard template system (see the section on Template Configuration for full details). The administrator can select an existing configuration template and set any required variables.

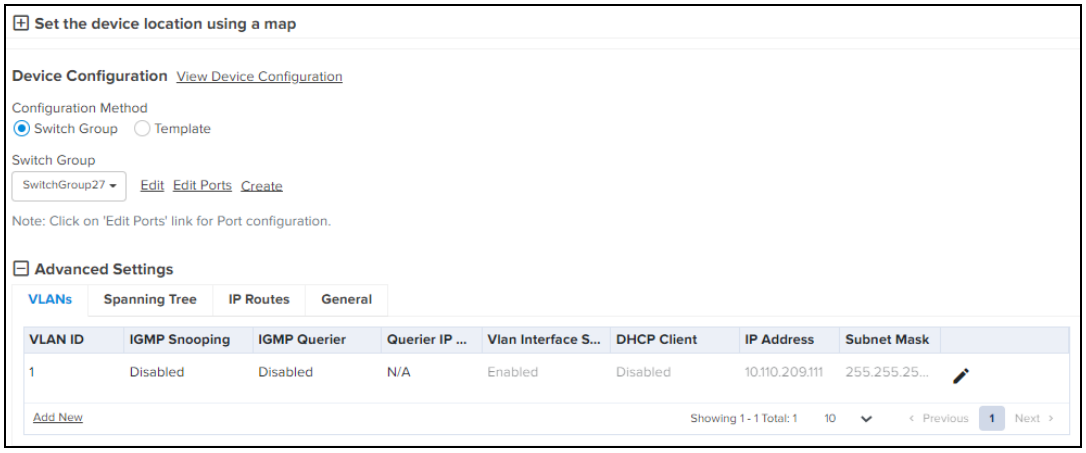
cnMatrix Configure Device

The administrator can select configuration method with the existing template or Switch Group.

User can configure the following Switch Group options while onboarding the devices:

- General
- IP Routes
- Spanning Tree

- VLANs



Software Update

Software Update pushes a software image to the device. The administrators can select an image version and push to all ePMP (AP or SM) device selected in a job.

Device Location

The Device location configuration includes Network, Tower, Latitude, and Longitude on a map.

Onboarding Actions

Approve Device

An administrator needs to approve devices before onboarding can begin. This is done by selecting Approve. As soon as a device is approved, it is eligible to start the onboarding process. This occurs immediately with connected devices. Any changes to the Onboarding Configuration need to be completed before Onboarding begins; the Approval check must also be disabled.

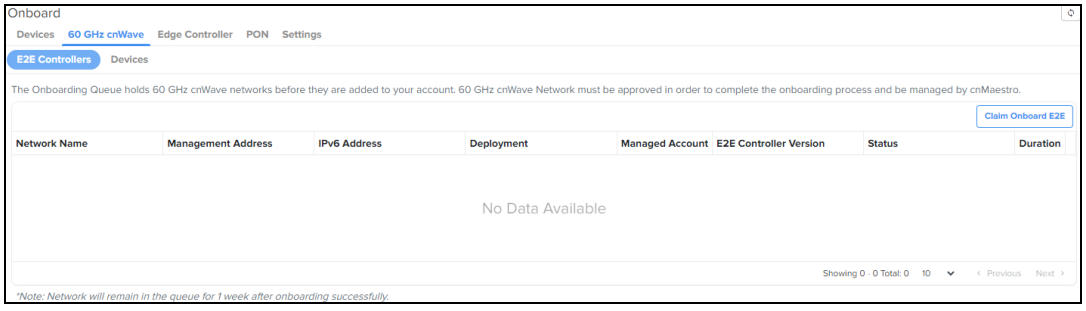
Delete Device

Devices deleted from the Onboarding Queue are removed from Cloud management. They can then be added to other accounts. See below for how to delete devices that have already onboarded.

60 GHz E2E Controller Onboarding

The Onboarding Queue has a separate tab for 60 GHz cnWave E2E Controllers, which must be approved by the user before they are added to cnMaestro as an E2E Network and can manage 60 GHz cnWave devices. This approval can be done either through the Onboarding Queue or the Hierarchical Tree (where the E2E Network is placed).

Once the onboarding is approved, the 60 GHz cnWave E2E Network (and its devices) can be managed by cnMaestro.



	NOTE: If **Auto Generate IPv6 Addresses** is enabled, E2E Controller fetches the IPv6 addresses automatically.

Refer to 60 GHz E2E Controller Onboarding chapter for details on how to onboard E2E devices.

For details on how to onboard Edge Controller and PTP 820/850 refer to Onboard Edge Controller

Header Notification

The header bar in cnMaestro displays the following UI controls:

These UI controls are located on the top right side of the UI page. The **Search** UI control allows you to provide keywords and search for the required knowledge base information (for example, onboarding devices to cnMaestro) available in Cambium community. The **Notifications** UI control provides the count of major alarms. The **Out of sync devices** UI control provides the count of devices that are out of sync. The **Administrator** UI control supports a drop-down list, which you can use to search and view account names, create account, edit profile, and log out.

Zero Touch Configuration

Zero Touch Configuration allows PMP SMs and also ePMP SMs to automatically appear in the Onboarding Queue, provided parent AP is already onboarded.

Claim Your First Wi-Fi AP (Cloud)

Irrespective of the account type, the **Claim Your First Wi-Fi AP** option has been introduced to simplify the Wi-Fi AP deployment. This option allows the claiming of Wi-Fi APs. This option is available when no APs have been claimed for your device.

Consider the following points for using the **Claim Your First Wi-Fi AP** option:

- For the access and backhaul account type, navigate to the **Wi-Fi AP Group** tree view. You can see this option for claiming your first Wi-Fi AP.
- For the Wi-Fi account type, the **Wi-Fi AP Groups** tree menu (available on the Monitor and Manage page) is launched with the **Claim Your First Wi-Fi AP** option automatically (as shown in Figure 44).
- For Cloud users who want to claim Wi-Fi AP for a single device (after onboarding the device for the first time and if no AP has been claimed), navigate to the main **Home** page. You can locate the **Claim Your First Wi-Fi AP** widget on the right side of the **Home** page (as shown in Figure 45).

Figure 44 The Claim Your First Wi-Fi AP option

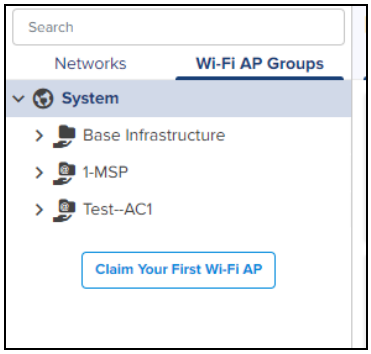
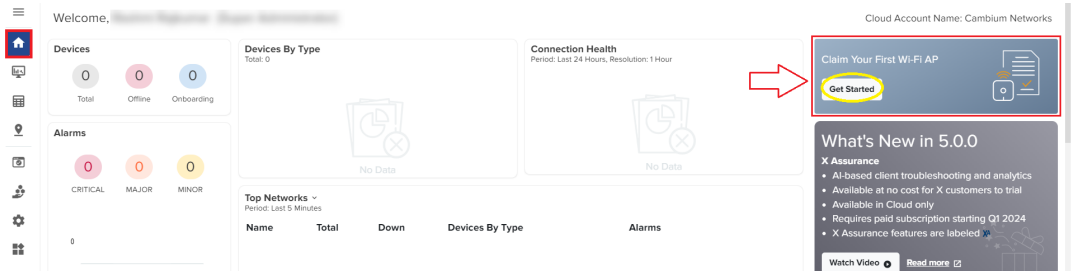


Figure 45 The Claim Your First Wi-Fi AP widget on the Home page



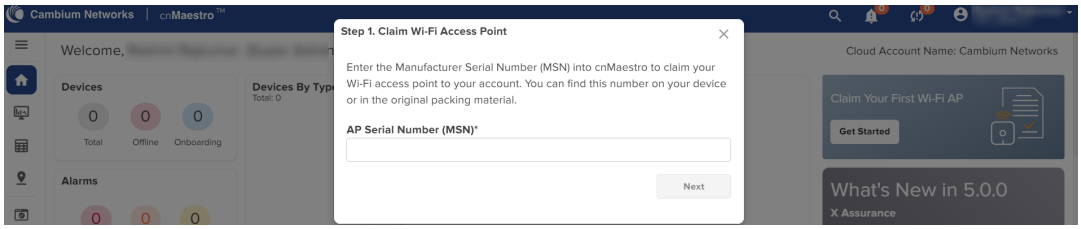
If there are any APs claimed already for the Wi-Fi devices, this **Claim Your First Wi-Fi AP** option is not available on Home and Monitor and Manage UI pages

Claiming for a single Wi-Fi device from the Home page

To claim your first Wi-Fi AP for a single device, perform the following steps:

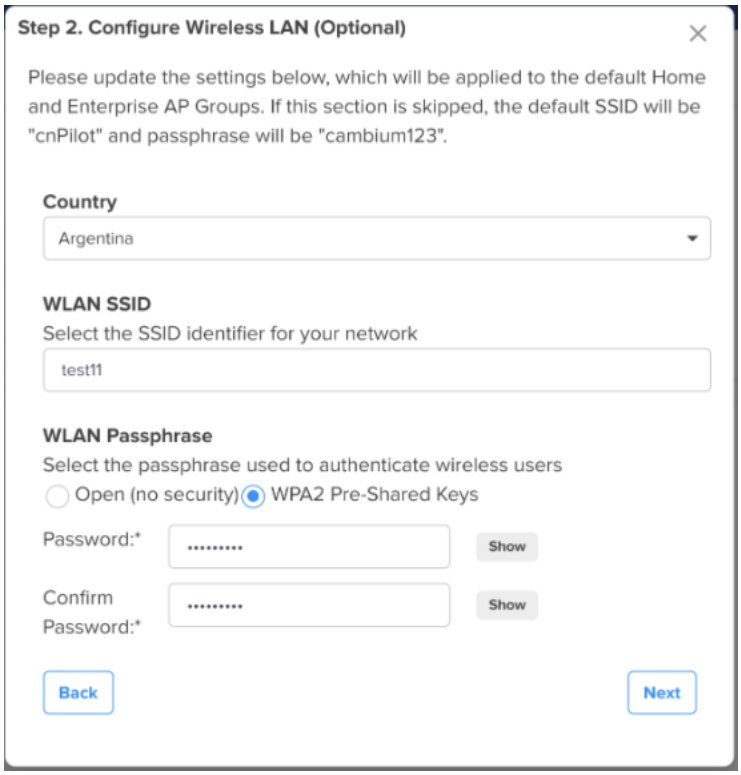
1. On the main **Home** page, locate the **Claim Your First Wi-Fi AP** widget on the right side of the page and click **Get Started** (as shown in Figure 45).

The **Claim Wi-Fi Access Point** screen appears.



2. Enter a valid value in the **AP Serial Number (MSN)** text box (for example, AxCx4040Q2V8) and click **Next**.

The **Configure Wireless LAN (Optional)** screen displays multiple settings, which are applicable to Wi-Fi APs (home and enterprise Wi-Fi).



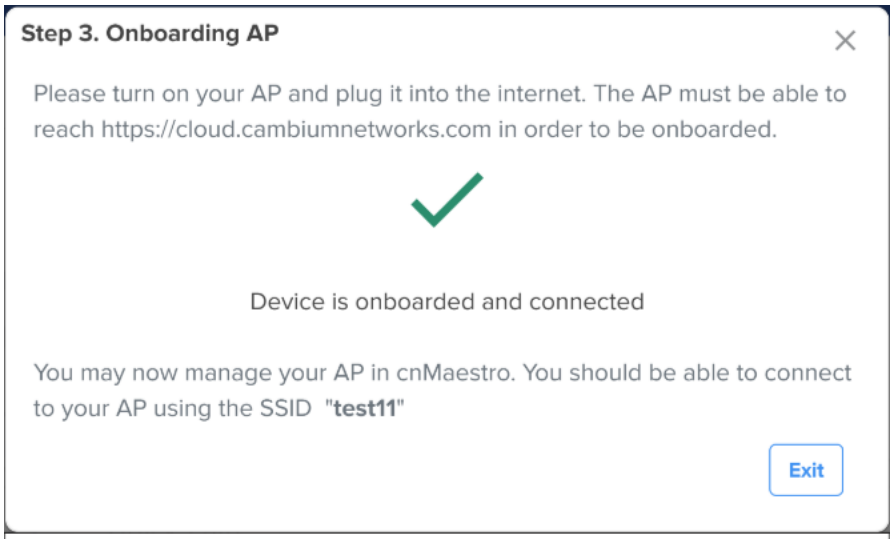
You can update the following settings based on your requirements.

- **Country**: Name of the country (used for the regulatory purpose).
- **WLAN SSID**: Unique name or ID that identifies your wireless network. Do not leave this field blank.
- **WLAN Passphrase**: The passphrase is supported only if the WPA2 Pre-Shared Keys option is selected as the security method. The minimum length of the passphrase is eight characters.

If you skip configuring this settings section, the default SSID and the security configuration of the device are retained.

3. Click **Next**.

The **Onboarding AP** screen displays the onboarding status (for example, waiting) for the device. If the device is successfully onboarded, the **Onboarding AP** screen displays the following message:



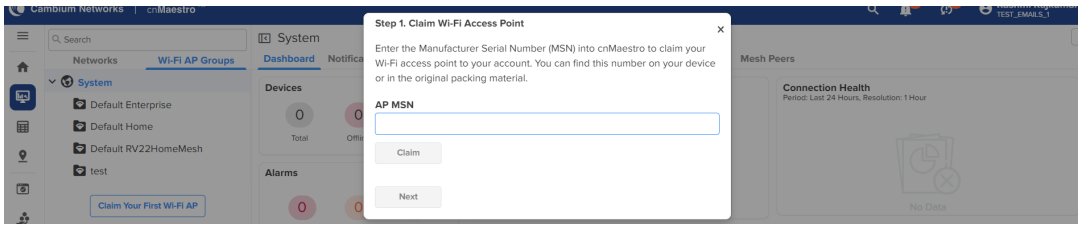
If the onboarding fails, the **Onboarding AP** screen displays a message indicating the failure status.

Claiming for a single Wi-Fi device using the AP Group menu

To claim your Wi-Fi AP using the **Wi-Fi AP Groups** tree menu, perform the following steps:

1. Navigate to **Monitor and Manage** > **Wi-Fi AP Groups** tree menu, and click **Claim Your First Wi-Fi AP** (as shown in Figure 44).

The **Claim Wi-Fi Access Point** screen appears.



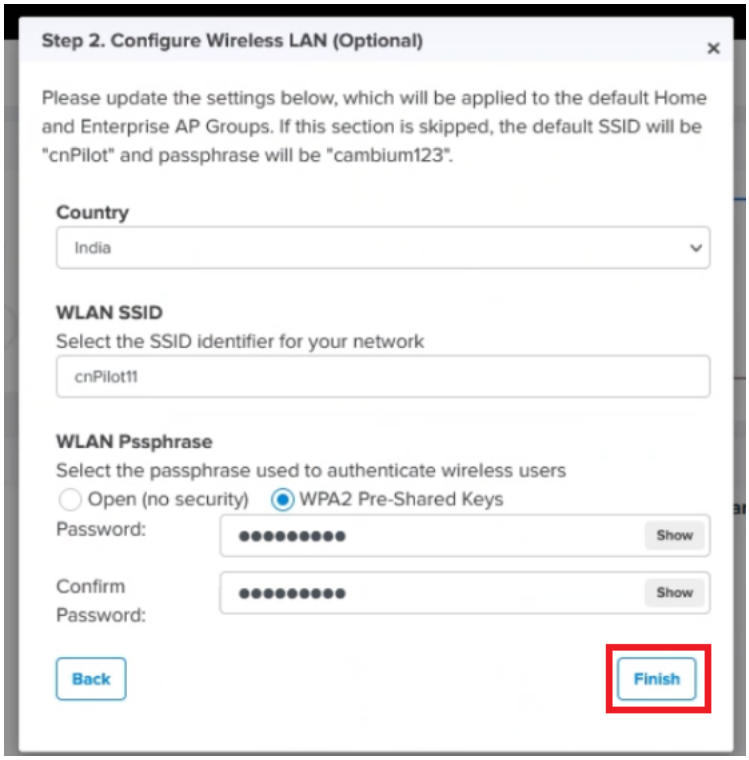
2. Enter a valid value in the **AP MSN** text box and click **Claim**.

The device is successfully claimed.

3. Click **Next**.

The **Configure Wireless LAN (Optional)** screen displays the following fields for configuration: Country, WLAN SSID. and WLAN Passphrase.

4. Enter the configuration details.



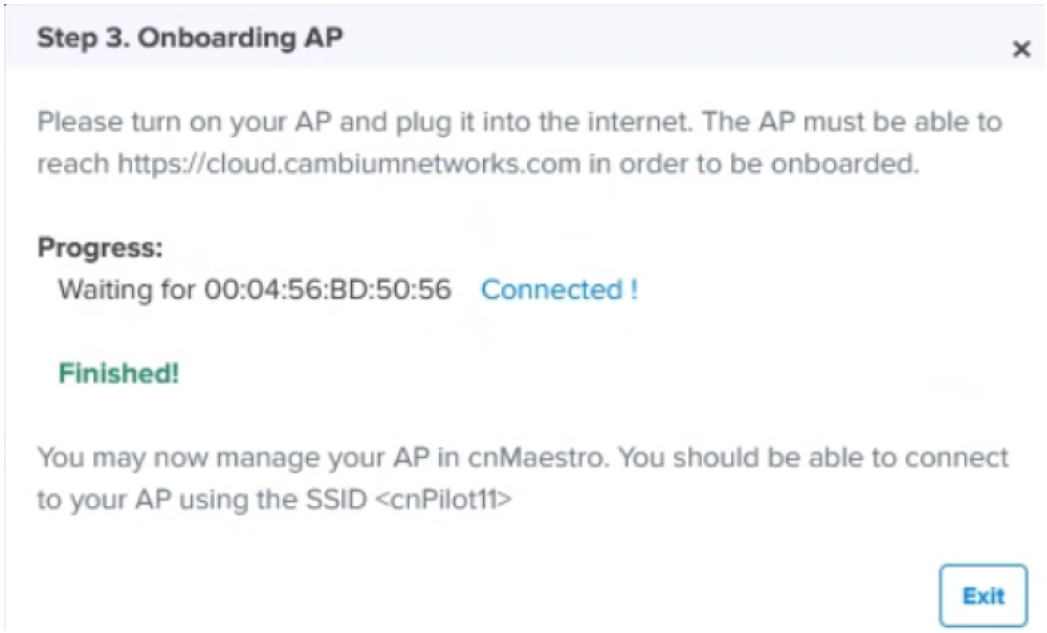
You can configure the following settings based on your requirements:

- **Country**: Name of the country (used for the regulatory purpose).
- **WLAN SSID**: Unique name or ID that identifies your wireless network. Do not leave this field blank.
- **WLAN Passphrase**: The passphrase is supported only if the WPA2 Pre-Shared Keys option is selected as the security method. The minimum length of the passphrase is eight characters.

If you skip configuring this settings section, the default SSID and the security configuration of the device are retained.

5. Click **Finish**.

The **Onboarding AP** page displays the onboarding status and configured actions for the device.

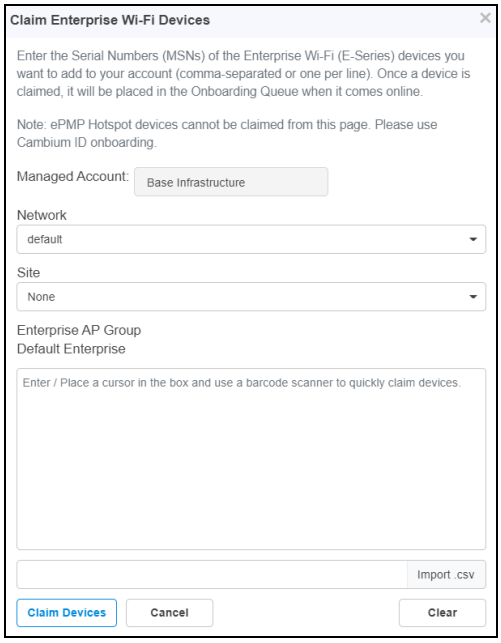


The device is mapped to the default Wi-Fi AP Group, and the configuration is updated in the Default Enterprise WLAN.

Claiming multiple Wi-Fi devices from AP Group

To claim multiple devices from the AP Group, navigate to the Wi-Fi AP Groups tree view and click the drop-down menu for the selected AP Group.

1. Click the **Claim Device**s option.
2. In the pop-up dialog select the Network and Site under which these devices should be placed and by default devices claimed under this group will have its configuration settings.



3. Specify the Manufacturing Serial Numbers (MSNs) of the devices line-by-line or comma-separated, or click the **Import .csv** option to import the MSNs of the devices from a file.
4. Click **Claim Devices** to add to the selected AP Group with the configuration applied.

NOTE:

In cnMaestro On-Premises the procedure is the same as Cloud, but instead of MSN, the user should use the Device MAC Addresses.

Claiming multiple Wi-Fi devices from Enterprise Site Dashboard

To claim multiple devices from the Site Dashboard, perform the following steps:

1. Navigate to the **Manage** > **Network** tree view and select the drop-down menu for the Site.
2. Click **Claim Devices** from the drop-down.
3. In the pop-up dialog select the AP Group that should be applied for Enterprise Wi-Fi devices. The devices claimed under this site will have the configuration settings from the selected AP Group.
4. Specify the MSNs of the devices line-by-line or comma-separated, or use the **Import .csv** option to import the MSNs of the devices from a file.
5. Click **Claim Devices** to add the devices to the selected AP Group and click **Apply Configuration**.

Miscellaneous Onboarding Issues

Configuring Devices After Onboard

When Onboarding completes, the device will no longer be managed through the Onboarding Queue. Instead, Configuration and Software Upgrade needs to be performed through the standard cnMaestro UI sections.

Deleting Devices

While a device is in the Onboarding Queue, it can be removed from the account by deleting it from the queue. After Onboarding, the device needs to be manually deleted. The device can be deleted either by right-clicking the device node in the tree and selecting the **Delete** option or from the **Inventory** page.

Transferring Device Ownership

When a device is sold to a third-party, the device ownership needs to be transferred. This is done by deleting the device in one account, thereby opening it up to being claimed by another.

NOTE:

When the device is in **Reset** or **Delete** state, the device can onboarded without re-approval when using a Cambium ID or Onboarding Key.

Onboarding Examples

This section provides the following topics:

- Onboarding Existing Networks
- Onboarding New Devices

Onboarding Existing Networks

Existing networks can be onboarded by setting Cambium ID on already-deployed devices over SNMP (see the section on Device-Specific Onboarding for details on the OID). These devices will contact Cambium Cloud and be mapped to the corresponding Cloud Management. To complete onboarding, the administrator should navigate to the Onboarding Queue and approve all devices.

Onboarding New Devices

New devices are onboarded either using Cambium ID (which is a requirement for serial numbers less than 12 characters in length) or through the Serial Number.

Claiming Devices using Cambium ID and Device UI

- Configure cnMaestro to Support Cambium ID

First, make sure Cambium ID support is enabled, and a password field is set.

1. Navigate to **Home > Onboard Devices** and click **Claim from Device**.
2. Select **Allow device to be claimed using Cambium ID.**
3. Click **Add New.**
4. Choose the name of the user from the **Name** drop-down list.
5. Enter the key for the user in the **Onboarding Key** textbox. The minimum length of characters for the key is 8.
6. Click **Save**.

- Set Cambium ID on the Device UI

Launch the device UI and enter the Cambium ID and password. The example below defines how to set for ePMP.

1. Login to the device UI and navigate to **Configuration > System > cnMaestro tab**.
2. Enable the radio button for enabling **Remote Management.**
3. Enter the cnMaestro cloud URL in the **cnMaestro URL** textbox.
4. Enter Cambium ID in the **Cambium ID** textbox.
5. Enter the Onboarding key in the **Onboarding Key** textbox.
6. Click **Save** the device.

- **Approve the Device for Onboarding:**

1. Navigate to **Home > Onboard Devices** and click the **Onboard** tab.
2. Find the device and onboard using the Cambium ID.
3. You can able to see who onboarded the device.
4. The Status field should display **Waiting for Approval**.
5. Make any additional onboarding configuration changes you want.
6. Approve the device by clicking the **Approve** button under **Actions**.
7. The device status will change to **Onboarded** after onboarding finishes under the **Status**.

Claiming Devices Using Cambium ID and SNMP

Devices can be claimed over SNMP by using the Cambium ID and Onboarding Key. See Claiming Devices with Cambium ID section for devices you would like to onboard in this way.

Device-Specific Onboarding Instructions

Onboarding cnMatrix

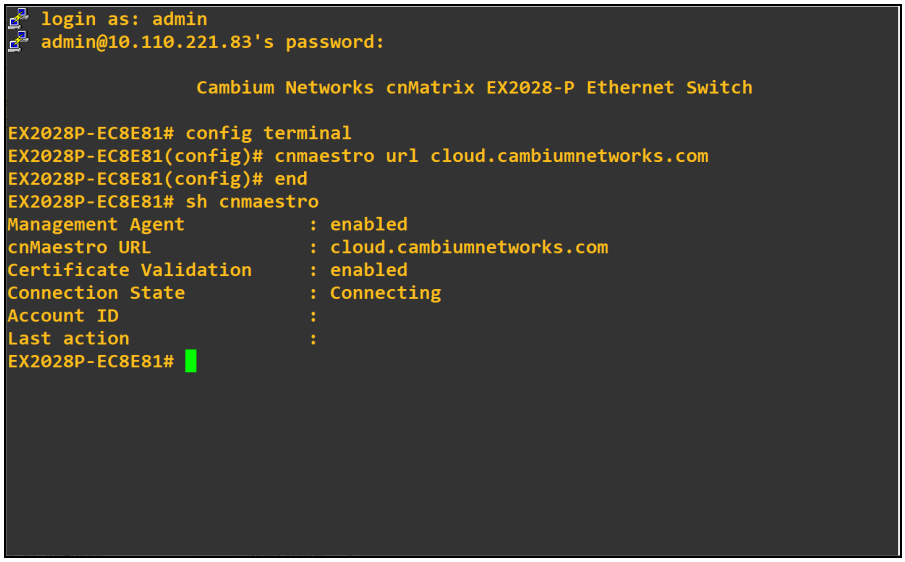
You can onboard cnMatrix through device CLI and using the device UI.

Execute the following command to onboard cnMatrix device connection to cnMaestro:

```
cnMatrix(config) # cnMaestro url cloud.cambiumnetworks.com
```

Execute the following command to view the status of cnMatrix device connection to cnMaestro:

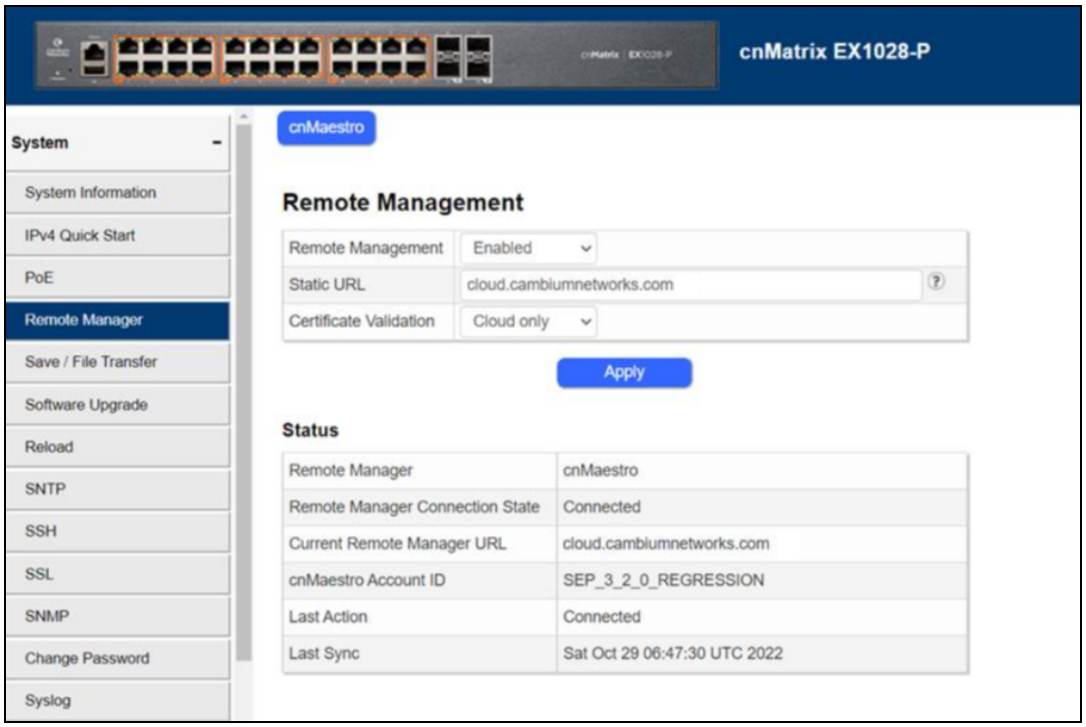
```
cnMatrix(config) # show cnMaestro
```



Onboarding cnMatrix through UI

In the cnMatrix device UI perform as follows:

1. Navigate to **System > Remote Management.**
2. Enter the details in **Remote Management** section.
3. Click **Apply**.

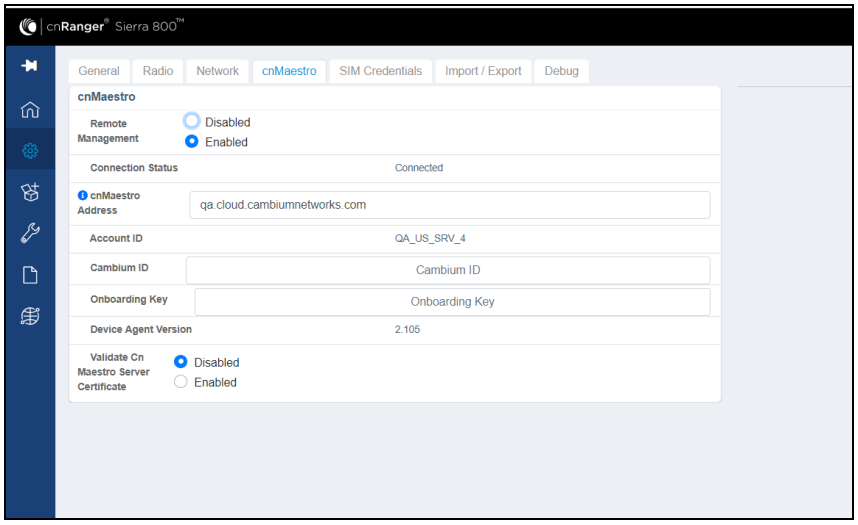


Onboarding cnRanger

To view the status of Sierra 800 and Tyndall 101 connection to cnMaestro.

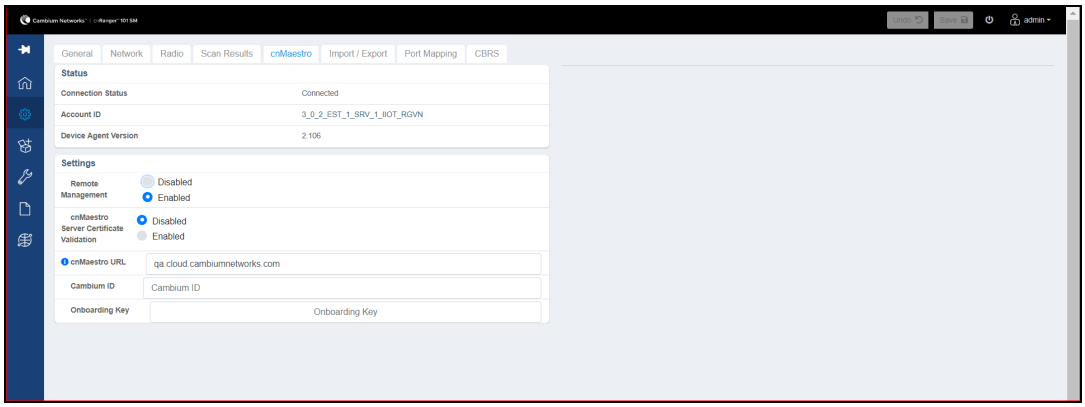
Setting static URL for cnMaestro on Sierra 800

1. Navigate to **Configuration > cnMaestro**.
2. Under cnMaestro section, enter the URL in the cnMaestro Address.
3. Click **Save**.



Setting static URL for cnMaestro on Tyndall 101

1. Navigate to **Configuration > cnMaestro**.
2. Under cnMaestro section, enter the URL in the cnMaestro URL.
3. Click **Save**.



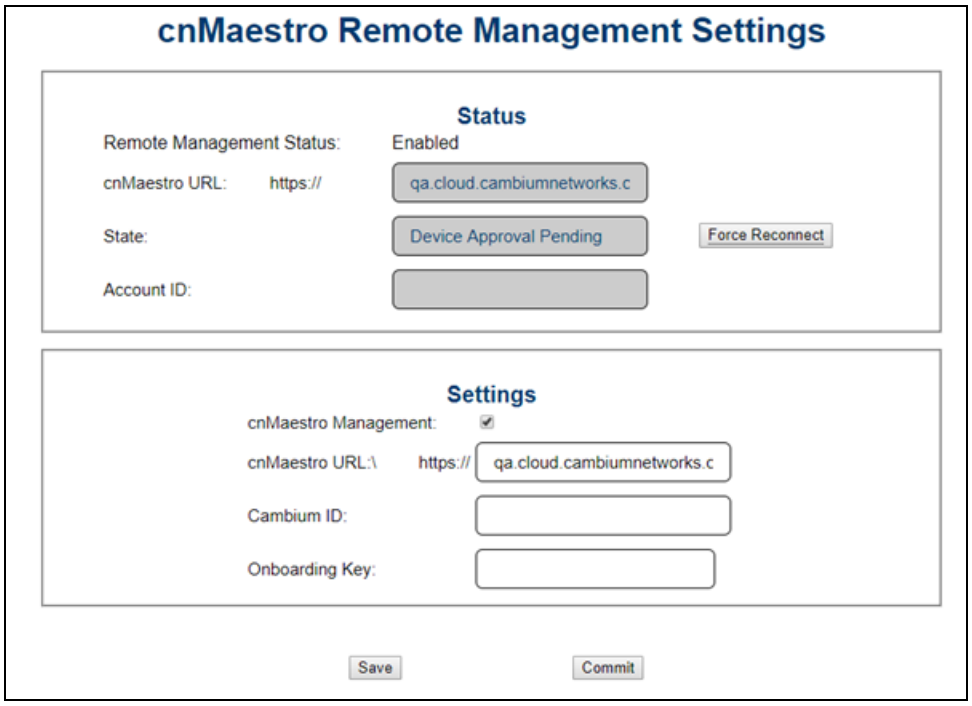
Onboarding cnReach

Onboarding through UI

In the cnReach device UI,

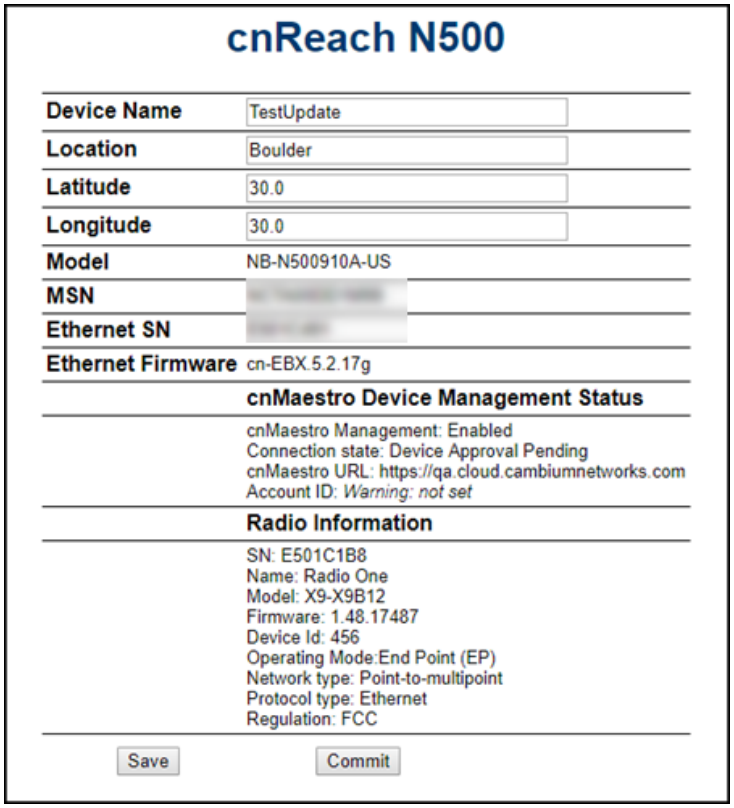
1. Navigate to **cnMaestro** > **Management Settings**.
2. Enable **cnMaestro Management** in Settings section.
3. Enter your **Cambium ID** and **Onboarding Key**.
4. Click **Save**.
5. Navigate to home page to view the status of the cnReach device connection to cnMaestro.

Figure 46 Onboarding cnReach through UI



To view the status of the cnReach connection in the cnMaestro:

Figure 47 Viewing the cnReach connection to cnMaestro



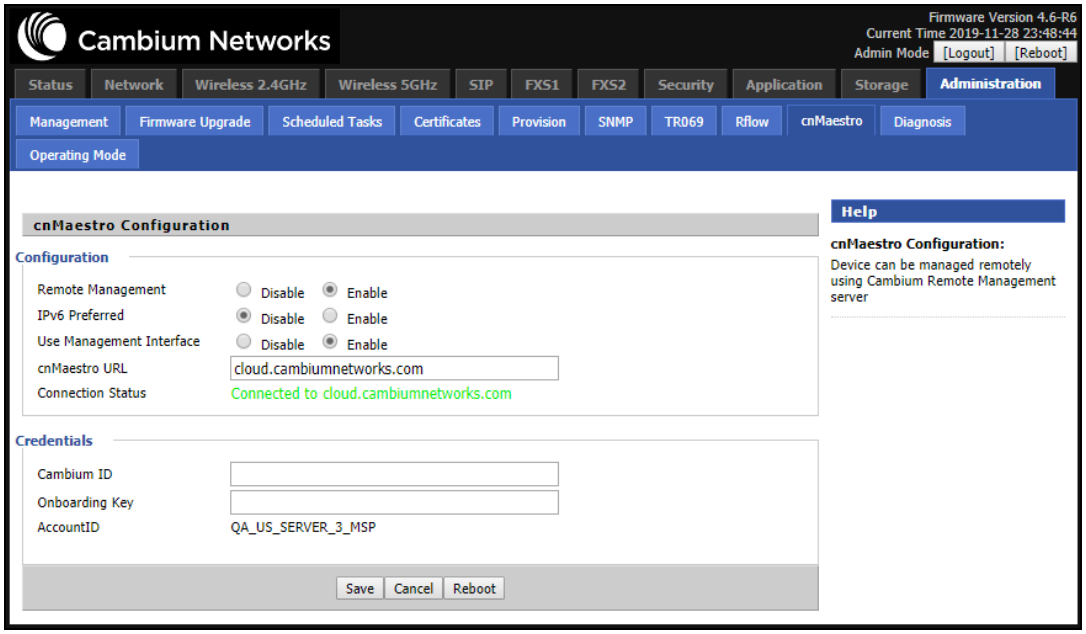
Onboarding cnPilot R-Series

Onboarding through UI

To view the status of the cnPilot R-Series device connection to cnMaestro:

1. Navigate to **Administration > cnMaestro**.
2. Under cnMaestro configuration section.
3. Enter the URL in the **cnMaestro URL**.
4. Click **Save**.

Figure 48 Viewing the cnPilot R-Series device connection



Onboarding through SNMP

The following OIDs can be configured:

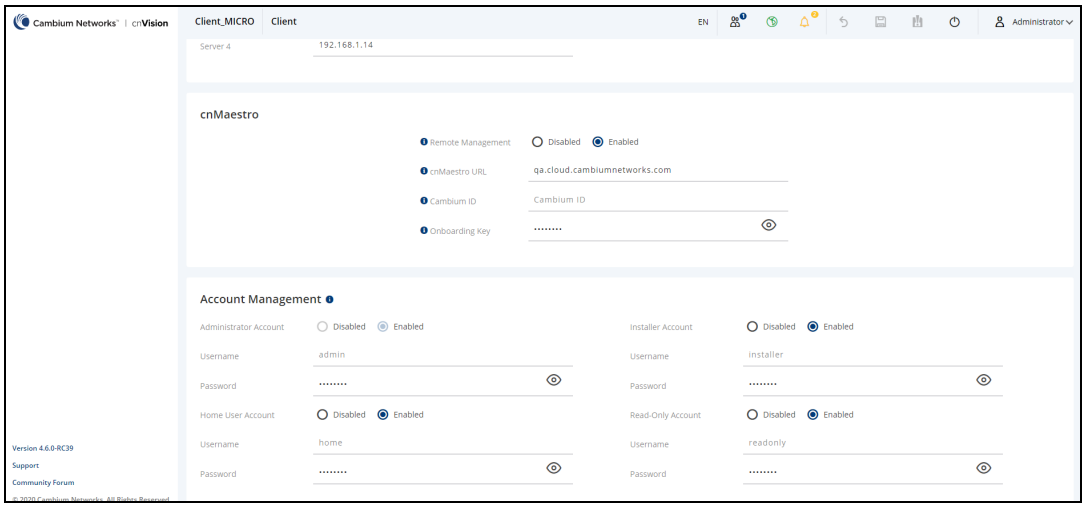
- cambium_id
- cambium_token
- cns_staic_url

Onboarding cnVision

Onboarding cnVision Client

In the cnVision Client device UI,

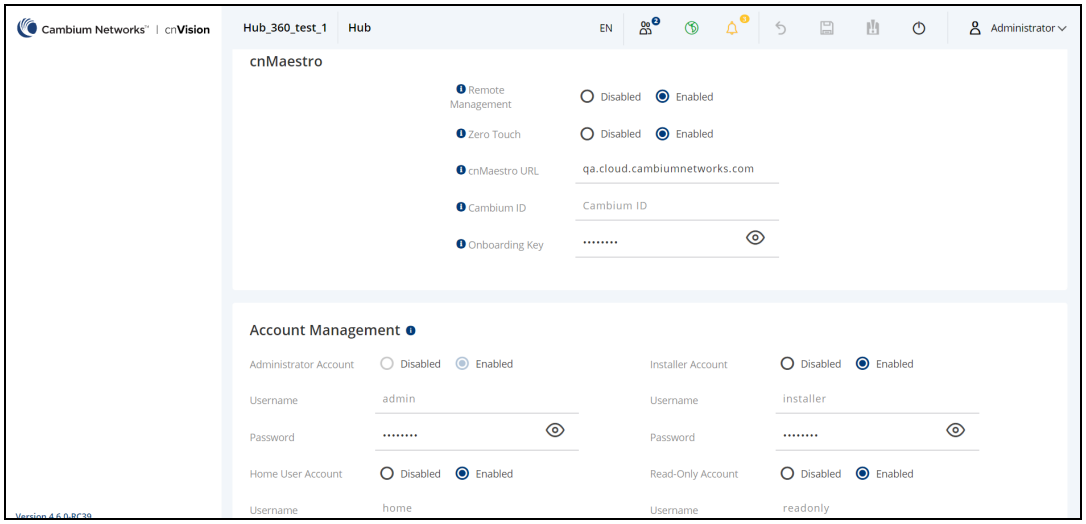
1. Navigate to **Configuration > System.**
2. Under cnMaestro section, enter cnMaestro URL.
3. Click **Save**.



Onboarding cnVision Hub

In the cnVision Hub device UI,

1. Navigate to **Configuration > System.**
2. Under cnMaestro section, enter cnMaestro URL.
3. Click **Save**.



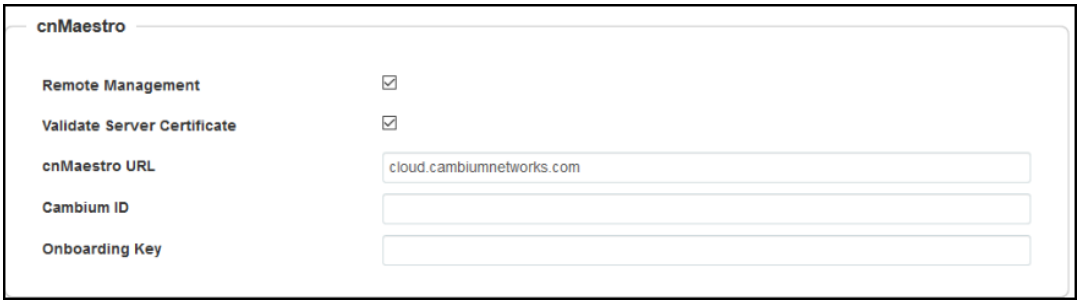
Onboarding Enterprise AP

Onboarding through UI

In the Enterprise AP device UI,

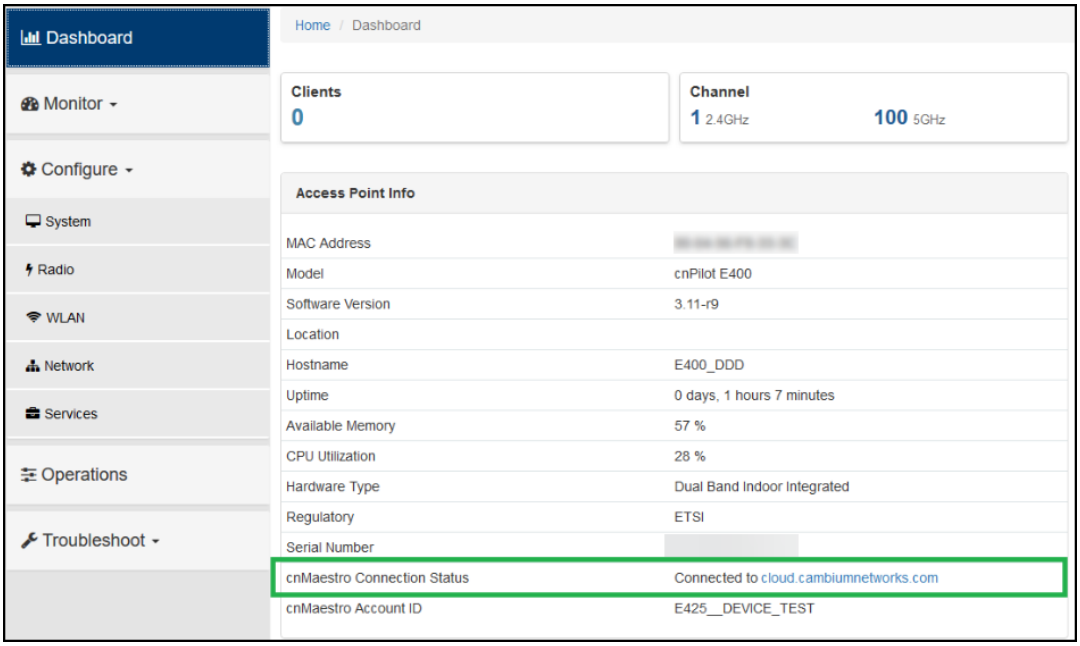
1. Navigate to **Configure > System**.
2. Scroll to **Management** > **cnMaestro**.
3. Enable **Remote Management**.
4. Enable **Validate Server Certificate** if required.
5. Enter **cnMaestro URL**.
6. Enter **Cambium ID** and **Onboarding Key.**
7. Navigate to **Dashboard** to view the status of the Enterprise AP device connection to cnMaestro.

Figure 49 Onboarding Enterprise AP through device UI



To view the status of the device connection to cnMaestro:

Figure 50 Viewing the Enterprise AP connection to cnMaestro



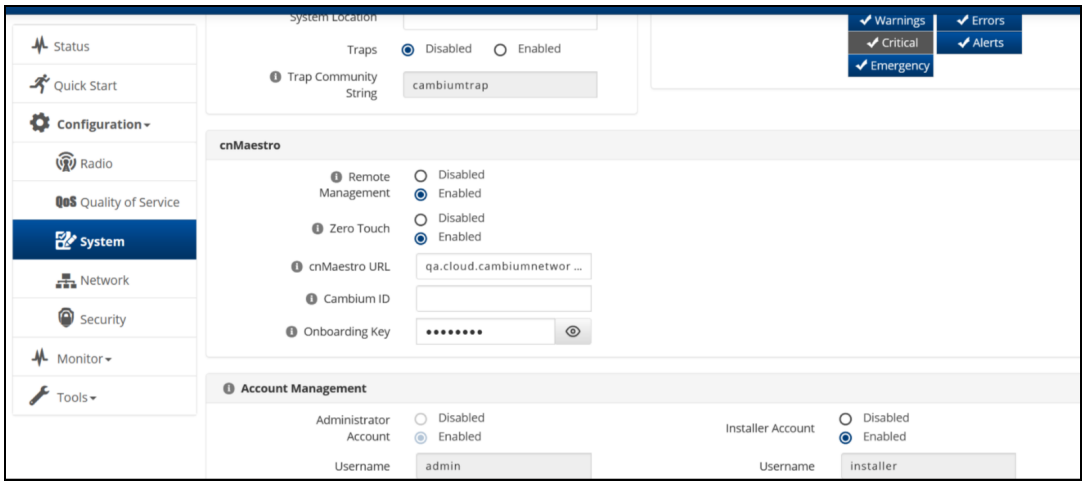
Onboarding ePMP 1000

Onboarding through UI

In the ePMP device UI,

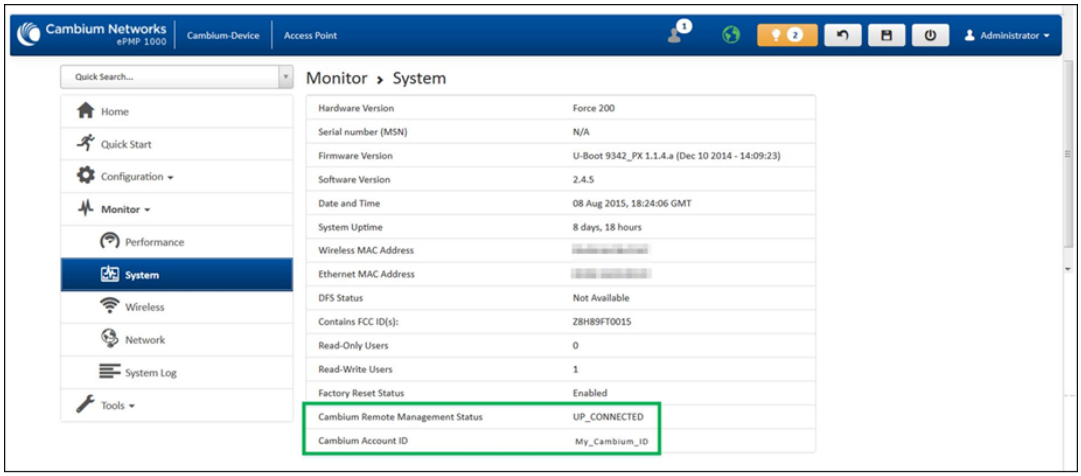
1. Navigate to **Configuration > System**.
2. Scroll to **cnMaestro**.
3. Select **Enable** and enter your Cambium ID and the user's Onboarding Password.
4. Navigate to **Monitor > System** to view the status of the ePMP device connection to cnMaestro.

Figure 51 Onboarding ePMP 1000 through UI



To view the status of the ePMP device connection to cnMaestro:

Figure 52 Viewing the ePMP device connection to cnMaestro



Onboarding through SNMP

The following OIDs can be configured:

- cambiumDeviceAgentEnable
- cambiumDeviceAgentCNSURL
- cambiumCNSDeviceAgentID
- cambiumCNSDeviceAgentPassword

The following OID can be used to check the status of the device's connection to cnMaestro.

cambiumCnsServConsStat

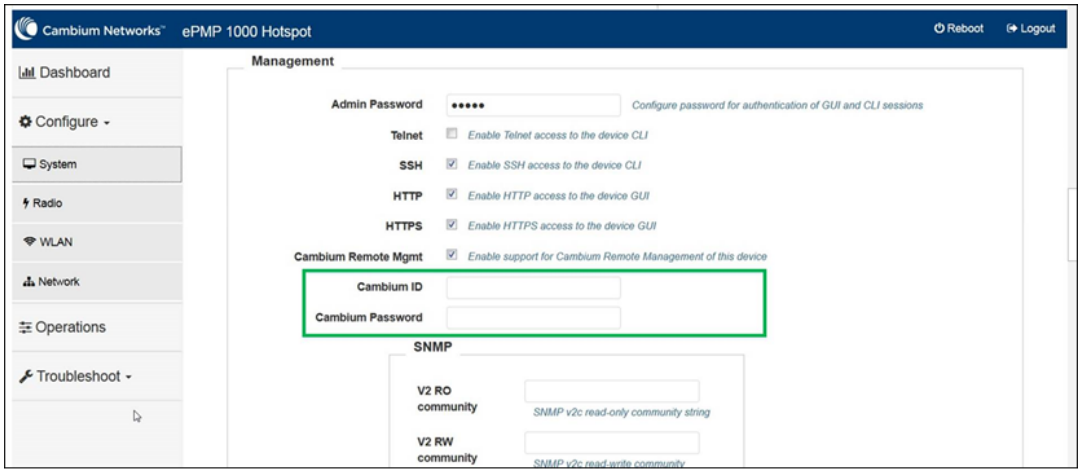
Onboarding ePMP1000 Hotspot

Onboarding through UI

To onboard ePMP 1000 Hotspot device connection to cnMaestro:

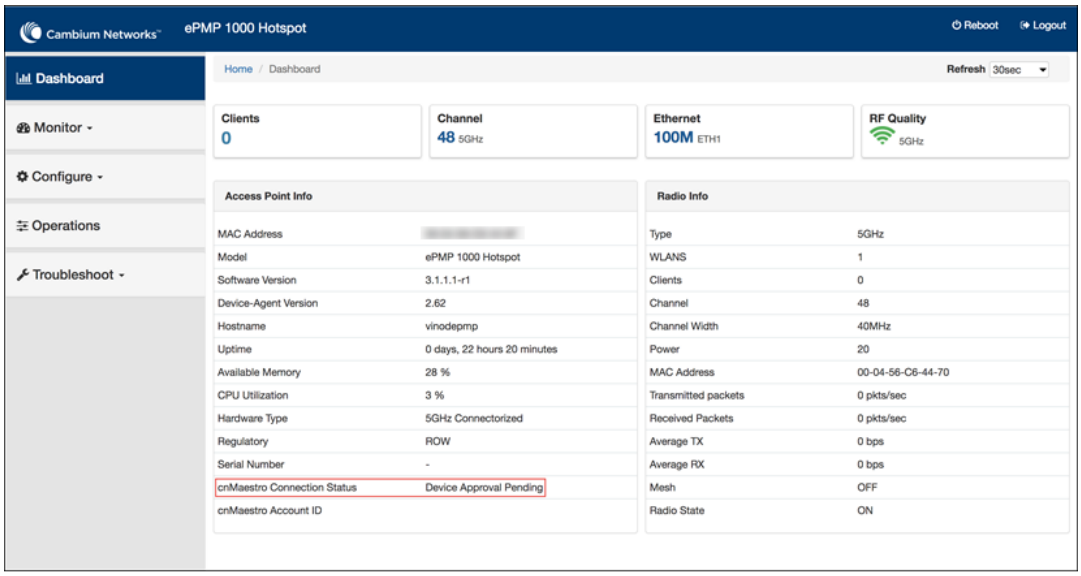
1. Navigate to **Configuration > System**.
2. Scroll to **Management**.
3. Select **Enable Cambium Remote Management.**
4. Enter your **Cambium ID** and **Onboarding Password**.

Figure 53 Onboarding ePMP1000 Hotspot through UI



To view the status of the ePMP 1000 Hotspot device connection to cnMaestro:

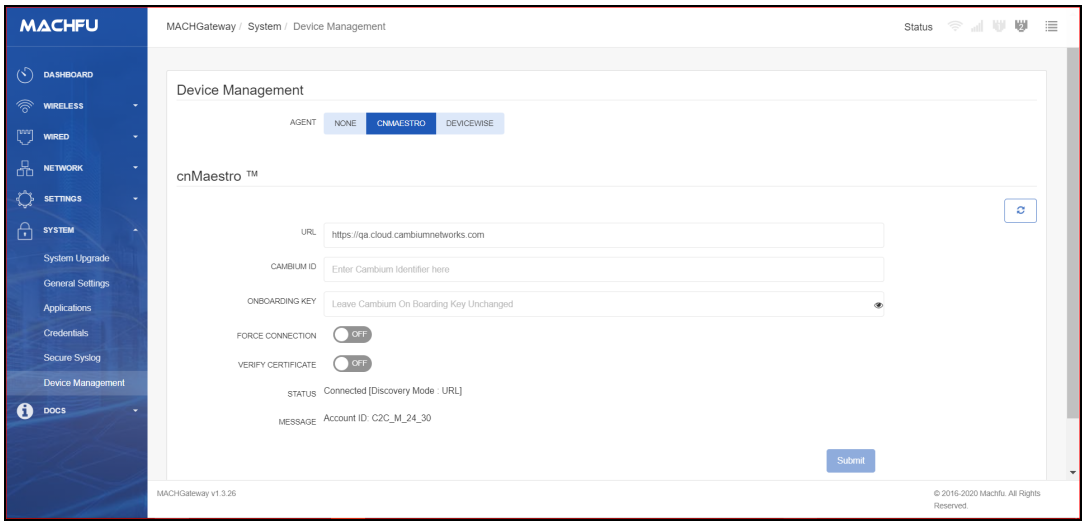
Figure 54 Viewing the ePMP 1000 Hotspot device connection to cnMaestro



Onboarding Machfu

In the Machfu device UI,

1. Navigate to **System > Device Management**.
2. Under cnMaestro section, enter cnMaestro URL.
3. Click **Save**.



Onboarding PMP

Onboarding through UI

To onboard PMP device connection to cnMaestro:

In the PMP device UI,

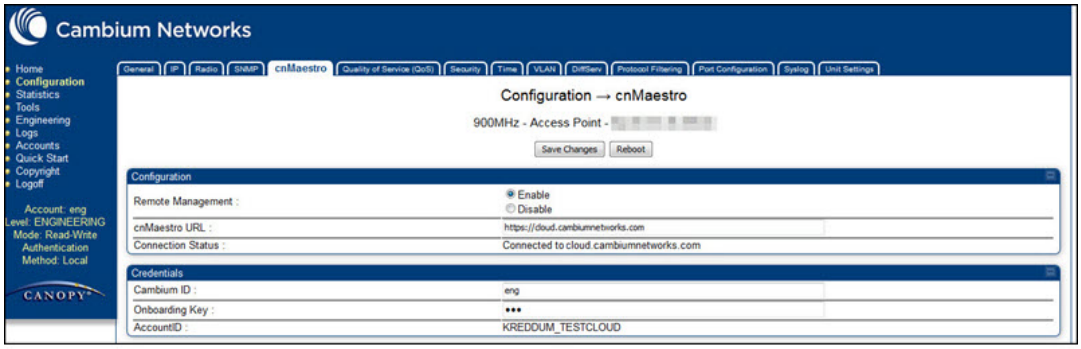
1. Navigate to **Configuration > cnMaestro**.
2. Under **Configuration**, provide the following details:

a. Select **Enable** under **Remote Management**.

b. Enter the URL to connect to cnMaestro in the **cnMaestro URL** textbox.

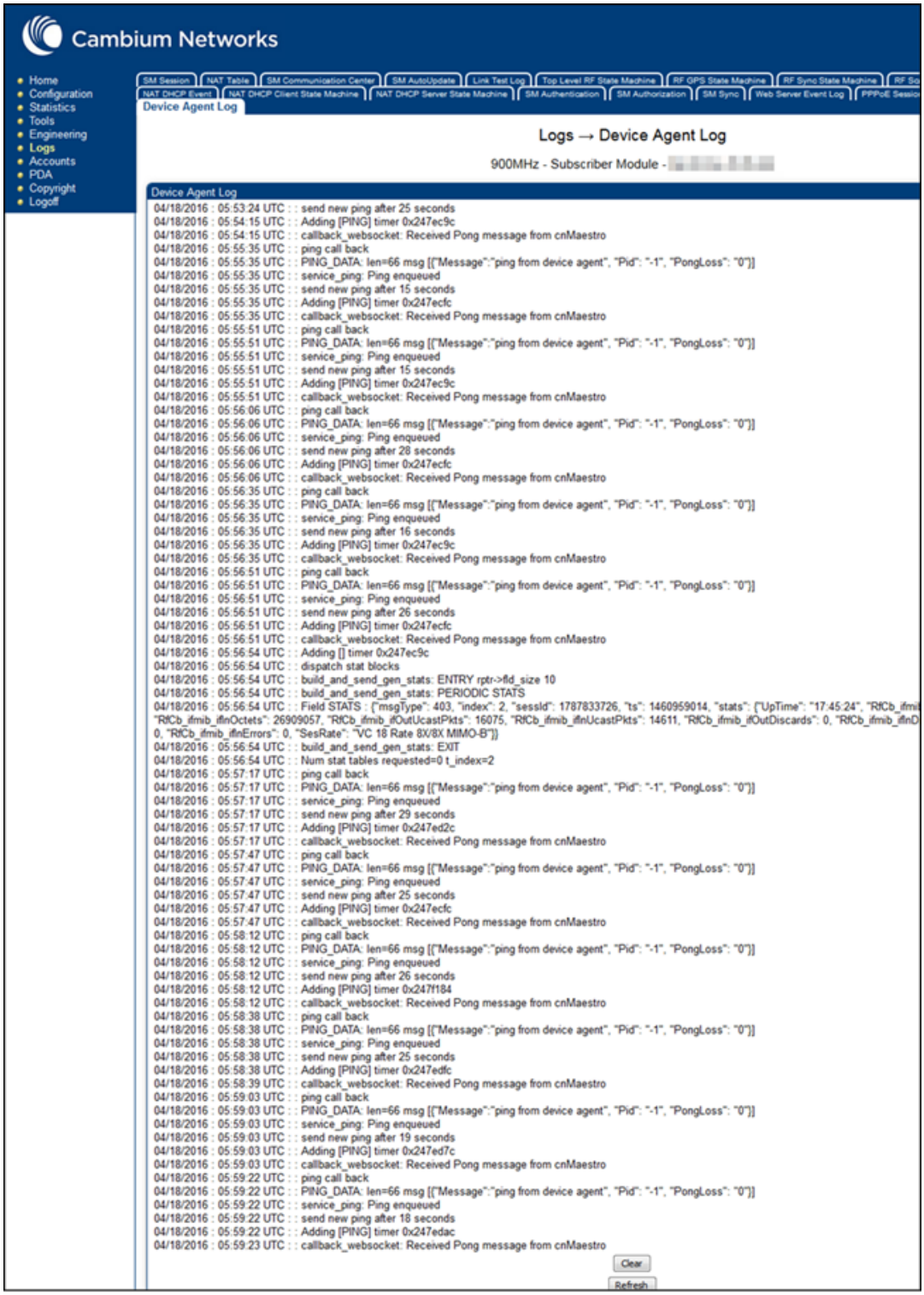
3. Under **Credentials**, enter the **Cambium ID and the Onboarding Key** in the respective textboxes. The Account ID field displays the account id of the user.

Figure 55 Onboarding PMP through UI



To view the logs, navigate to **Logs** > **Device Agent Log** page:

Figure 56 Viewing Logs



Onboarding through SNMP

The following OIDs can be configured:

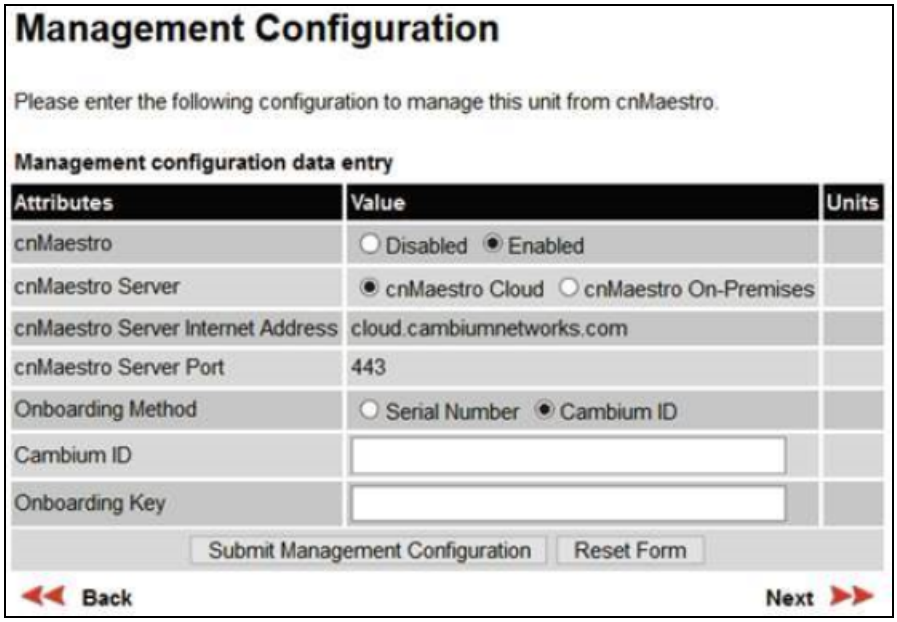
- cnMaestro Enable
- cnMaestro Url
- cambium ID
- cam Onboard Key

The following OIDs can be used to check the status of the device's connection to cnMaestro.

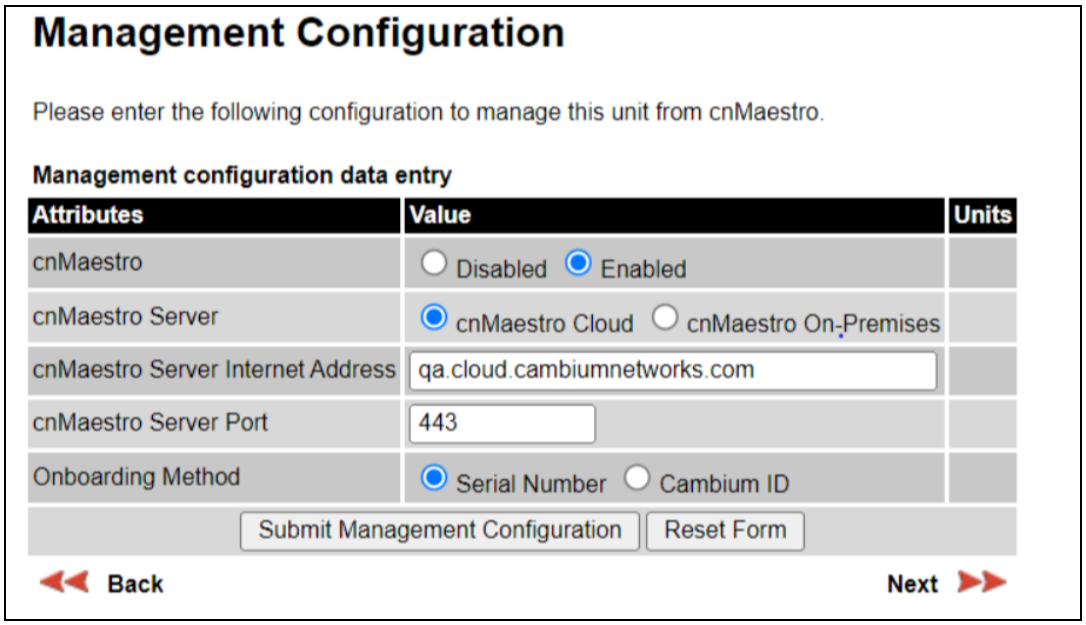
- cam AccID
- cnMaestro Status

Onboarding PTP 650/670/700

1. Navigate to **Installation** click **Run Installation wizard** button.
2. In the **Management Configuration** window, under cnMaestro, select **Enabled.**



3. Select **cnMaestro Cloud** radio button.



Onboarding Xirrus device

Perform the following steps to onboard Xirrus device through CLI.

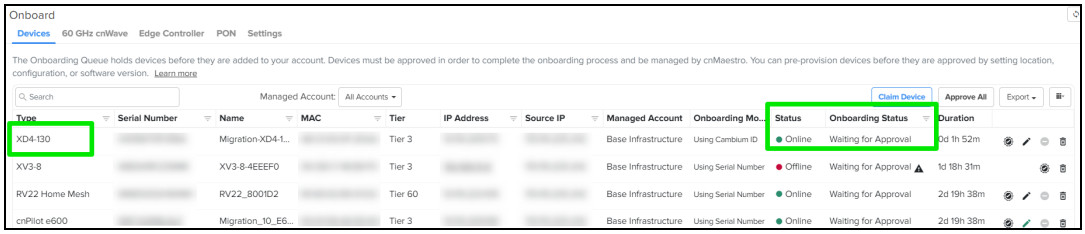
1. Connect to the device using any SSH tool.
2. Login as admin, the default password is admin.

3. Execute the following command in ssh console:

```
#ssh admin <device IP address>
#password <admin>
#configure
#management
#cloud server cloud.cambiumnetworks.com scheme cnmaestro enable
#save
#Saving configuration...OK
#cnMaestro-onboarding id cambium_ID key onboarding_key
#save
saving configuration...OK
#show management
Cloud Management enabled Cloud Timeout 50 seconds Cloud Port 443 Cloud Retry 5 Cloud
Scheme cnMaestro Cloud Server cloud. cambiumnetworks.com
Cambium ID NOTSET Cambium Key Set cnMaestro Status Not Connected
```

4. Login to Cloud account.
5. Navigate to **Home** > **Onboard** > **Devices**.
6. In the **Devices** page, the device onboarded is shown in Figure 57

Figure 57 Xirrus Device Waiting for Approval



The Status field display **Waiting for Approval**.

It is optional to provision the device for location, software version update, and assign to an AP Group.

7. Click **Save**.
8. Click **Approve**.

For details to migrate Xirrus devices from XMS to cnMaestro X using a tool, refer to XMSE to cnMaestro X.

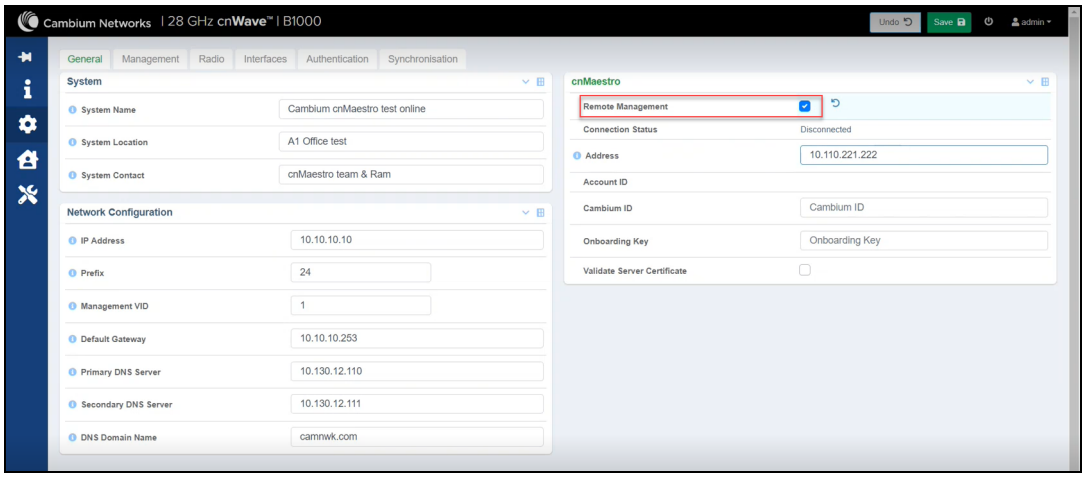
	NOTE: • Xirrus APs are onboarded only to cnMaestro X accounts not to cnMaestro Essentials. • Tier 3 subscription is applicable to Xirrus APs. • Xirrus devices can only be onboarded using Cambium Id and Onboarding Key for Cloud account.

Onboarding a cnWave 5G Fixed BTS device

Claiming the cnWave 5G Fixed BTS device

To claim the cnWave 5G Fixed BTS device, you must have access to the device GUI. In the cnWave 5G Fixed BTS device UI, perform the following steps:

1. From the main home page, navigate to **System > General.**
2. In the **cnMaestro** section, enable **Remote Management.**



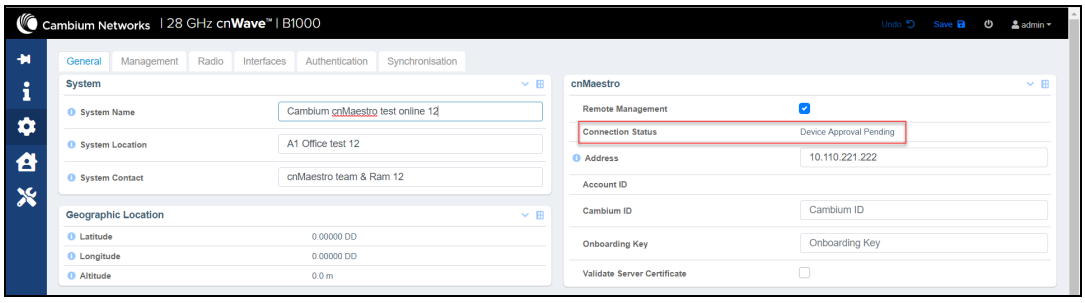
3. In the **Address** field, enter the cnMaestro URL or IP Address.
4. Enter your **Cambium ID** and **Onboarding Key**. **Validate Server Certificate** is an optional field.

> **Note**
>
> You can enter a valid **Cambium ID** and **Onboarding Key** in the cnWave 5G Fixed BTS device UI, when **Allow device to be claimed using Cambium ID** option is enabled in the **Settings** section in the cnMaestro **Onboard** page.

5. Click **Save**.

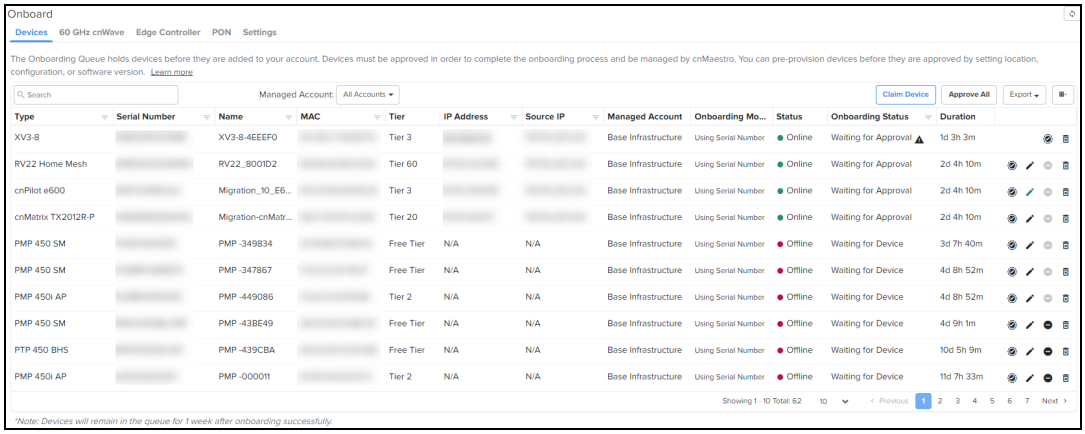
When the cnWave 5G Fixed BTS device is onboarded to the cnMaestro for the first time, the **Connection Status** field in the cnWave 5G Fixed BTS device UI displays **Device Approval Pending** as shown in Figure 58.

Figure 58 Device Approval Pending status in cnWave 5G Fixed BTS



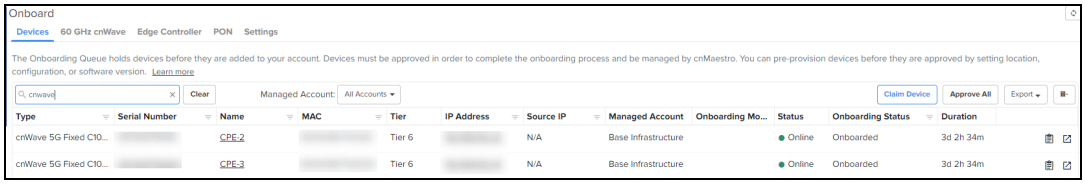
6. In the cnMaestro UI, navigate to **Onboard** > **Devices** and click **Approve**, as shown in Figure 59.

Figure 59 Approving the cnWave 5G Fixed device using the cnMaestro UI



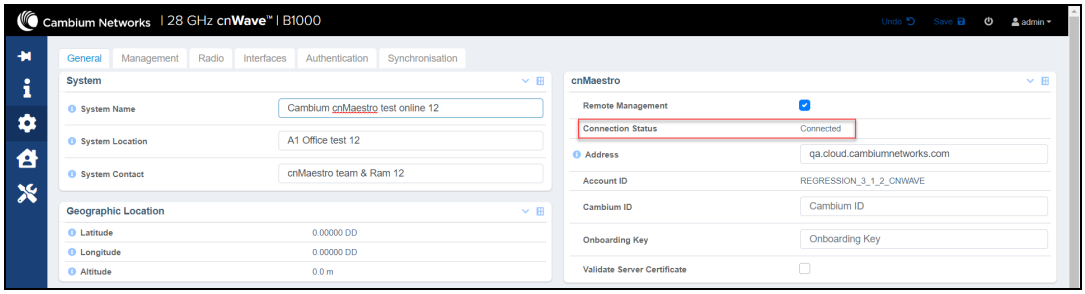
The cnWave 5G Fixed BTS device is onboarded to cnMaestro.

Figure 60 Viewing the cnWave 5G Fixed BTS device onboarded in cnMaestro



The **Connection Status** field in the cnWave 5G Fixed BTS device UI displays **Connected**, on approval, as shown in Figure 61.

Figure 61 cnWave 5G Fixed BTS device Connected

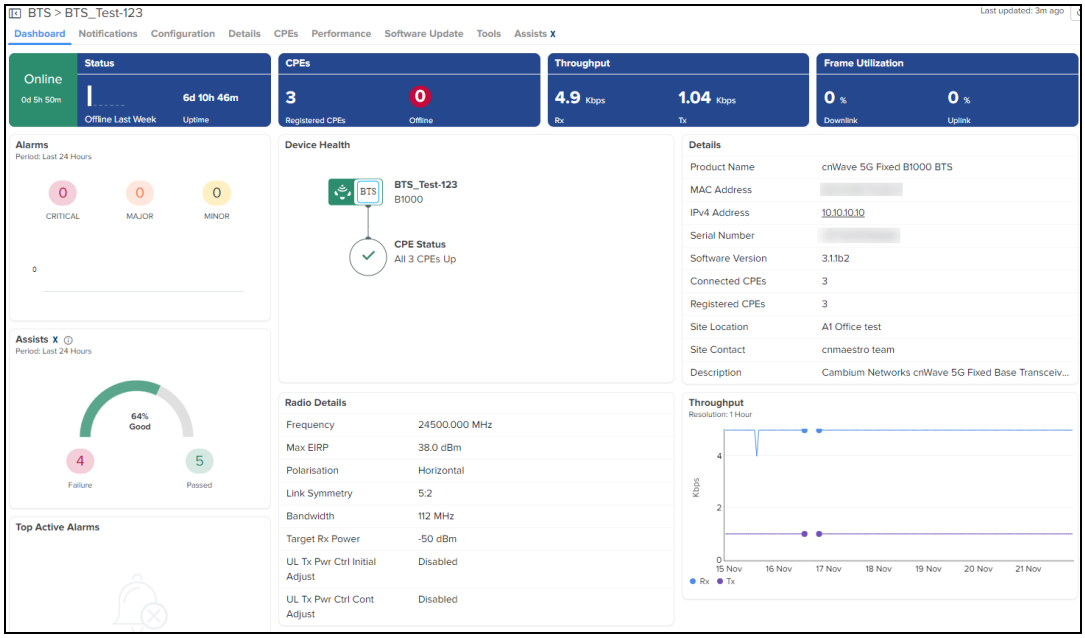


To view the cnWave 5G Fixed BTS device in cnMaestro, perform the following steps:

1. From the cnMaestro UI home page, navigate to **Monitor and Manage** > default network or navigate to **Onboard** > **Devices.**
2. Click on the **Onboarded** link.

Registered cnWave 5G Fixed CPE devices are also onboarded along with cnWave 5G Fixed BTS device.

Figure 62 Viewing cnWave 5G Fixed BTS device and registered CPE devices



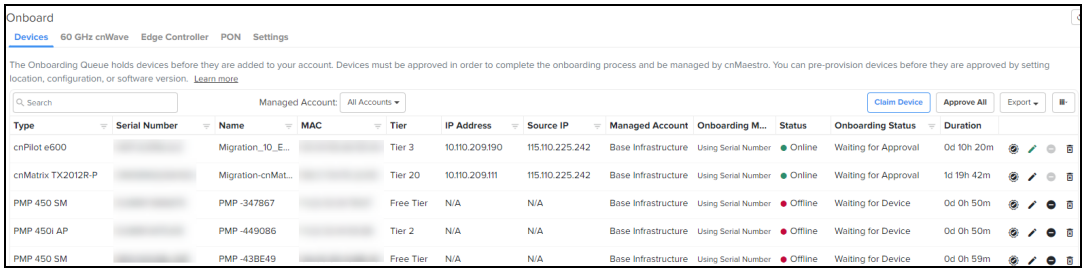
Claiming the cnWave 5G Fixed BTS device with a Serial Number

To claim and onboard the cnWave 5G Fixed BTS device, perform the following steps:

1. From the home page of cnMaestro, navigate to **Onboard > Devices** tab.

   The **Onboard** page appears with details of the devices and their serial numbers, as shown in Figure 63.

Figure 63 Onboard page



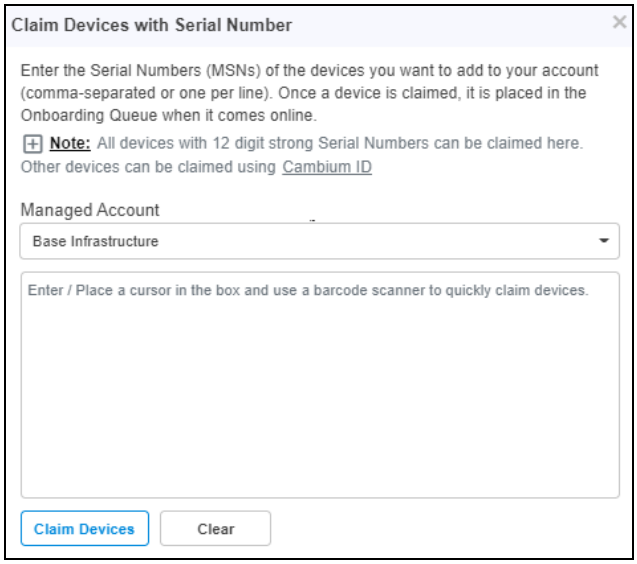
2. Click **Claim Device** located at the right side of the **Onboard** page, as shown in Figure 63.

   The **Claim Devices with Serial Number** page appears, as shown in Figure 64.

3. Enter the serial number of the cnWave 5G Fixed BTS device in the text box, as shown in Figure 64.

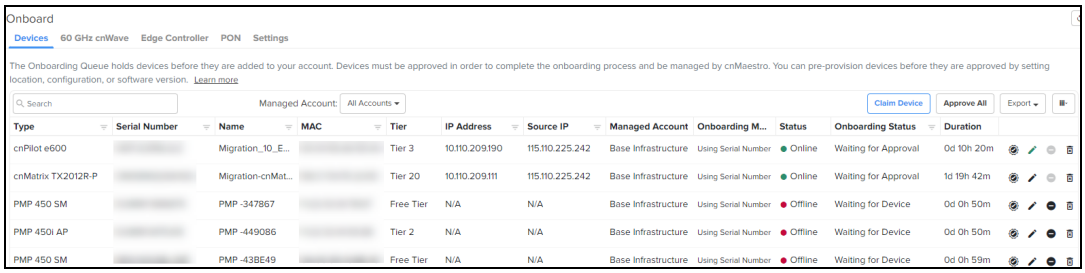
	Note You can also place the cursor in the text box and use a barcode scanner to quickly claim the devices.

Figure 64 Claim Devices with Serial Number page



4. Click **Claim Devices.**
5. To onboard the cnWave 5G Fixed BTS device, click **Approve** located at the right side of the **Onboard** page, as shown in Figure 65.

Figure 65 Onboarding Queue



Note

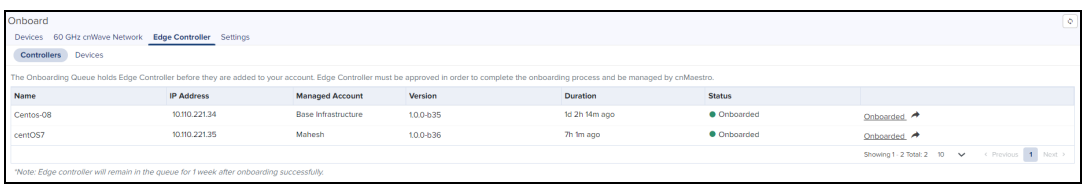
If you do not click **Approve**, the device remains in the Onboarding Queue.

Onboard Edge Controller

To onboard Edge Controller perform the following steps:

1. Enter cnMaestro URL or IP address, Cambium ID, and Onboarding Key in CLI.
2. Navigate to **Onboard > Edge Controller** > **Controllers**.
3. Click **Approve**.

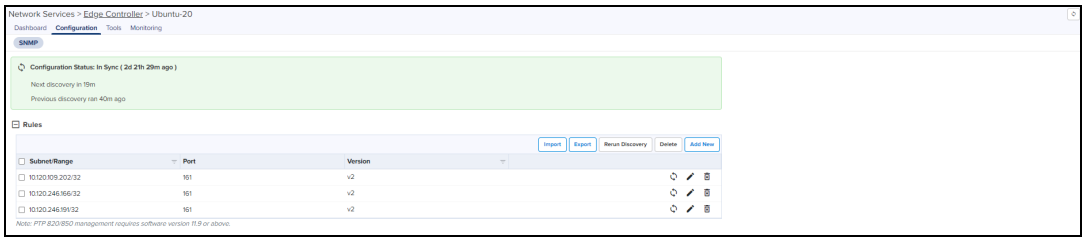
Figure 66 Edge Controller



Onboard PTP 820/850 devices

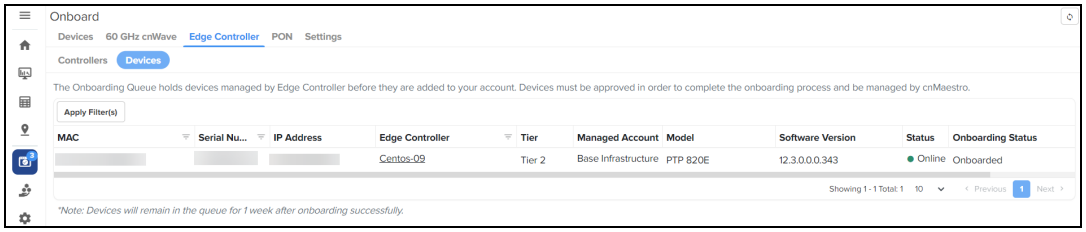
To onboard PTP 820/850 devices perform the following steps:

1. Ensure SNMP rules are added in Edge Controller configuration.



2. Navigate to **Onboard** > **Edge Controller** > **Devices.**
3. Click **Approve.**

Figure 67 PTP 820/850 devices



Onboarding the NSE 3000 Devices to cnMaestro

Note

If the device needs static IP or other WAN configuration to be connected to the internet, refer to Device UI Configuration.

This section describes the onboarding of NSE 3000 to the cnMaestro Cloud X account. The onboarding process requires the device Manufacturing Serial Number (MSN). The MSN of the device can be found at the bottom of the device as shown in Figure 68.

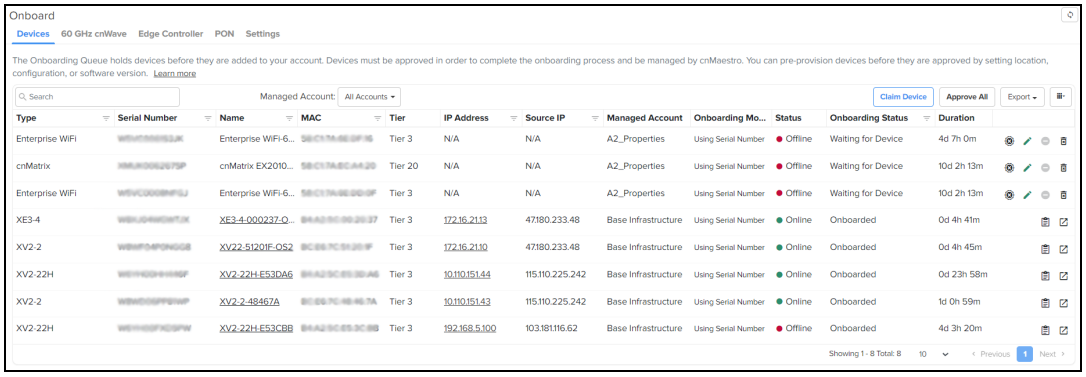
Figure 68 : MSN of device

To onboard the device, perform the following steps:

1. Open a web browser and type the URL https://cloud.cambiumnetworks.com.

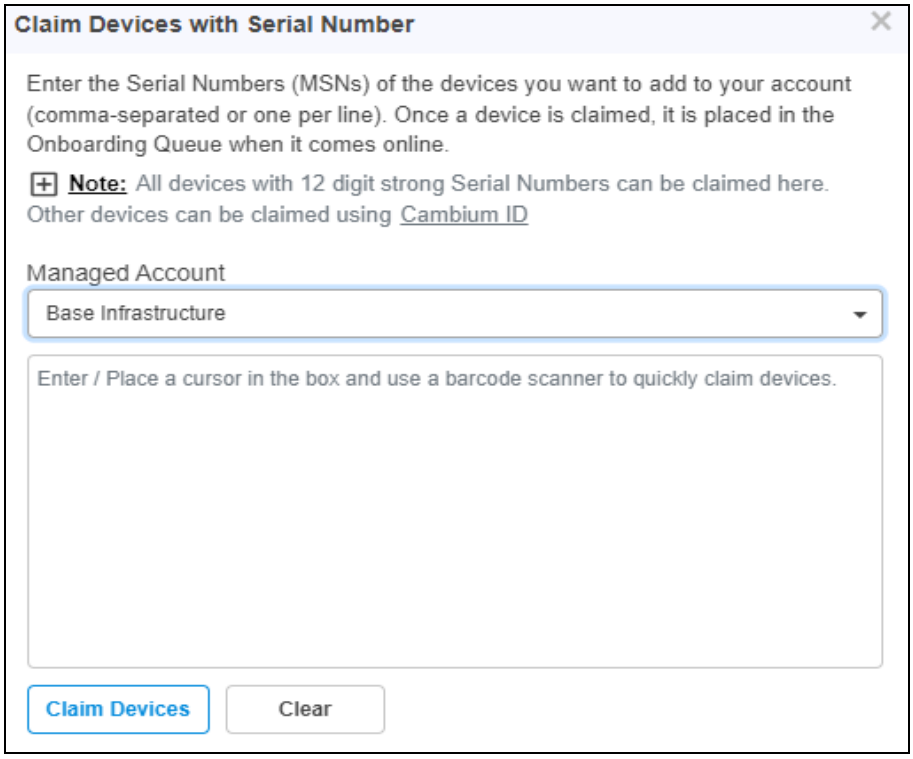
   The sign in page appears.
2. Create a new cnMaestro X account or select an existing cnMaestro X account. A tier 30 subscription is required.
3. Navigate to cnMaestro **Home** > **Onboard** > click **Claim Device.**

Figure 69 Onboard page



4. **Claim Devices with Serial Number** window pops up.

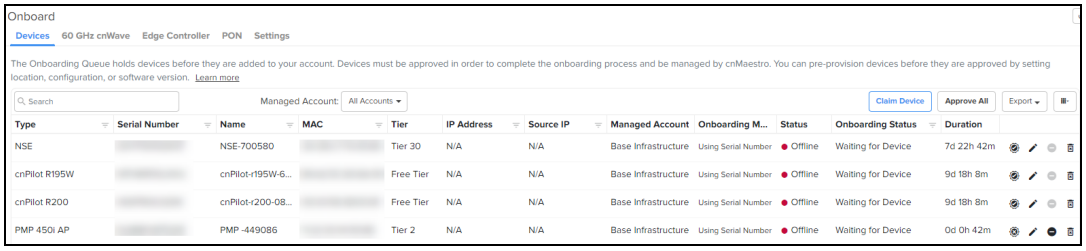
Figure 70 Claim devices with Serial Number



5. Select the **Managed Account** from the drop-down.
6. Enter the Serial Number (MSN) of the device in the text box.
7. Click **Claim Devices**.

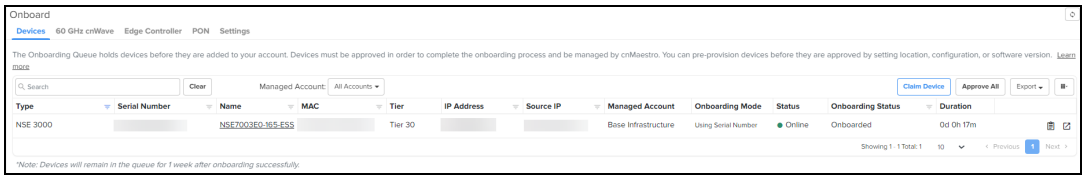
   The device will be listed in the Onboarding Queue.
8. Click the **Approve Device** ( ) icon or **Approve All** at the right side of the Onboard page, as shown in

Figure 71 Approve



When device is approved appears on the Onboard page as shown below in Figure 72.

Figure 72 NSE 3000 Device Onboard



Onboarding Home Mesh Routers to cnMaestro

To onboard the Home Mesh Router to cnMaestro, see Onboarding the Home Mesh Router to cnMaestro.

Claiming the Home Mesh Router on the cnMaestro Cloud's **Onboard** page is not supported.

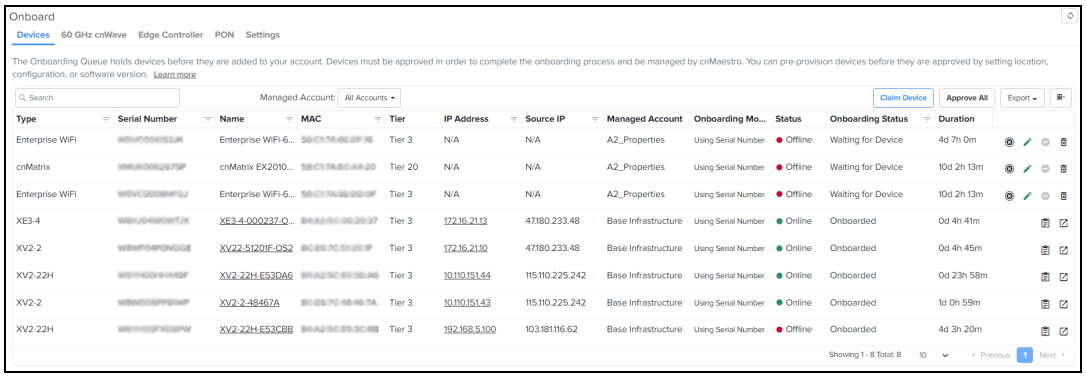
Onboarding PON devices to cnMaestro

This section describes the onboarding of PON devices to the cnMaestro X account. The onboarding process requires the device Manufacturing Serial Number (MSN). The MSN of the device can be found at the bottom of the device as shown in Figure 73.

To onboard the router, complete the following steps:

1. Navigate to cnMaestro **Home** > **Onboard.**

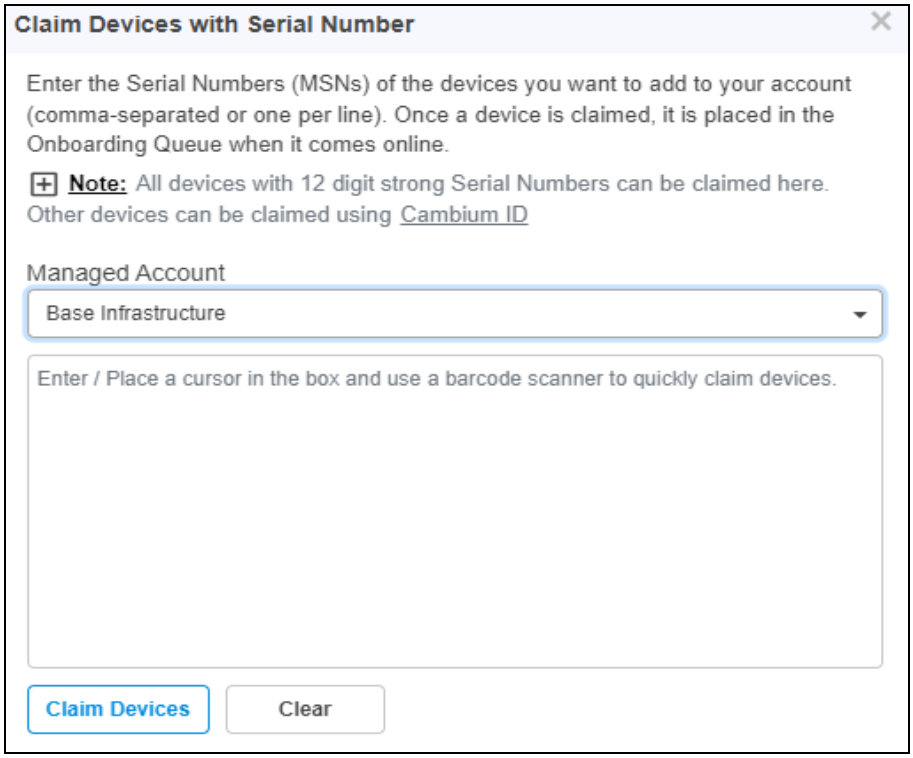
Figure 73 Onboard page for PON devices



2. Click **Claim Device**.

   The **Claim Devices with Serial Number** window is displayed.

Figure 74 Claim devices with Serial Number



3. Select the account from the **Managed Account** drop-down list .
4. Enter the Serial Number (MSN) of the device in the text box.
5. Click **Claim Devices**.

   The device will be listed in the Onboarding Queue.

6. Click the **Approve Device** ( ) icon.

Onboarding 60 GHz E2E Controller

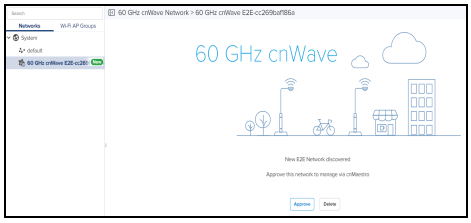
There are two ways to deploy 60 GHz E2E Controller:

- External E2E Controller
- Onboard E2E Controller

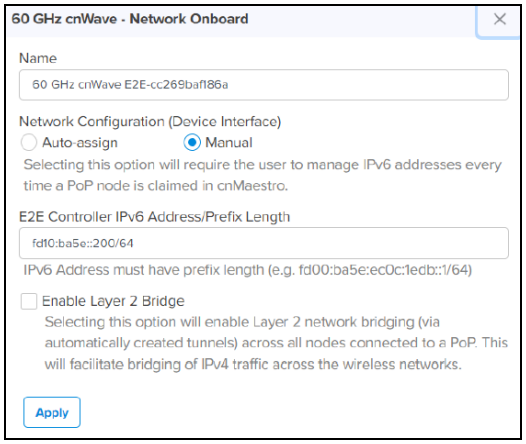
External E2E Controller Onboarding

To Onboard the External E2E Network through **Monitor and Manage** page:

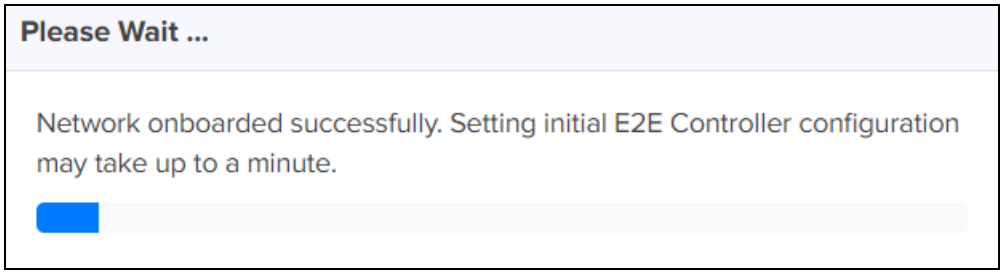
1. Navigate to **Monitor and Manage > Network >** select **60 GHz cnWave E2E Controller.**
2. Click **Approve** and **60 GHz cnWave–Network Onboard** window appears.



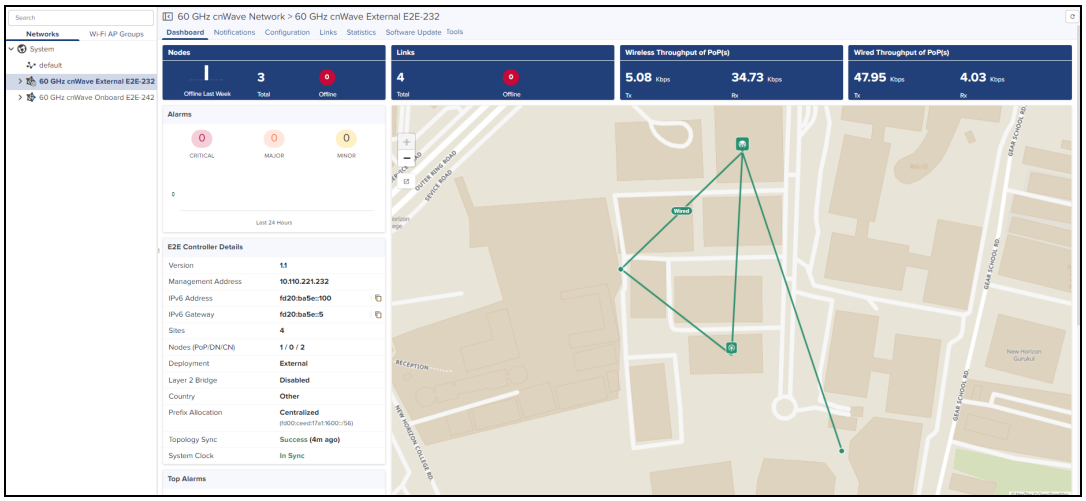
3. By default, **Auto-assign** is selected you can select **Auto-assign** or **Manual** to update IPv6 address in E2E Network and wait for a while until IPv6 address gets updated.
4. **Enable Layer 2 Bridge** if required.



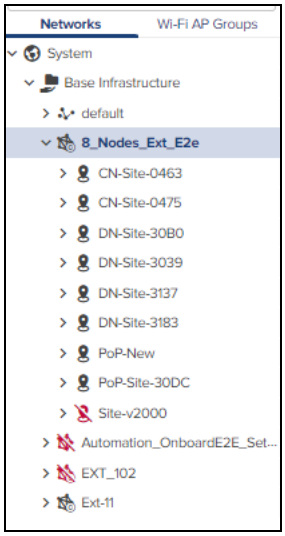
5. Click **Apply.**
6. Wait for a while till network onboard is successful.



7. After successfully onboarded, the External E2E Network UI shows the Dashboard of the network as shown below:



External E2E Controller network icon will be indicated with icon as shown below:



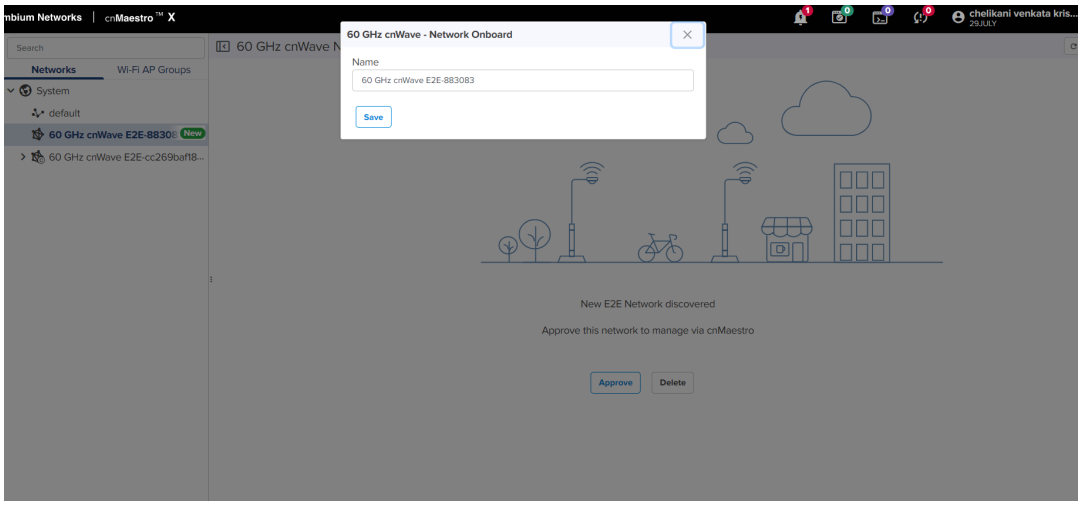
Onboard E2E Controller (Running Onboard)

cnMaestro remote management details are configured through onboard E2E controller. The Onboard E2E Controller is hosted on a 60Hz cnWave device. (E2E Controller option to be enabled in the device UI).

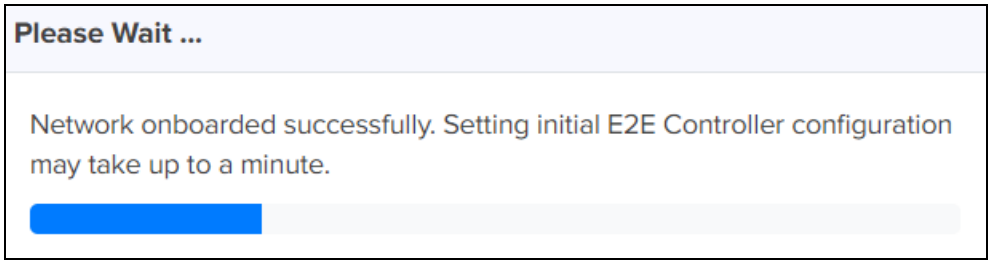
To approve proceed as follows:

1. Navigate to **Monitor and Manage > Network >** select **60 GHz cnWave E2E Network.**
2. Click **Approve.**

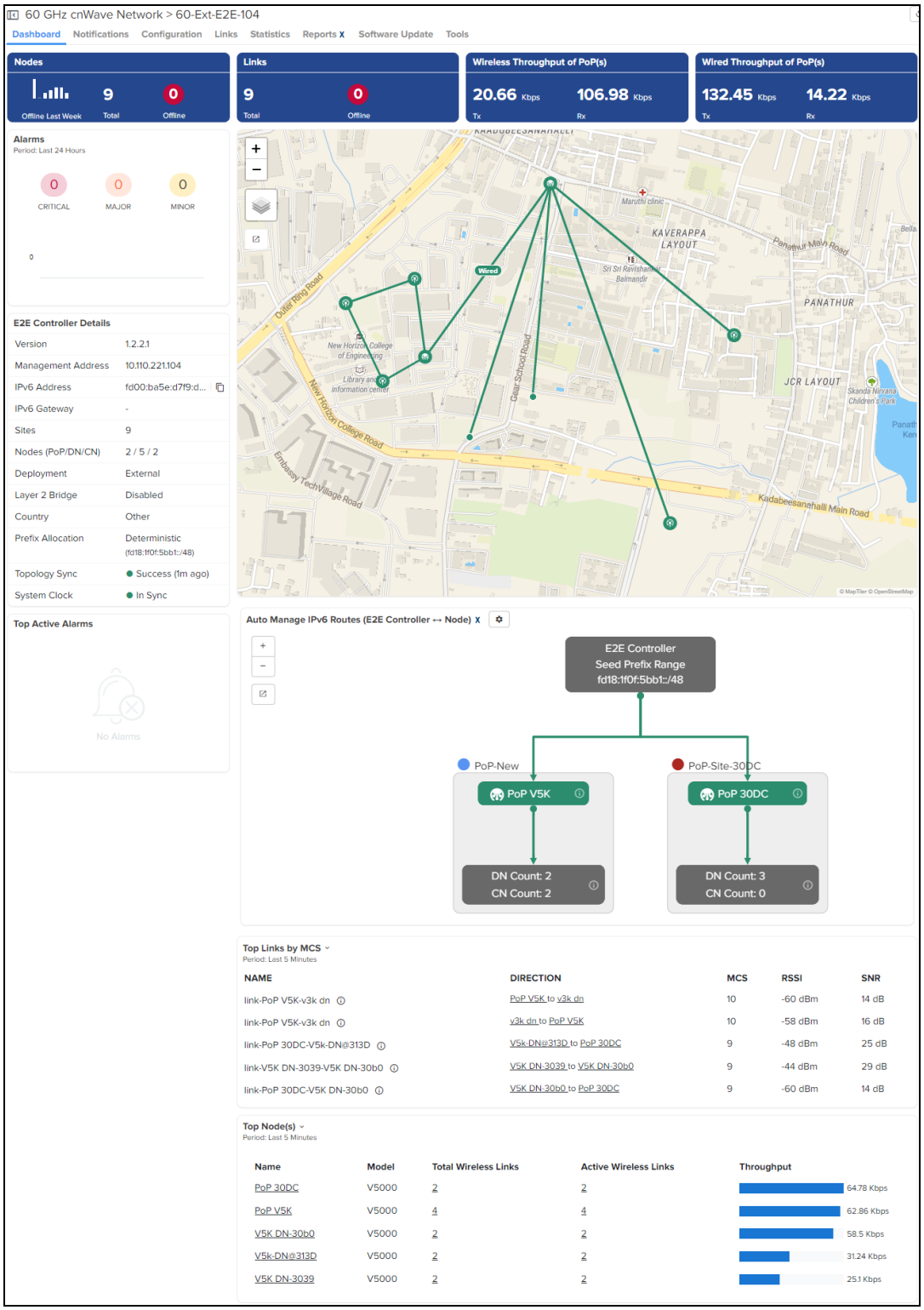
60 GHz cnWave-Network Onboard window appears. Edit network name and click **Save**.



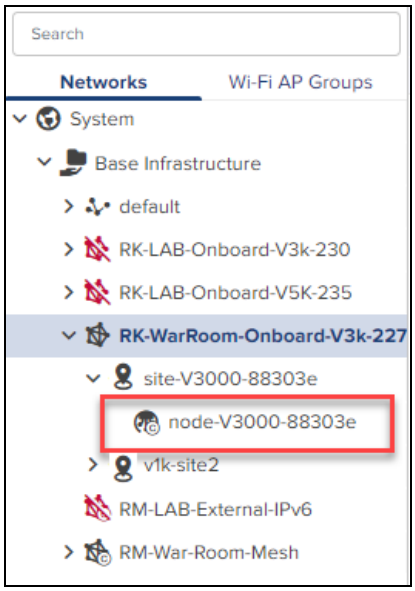
3. Wait for a while till network onboard is successful.



4. After the successful Onboard E2E Network, it can be managed through cnMaestro.



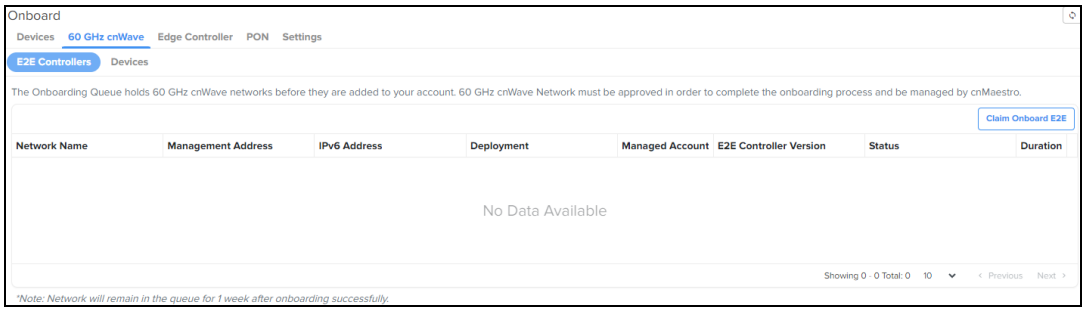
If PoP Node is running the Onboard E2E Controller then the PoP icon will be indicated with as shown below:



Onboard E2E Controller (Running Onboard) Onboarding with Serial Number

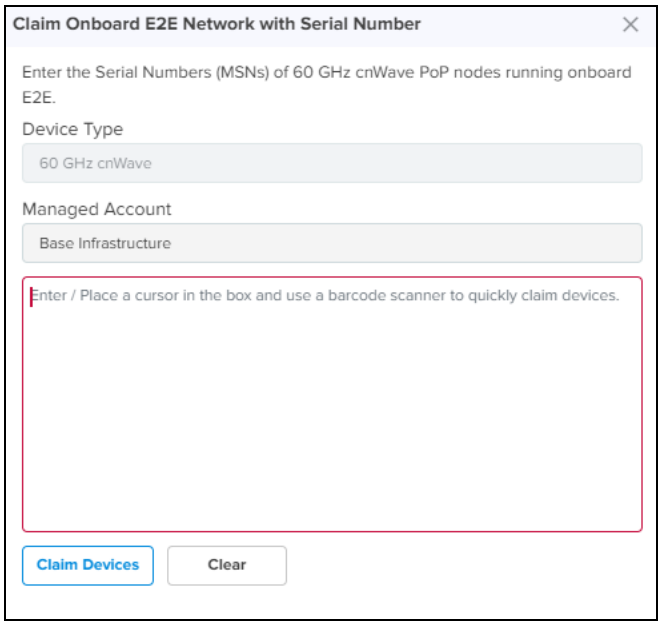
From homepage click Onboard icon in the left pane, to claim Onboard E2E devices.

1. Navigate to **Onboard** > **60GHz cnWave Network** > click **Claim Onboard E2E.**



Claim Onboard E2E Network with Serial Number windows appears.

2. Enter **Serial Number** and click **Claim Devices**.


Claim Onboard E2E Network with Serial Number
Enter the Serial Numbers (MSNs) of 60 GHz cnWave PoP nodes running onboard E2E.
Device Type
60 GHz cnWave
Managed Account
Base Infrastructure
Enter / Place a cursor in the box and use a barcode scanner to quickly claim devices.
Claim Devices
Clear

Monitoring

This section includes the following topics:

- Network Monitoring
- Network Service Edge
- Wireless LAN Dashboard
- Inventory
- Reports

	NOTE: Following are the retention period for various data in cnMaestro: • Wi-Fi AP performance data—1 year • Wireless clients data—1 week • Guest Access session and login events—1 week • Wi-Fi events—24 hours

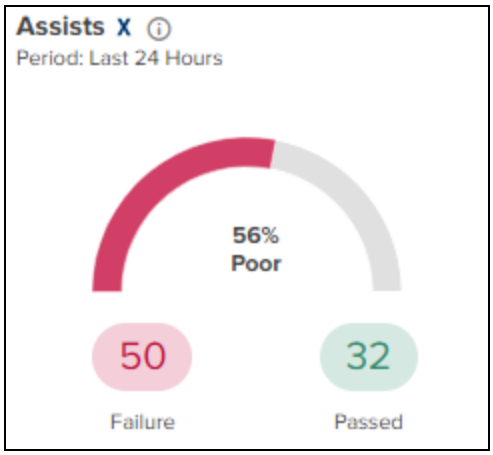
Network Monitoring

The Monitoring tab displays the monitoring pane for cnMaestro. The section includes the following:

- Assists
- Dashboard
- Notifications
- Statistics and Details
- Performance
- Maps
- Tools
- WIDS

Assists

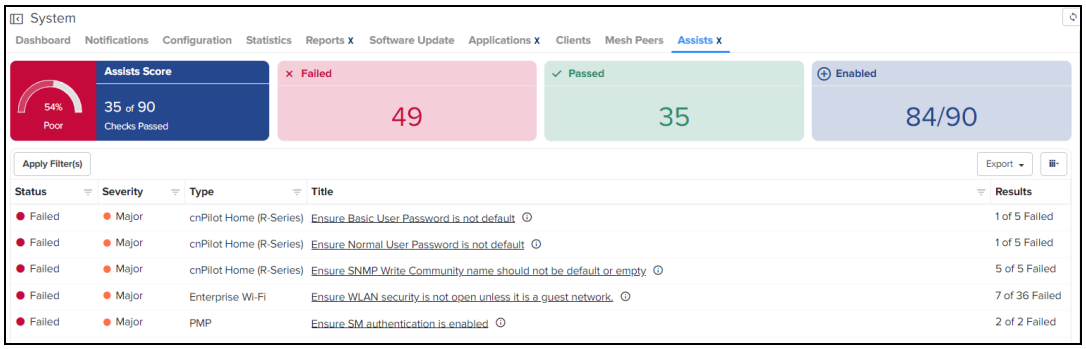
Assists displays scanned configuration scores and results for last 24 hours.



Assists scans the configurations and generates assists scores. It evaluates specific issues that might occur during deployment . Assists summarizes the scores and status results at System, Network, Site, Tower, and Device levels as shown in Figure 75.

This enables prioritization of management traffic.

Figure 75 Assists home page



NOTE:

- Assists is a cnMaestro X feature available for cnPilot, cnMatrix, cnWave 5G Fixed, ePMP, PMP, and Enterprise Wi-Fi devices except AOS devices.
- Minimum software version for cnWave 5G Fixed devices must be 3.1b5 for assist data to be generated.
- For ePMP, and cnWave 5G Fixed devices, the Assists X page generates data every 24 hours.
- For PMP devices with software version 21.1 or higher, the Assists X page generates data immediately after onboarding. For software versions lower than 21.1, this page continues to generate data on a 24-hour schedule.
- For cnPilot Home R-series, cnMatrix, and Enterprise Wi-Fi, the Assists X page generates data immediately after onboarding.

Assists scores are shown in percentage values. The Assists scores guide users to isolate issues by scanning an environment and evaluating configuration and infrastructure. Assists scores are determined as shown in Table 16.

Table 16: Assist Scores

Score Value	Description
0-61%	Poor
61 % to 90%	Good
91% and above	Excellent

Table 17: Assists parameters

Fields	Description
Status	Status of the Assists are shown as follows: • Passed • Failed • Disabled
Severity	Severity level of the assists are shown as follows: • Critical: Catastrophic problem that makes the feature unusable. • Major: Issue that greatly degrades the feature, but it is still usable. • Minor: Limited issue that alters functionality in a targeted way. • Notify: Message used primarily for information.
Type	Type of the device.
Title	Short title describing the assist.
Category	Type of category such as Security, Network, Infrastructure, and Performance.
Group	Grouped based on Position, Access, and Configuration of cnMaestro.
Results	Result of Assists such as Passed, Failed, and Disabled. For more details on assists result description refer to Figure 76.

Hover the cursor on the **Results** column in the Assists home page. It displays a preview of the assist results as shown in Figure 76.

Figure 76 Assists Results

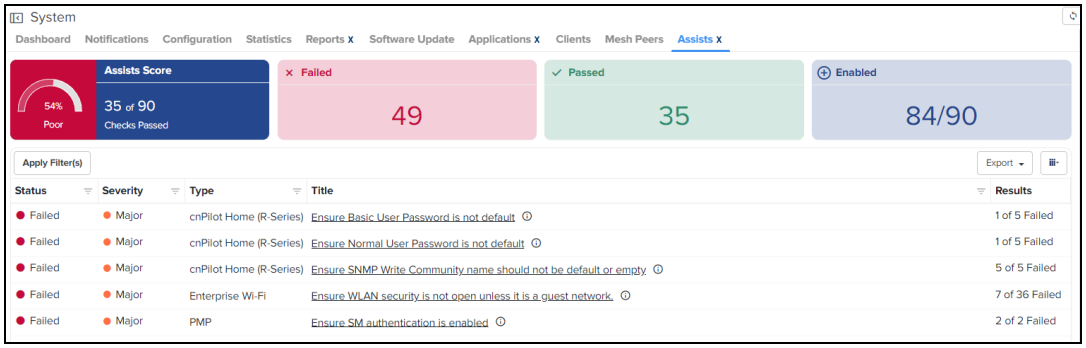


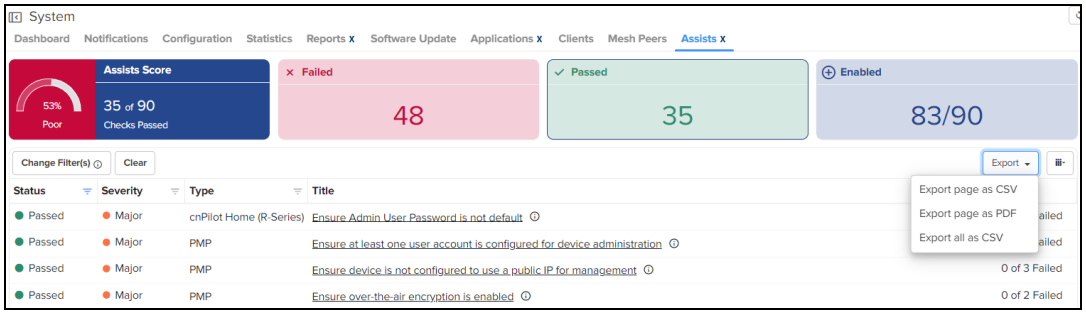
Table 18: Assist Result Status

Assist Result	Description
Passed	Assists recommendations are met.
Failed	Assists has failed.
Disabled	Assists is disabled. Note: Only Super Administrator and Administrator have access to change disable option.

Export Assist

The Assist table can be exported in a CSV or PDF file format. The following export options are available:

- Export page as CSV
- Export page as PDF
- Export all as CSV

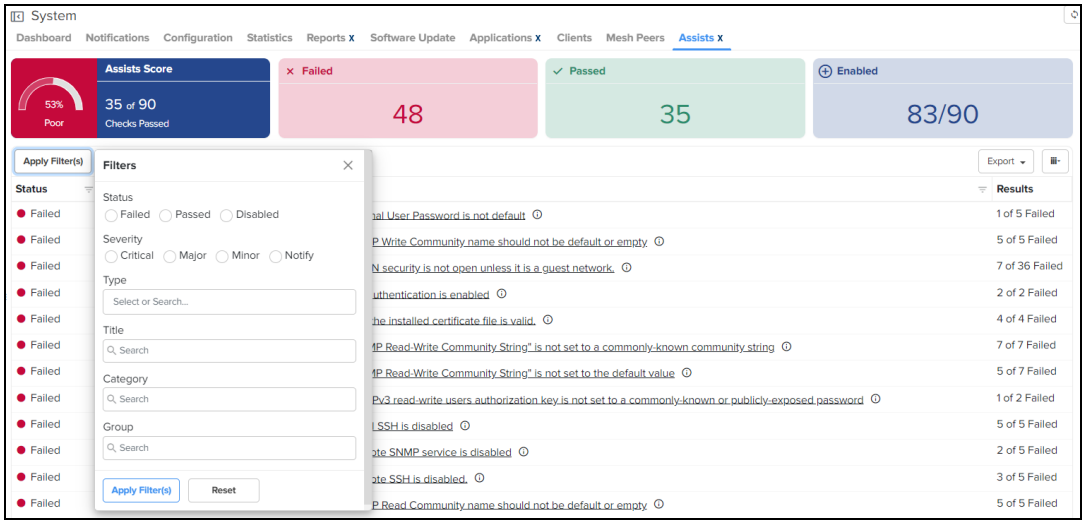


Assist filter

To create custom filters for assists, perform the following steps:

1. In the Assists table, click **Apply Filter(s)**.
2. Enter the values in the fields for applying the filters.
3. Click **Apply Filter.**

Figure 77 Assists: New Filter



You can manually filter or search by typing parameters in the column header of the Assists table.

4. Click **Reset** to reset the filter option in the Assists table.
5. Click **Clear Filters** to clear all the filter options.

If you do not receive expected filter details, click **Change Filter(s)** in the Assists table to apply new filters.

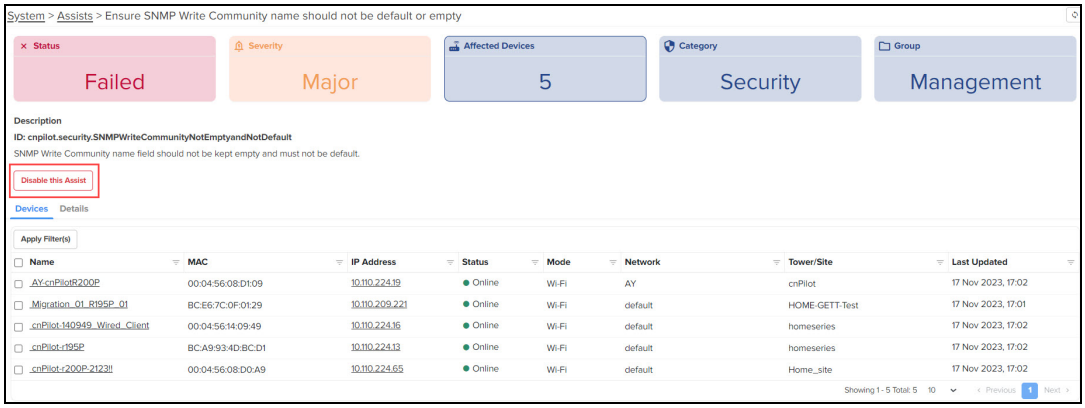
Assists Status

To evaluate the Assists Status, click on the **Title** column with Affected Devices in the Assists table. A detailed Assists page appears with **Description** and **Remediation** as shown in Figure 78.

To disable Assists, perform the following steps:

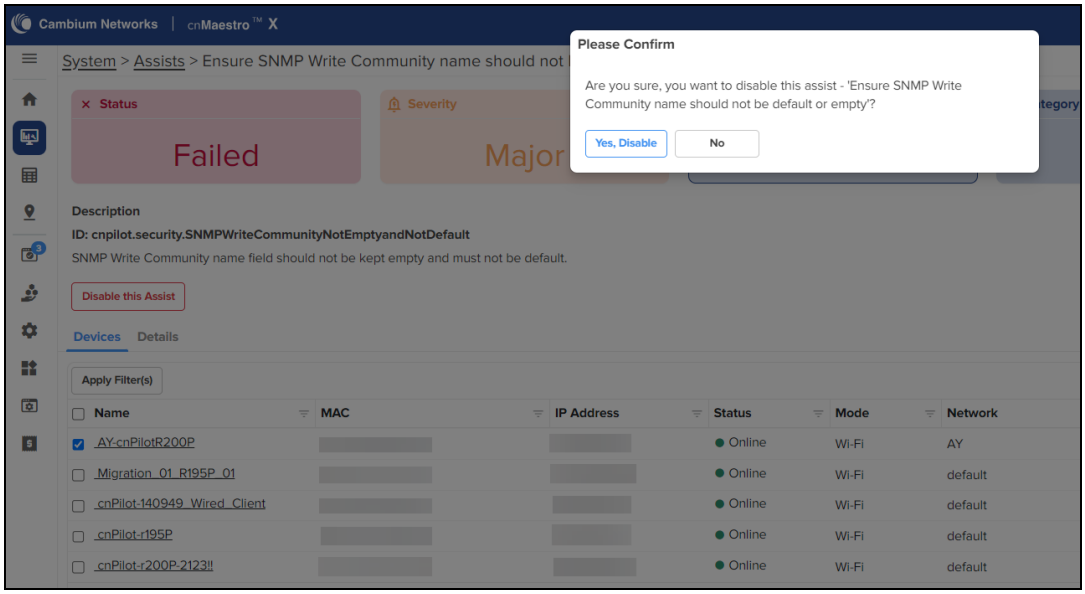
1. In the **Assist Status** page, click **Disable this Assist.**

Figure 78 Assist Status page



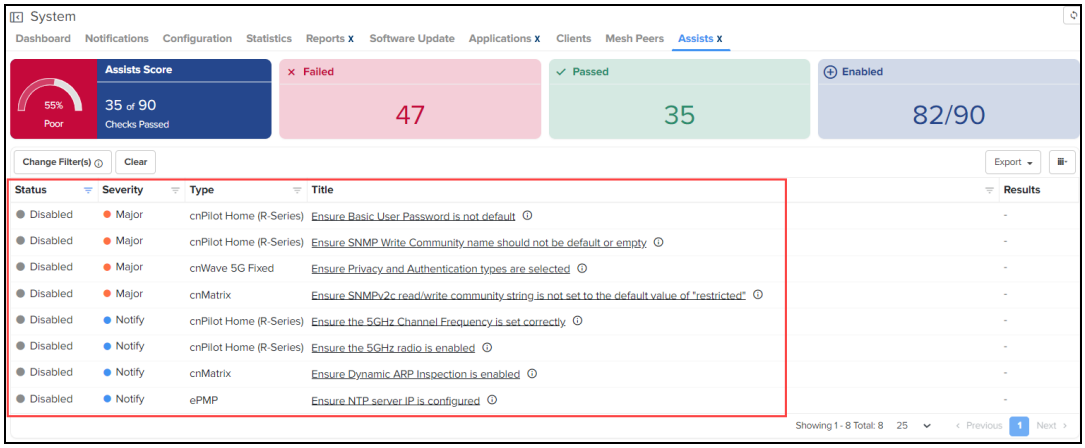
A confirmation message appears for the assist to disable.

2. Click **Yes, Disable**.

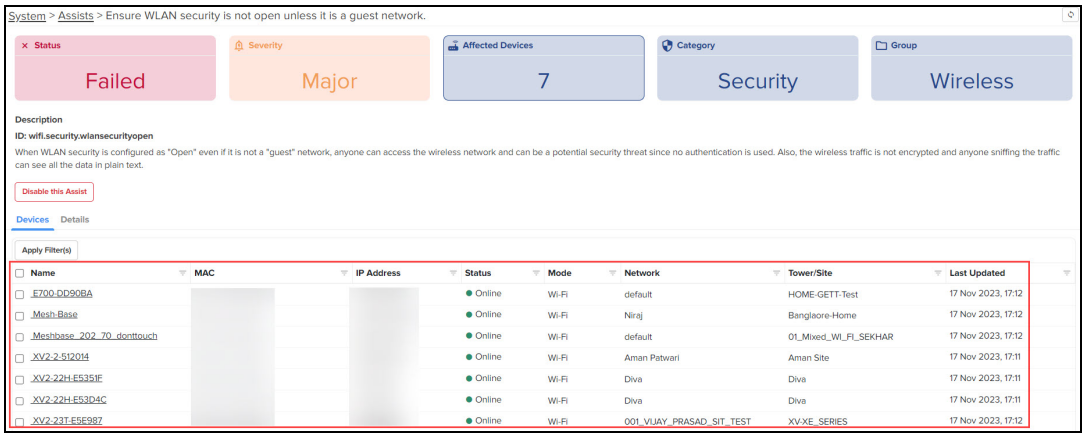


Assists disabled are listed at the bottom of the Assists home page. The **Results** column do not indicate the progress bar for the Assists Disabled as shown in Figure 79. The total number of enabled Assists in the home page is reduced when Assists is disabled.

Figure 79 Assists Disabled



3. In the **Assists Status** page, click **Devices** tab to view the list of devices failed for the specific assist.

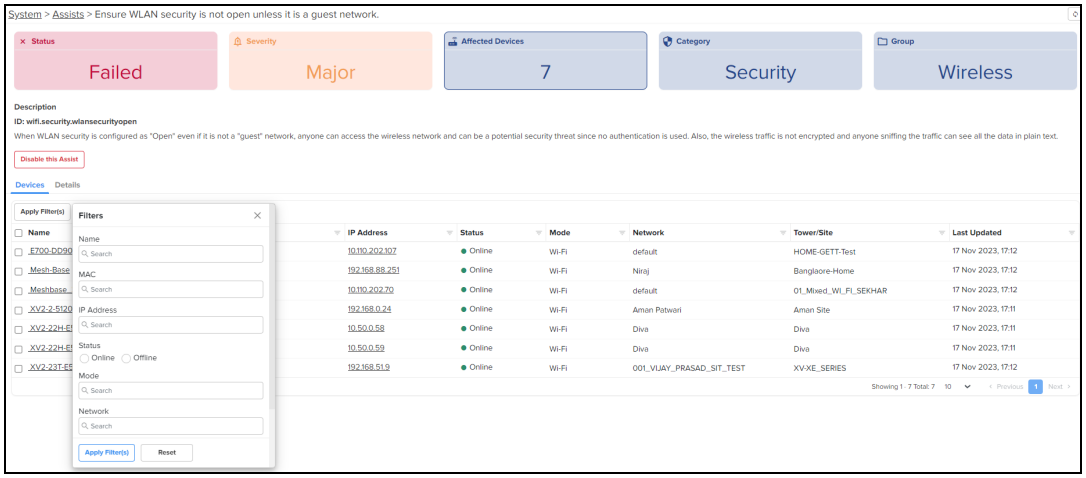


Device filter

To create a custom device filters, perform the following steps:

1. In the Assists page, click **Title**.
2. Navigate to Details > Device.
3. Click Apply Filters button.
4. Enter the values in the fields for applying the filters.
5. Click **Apply Filter.**

Figure 80 Assists device filter



You can manually filter or search by typing parameters in the column header of the device table.

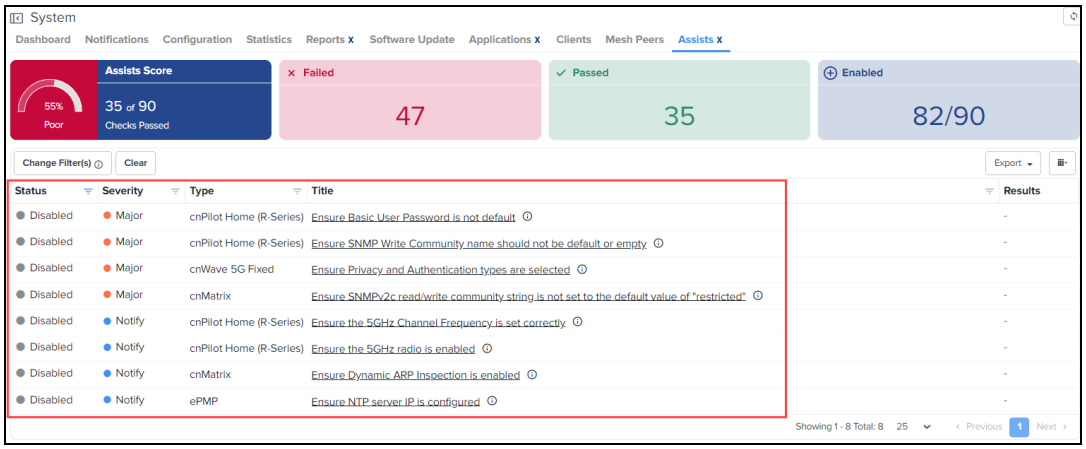
6. Click **Reset** to reset the filter option in the device table.
7. Click **Clear Filters** to clear all the filter options.

If you do not receive expected filter details, click **Change Filter(s)** in the device table to apply new filters.

Enable Assist

To enable assist, perform the following steps:

1. Click the disabled assist listed at the bottom of the Assists home page.



You will be directed to specific Assist page, as shown in the following figure.

2. Click **Enable this Assist**.

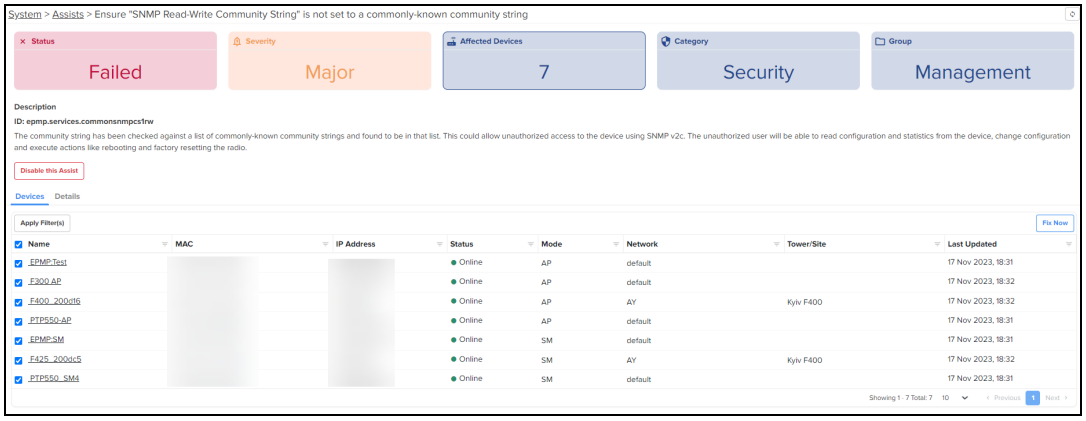
Assists fix now

	NOTE: • The Assists **Fix Now** feature is available only for ePMP and PMP devices.

Assists Device page allows the user to fix the failed assists.

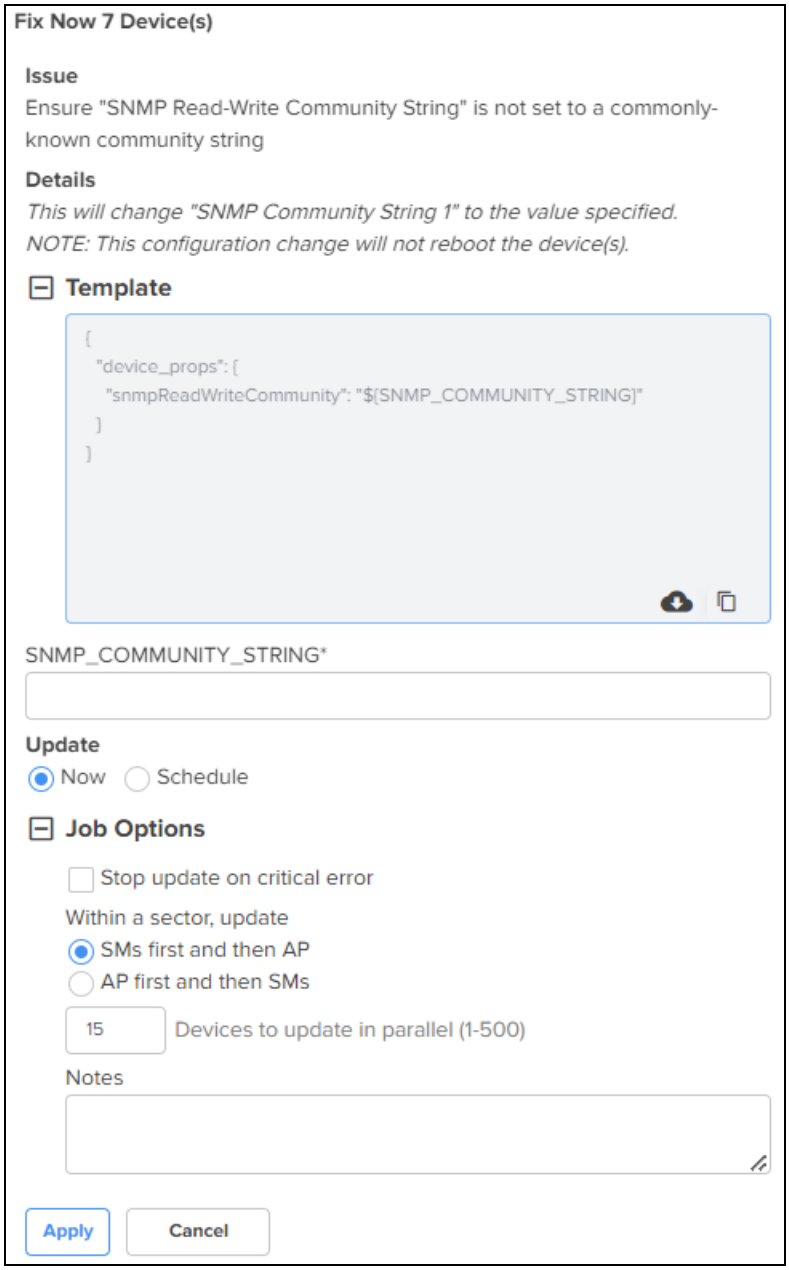
Perform the following steps to fix the failed assists:

1. Navigate to the **Assists Device** page.
2. Select the devices to be fixed.



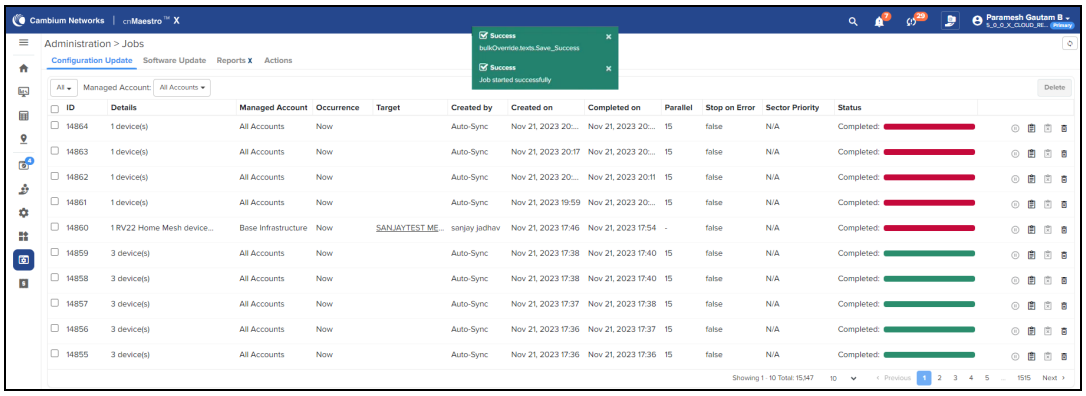
3. Click **Fix now**.

The **Fix Now** window pops up.



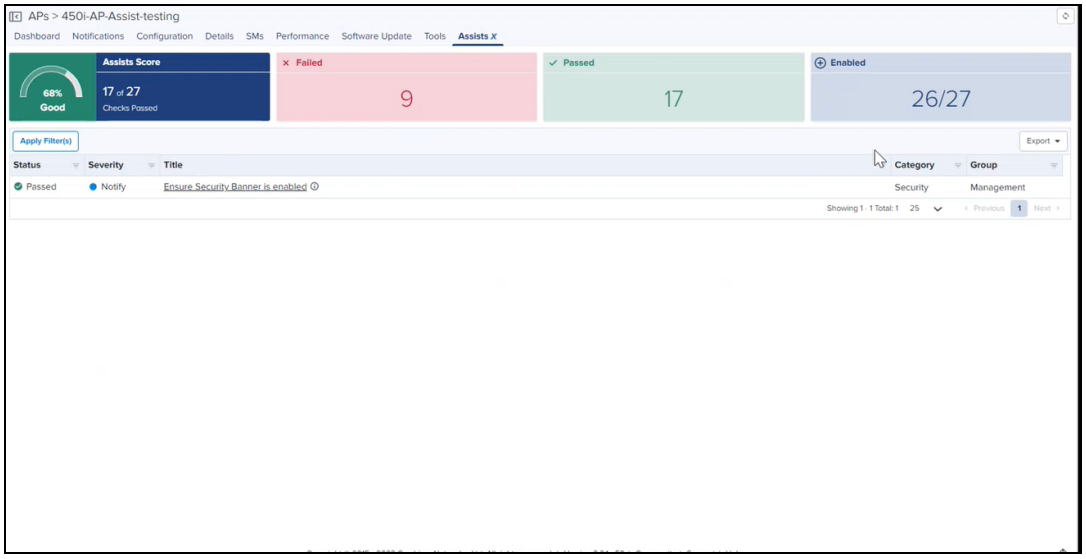
4. Select from the following options under the **Update** field, to fix the issue now or at a later date:
   - **Now**—Fix the issue immediately when you click **Apply** on this page.
   - **Schedule**—Fix the issue at the selected date and time. Select the required date and time from the **Start Date** and **Start Time** fields.
5. Click **Apply**.

   Success window pops up.



When the failed assists are fixed, the status is changed to **Passed** as shown in Figure 81.

Figure 81 Passed Assists



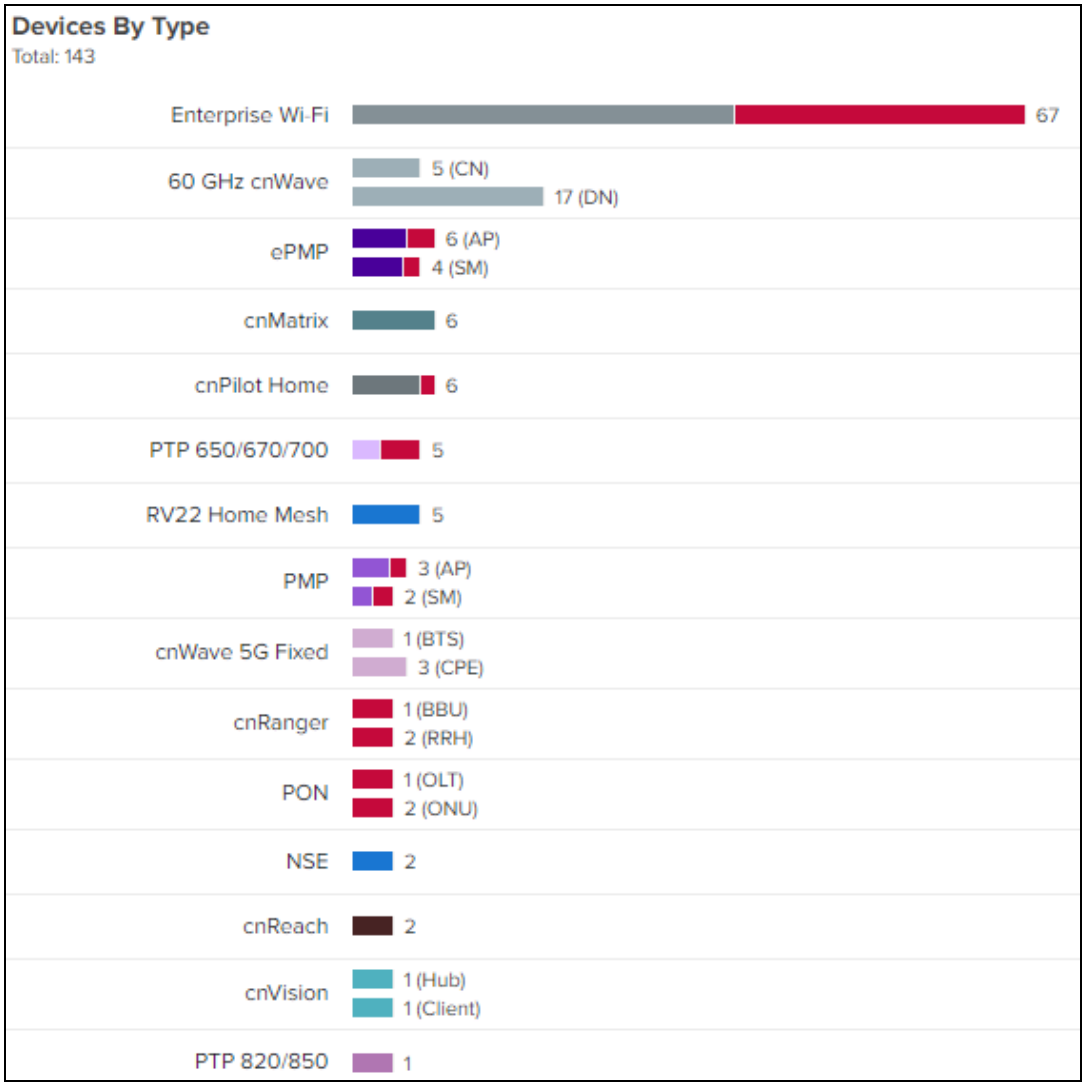
Dashboard

The **Dashboard** page in cnMaestro is customized for each device type and aggregation level (such as System, Network, Tower, and Site). Pages representing devices provide information on location, significant configuration parameters, and performance. System, Network, Tower, and Site nodes aggregate dashboard data for devices they contain.

KPI (Key Performance Indicators)

Each page has a set of KPIs tailored to the node type. These display a current value and often historical trend data over the last 24 hours.

Figure 82 Device by Type



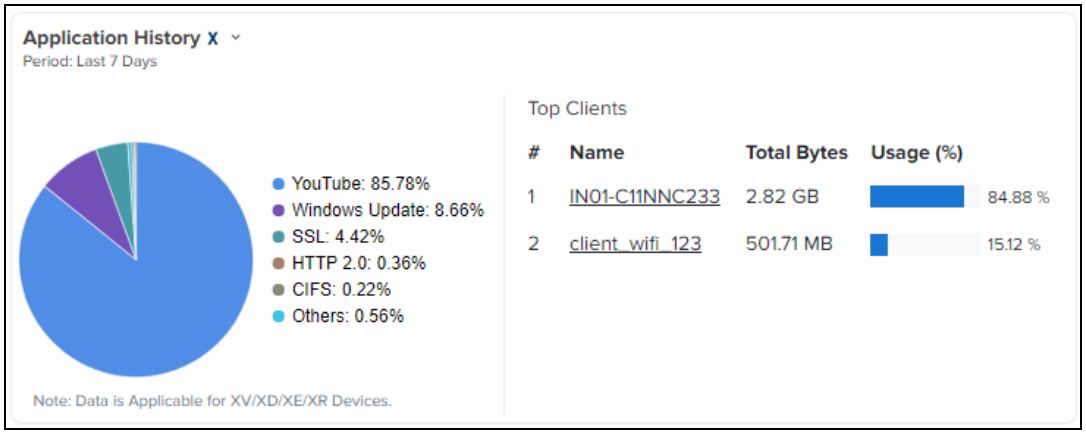
NOTE:

- KPI widgets at network and Tower-level show minimum four widgets when no data is available in KPI's. Shows wireless clients KPI when at least one Wi-Fi device is available. Wireless clients KPI is moved beside Wi-Fi KPI. Machfu KPI is not supported any more.

Application History

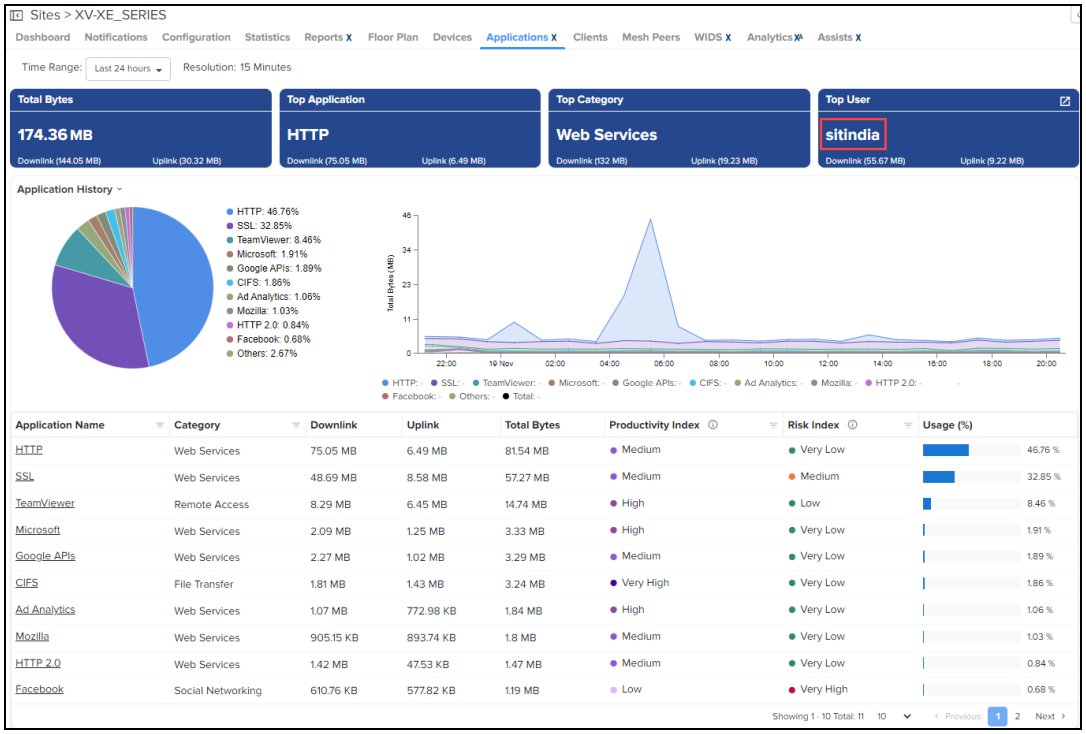
The Application History displays top client names and their top five application usage details for last 24 hours.

Figure 83 Application History



The **System Dashboard** page displays detailed system level application usage in **Application History** and **Category History**. It displays the **Top Clients** names and their top five application usage details. The Application Visibility parameter fields are explained in detail as shown below.

Figure 84 System > Application



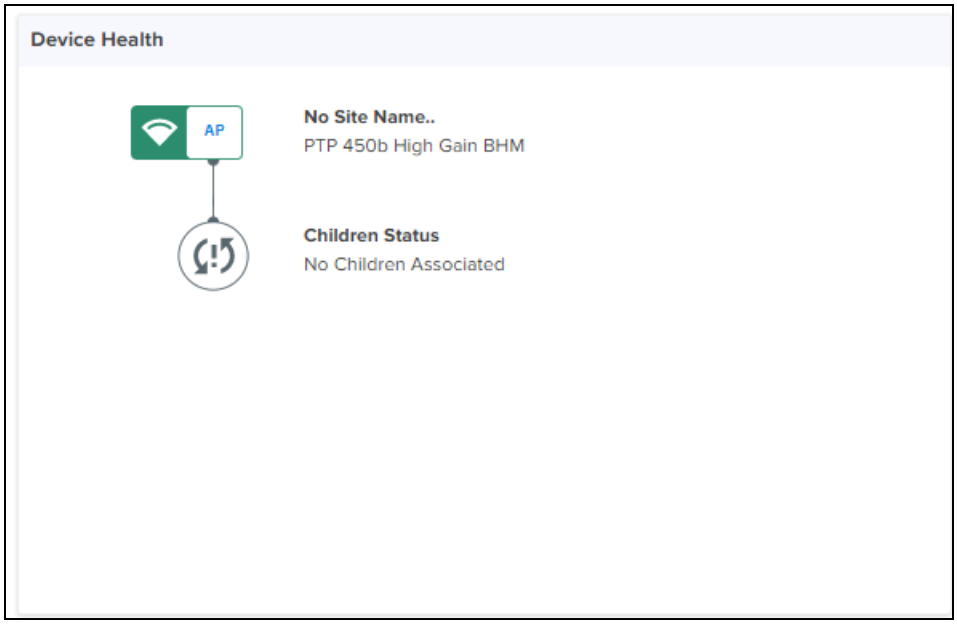
NOTE:

- By default, the application statistics for last 24 hours is displayed.
- Application data is available for NSE and Enterprise Wi-Fi (XV, XD, and XE) devices only.
- Application data is available only for the clients connected to NSE in Essentials accounts.

Device Health

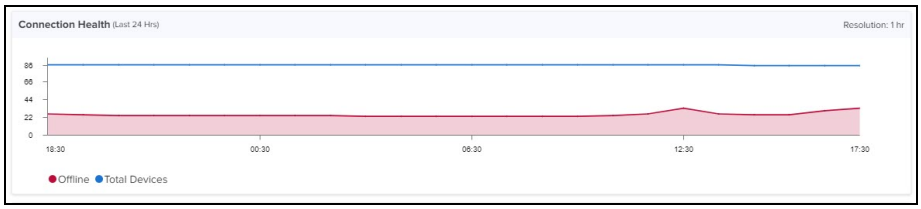
Device Health displays the health of the network from the Tower to the edge Device.

Figure 85 Device Health



Connection Health

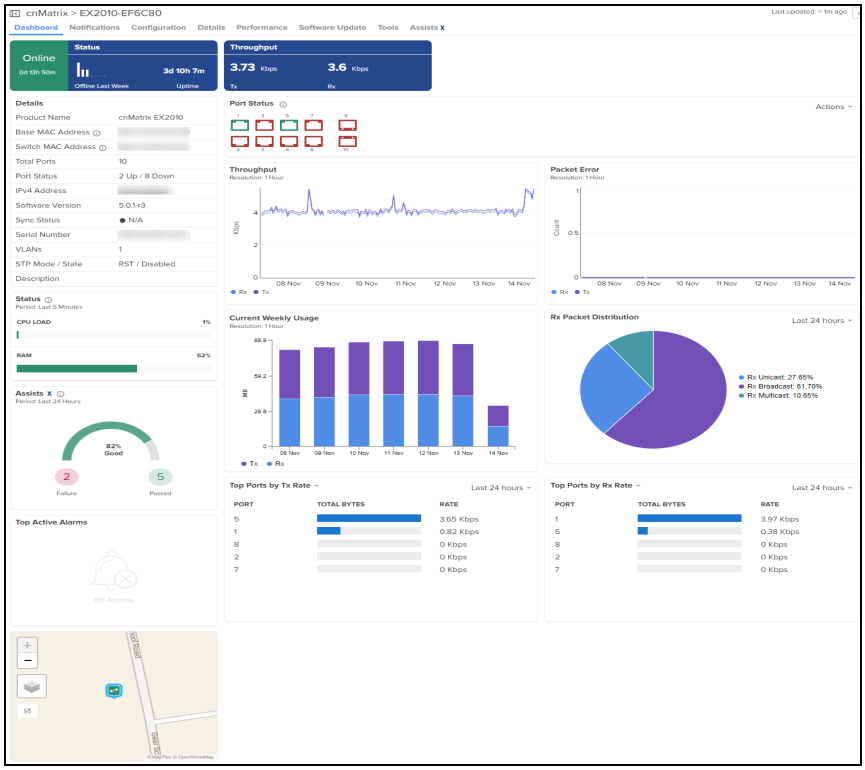
Connection Health displays the health of the devices connected to the network.



Charts and Graphs

Contextual charts and graphs provide details on important dashboard metrics.

Figure 86 Charts and Graphs



Notifications

The **Notifications** page displays details of alarms, alarm history, and events. These are synchronous messages that provide real-time system status.

Table 19: Notification overview

Type	Description
Alarms	Alarms indicate state and persist as long as the problematic activity continues; they reflect the current health of the devices in the network.
Alarms History	Expired Alarms are added to the Alarm History. The Alarm History page displays historical active alarm counts.
Events	Events are stateless, transient messages that occur in response to an input or action, such as if the CPU exceeds a threshold or a device association fails. Events are fire-and-forget; they are stored in an Event Table and provide a history of device activity.
Wi-Fi Events	Details of the Wi-Fi events are displayed.

For PTP 820/850 devices, additional two other notifications are displayed as shown in Figure 87 and Figure 88:

- Device Alarms displays the following parameters:
  - Alarm ID
  - Severity
  - Origin
  - Description

- Probable Cause
- Raised Time

- Device Events displays the following parameters:
  - Raised Time
  - Sequence Number
  - Severity
  - State
  - Description
  - Origin

Figure 87 PTP 820/850 Device Alarms

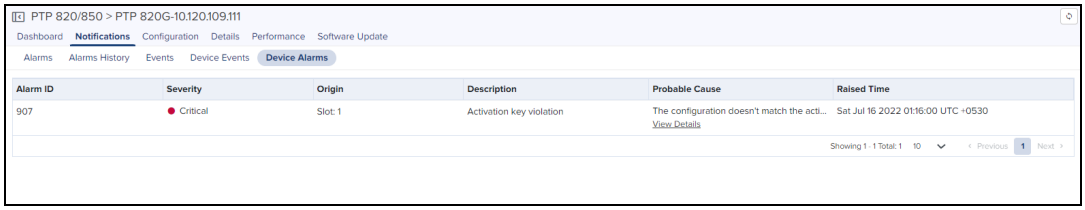
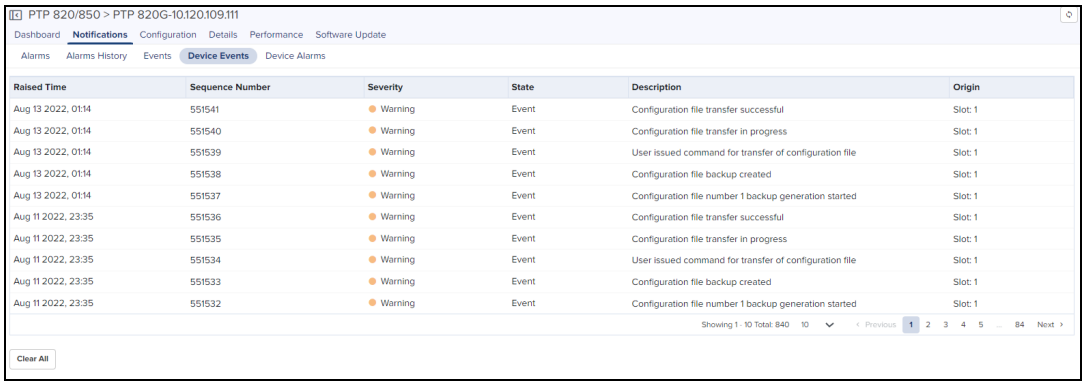


Figure 88 PTP 820/850 Device Events



Event/Alarm Source

Identity of the source device for the event or alarm.

Aggregation

Notifications are visible at every level of the device tree. Higher levels consolidate notifications for all devices at lower levels in the hierarchy. For example, the network level displays the events and alarms for all devices within that network. This aggregation is only available for System, Networks, Towers, and Sites. When a device is selected, such as an AP, the notifications will only be for it, and not its associated SMs (even though they are lower in the tree).

Storage

Events and Alarms are stored in cnMaestro for an extended period. They will be removed when the total count across the account surpasses 1,000 multiplied by the number of devices in the account. The oldest entries are cleared first.

Events

The Event Table stores a history of the most recent events for the selected node.

Event Severity

Event Severity is mapped to the following levels:

Table 20: Event Severity

	Severity	Definition
	Critical	Catastrophic problem that makes the product/feature unusable.
	Major	Issue that greatly degrades the product/feature, but it is still usable.
	Minor	Limited issue that alters product functionality in a targeted way.
	Notify	Message used primarily for information.

Event Export

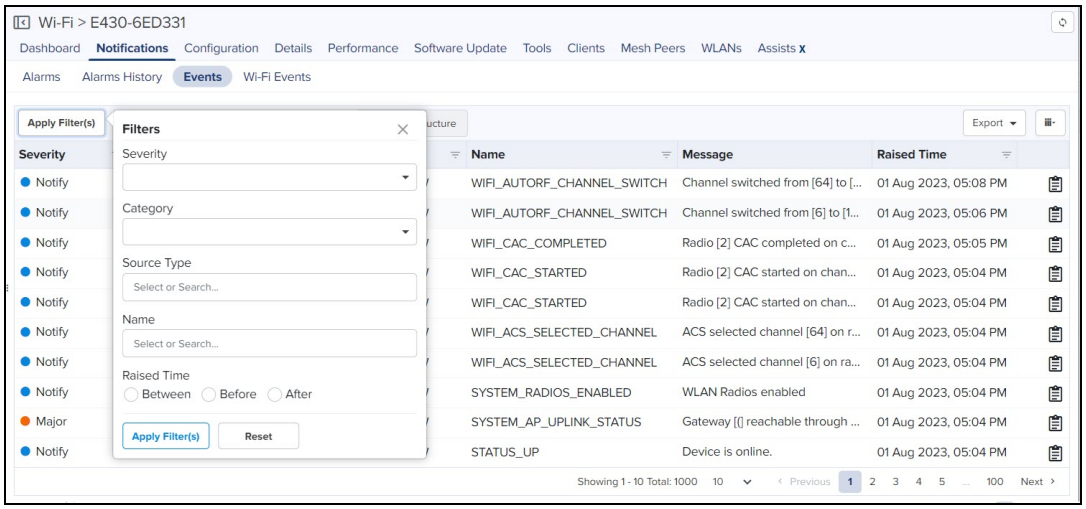
The data in the Event table is exported in a CSV or PDF file format. The following export options are available:

- Export page as CSV
- Export page as PDF
- Export all as CSV

You can create custom filters for events. To create a custom filter, perform the following steps:

1. In the Events table, click **Apply Filter(s)**.
2. Enter the values in the fields for creating the filters.
3. Click **Apply Filter**.

Figure 89 Events: New Filter

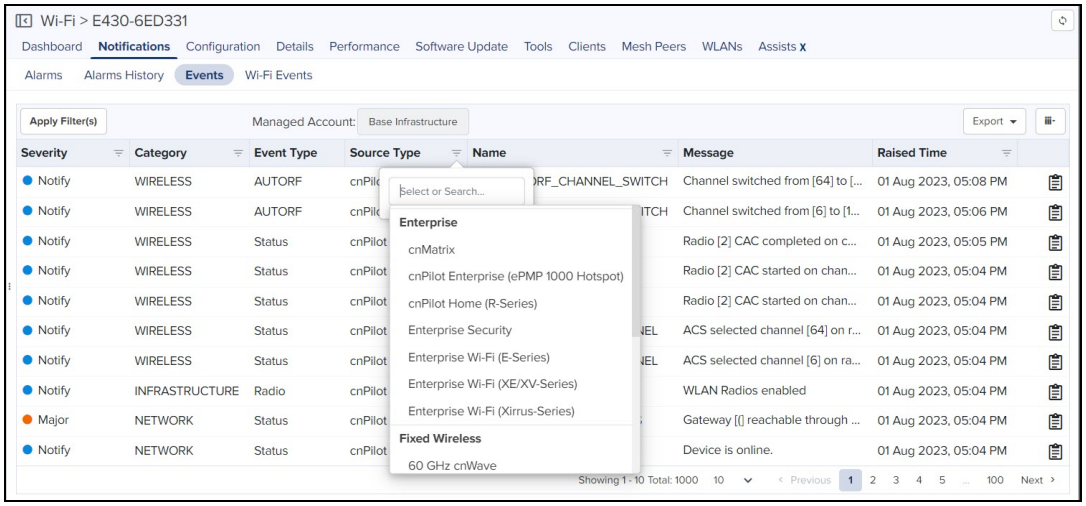


You can manually filter or search by typing parameters in the column header of the Events table.

4. Click **Reset** to reset the filter option in the Events table.
5. Click **Clear Filters** to clear all the filter options.

If you do not receive expected filter details, click **Change Filter(s)** in the Events table to apply new filters.

Figure 90 Events: Source Type filter



The **Source Type** column header is grouped based on the Device or System events. The **Name** column header is grouped based on the category names. The category name with corresponding subcategories and codes are shown in Table 21.

Figure 91 Events: Name filter

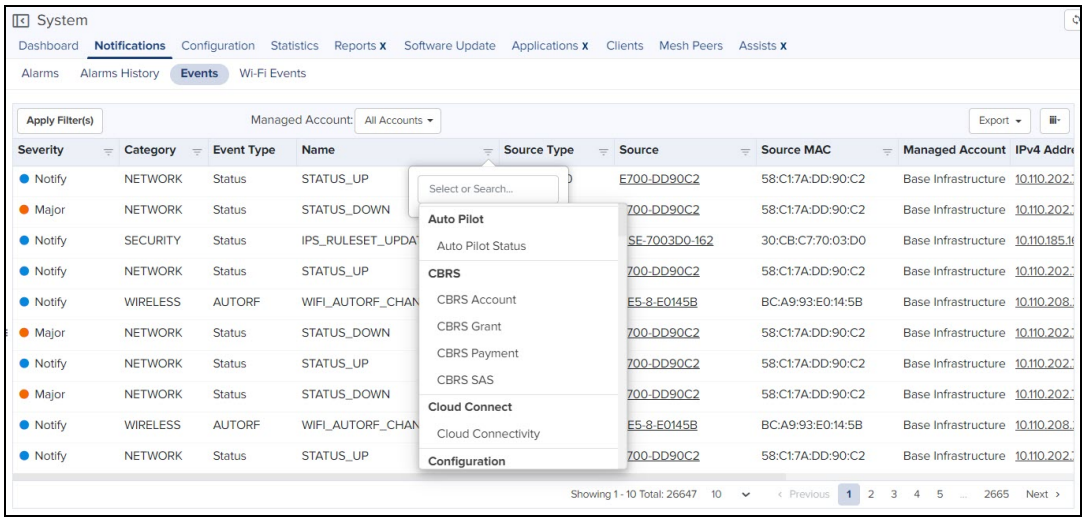


Table 21: Category Names and Codes

Category	Subcategory	Codes
Auto_pilot	Auto Pilot Status	AUTOPILOT_ADDED_AP
		AUTOPILOT_AP_CONNECTED
		AUTOPILOT_AP_DISCONNECTED
		AUTOPILOT_REMOVED_AP

CBRS	CBRS Account	CBRS_ACCOUNT
	CBRS Grant	CBRS_GRANT_TERMINATE
		CBRS_OPERATIONAL_PARAM_CHANGE
		CBRS_GRANT_SUSPEND
		CBRS_TX_ENABLE
		CBRS_TX_DISABLE
		SM_RECONNECT_FAILURE
		CBRS_ATTEMPT_CHANNEL_EXPANSION
		CBRS_START_CHANNEL_HUNT
		CHANNEL_CHANGE
		CBRS_EIRP_CHANGE
		CBRS_ALARM_PROXY_TIME_MISMATCH
	CBRS Payment	CBRS_PAYMENT
	CBRS SAS	SAS_ID_GENERATION
Cloud_Sync	Cloud Connectivity	CLOUD_SYNC
Configuration	Config Sync	CFG_IMP
		CFG_EXP
		CONFIG_SYNC
		CFG_UPD_ST
		SYSTEM_CONFIG_APPLIED

Device	Configuration	SYSTEM_CFG_FALLBACK_REBOOT
		SYSTEM_CFG_OVERWRITE_REBOOT
		SYSTEM_CONFIG_APPLY_FAIL
		SYSTEM_CONFIG_CAP_POWER
		SYSTEM_CONFIG_DEFAULTED
	Default AUTH Key	DEF_KEY_USED_TRAP
	Device Health	SYS_REB
		SYS_UP
		SA_MODE
		STATUS_DOWN
		STATUS_UP
	Device Status	PMAC_UPD
		THRESH_CPU_UTIL
		THRESH_DEVICE_TRAFFIC
		SYSTEM_CC_NOTSET
		PBA_DYN_DATA
		SYSTEM_AP_UPLINK_STATUS
		IET8222_MPPHSDR_INFO
		IET8222_MPPHSDR_NOTICE
		IET8222_MPPHSDR_WARNING
		CISCO_POWER_SUPPLY_STATUS
		AP_REG
		SYSTEM_RADIOS_ENABLED
		SYSTEM_CRITICAL_LOW_POWER
	Link Status	REGULATORY_FAIL
	Memory	SYSTEM_LOW_MEMORY_RESTART
		SYSTEM_RESTARTING_PROCESS
	Onboarding	ONBOARDING
	SM Events	STA_REG_FAIL
	Smart Antenna Events	BSA_ST
	Watchdog	SYSTEM_WATCHDOG_RESET
		SYSTEM_WATCHDOG_UNRESP
Device_Agent	Device Agent	COLD_START
		WARM_START
E2E	E2E Events	E2E_CTLR_IMG_UPD
GPS	GPS Status	GPS_SYNC_ST
		GPS_FW_UPD_ST
		GPS_VER
		GPS_SYNC
HA	Cluster Status	HA_STATE_CHANGE
		HA_SERVICE
Mesh	Mesh Events	WIFI_MESH_XTNDED_DEV
		WIFI_MESH_CLIENT_CONNECTED
		WIFI_MESH_CLIENT_DISCONNECTED
		WIFI_MESH_BASE_REC_TRIGGERED

Misc	Others	unknown
Mon8zn	Monetization State Update	SUBSCRIPTION_FEATURE_STATE_CHANGE
		SUBSCRIPTION_STATE_CHANGE
		SUBSCRIPTION_FEATURE_STATE_TRANSITION
	Monetization Subscription State	SUBSCRIPTION_DEFICIT
		SUBSCRIPTION_SLOT_DEFICIT
		SUBSCRIPTION_FEATURE_EXPIRY_NOTICE
Network	DHCP	DHCP_CLIENT_IP
		DHCPSRVR_IP_ASSIGNED
		DHCP_CLIENT_UPD
		DHCP_COMPLETE_EVENT
	Network - Others	NETWORK_INTERFACE_CHANGE
		MGMT_VLAN_CHANGED
		NETWORK_WWAN_DOWN
		NETWORK_WWAN_UP
		NETWORK_WWAN_BACKUP
		NETWORK_STATUS_DOWN
		NETWORK_STATUS_UP
	PPPoE Status	NETWORK_PPPOE_AUTH_FAILED
		NETWORK_PPPOE_CONNECTED
		NETWORK_PPPOE_DISCONNECTED
		NETWORK_RENEW_INTERFACE_IP
		NETWORK_TUNNEL_DOWN
		NETWORK_TUNNEL_UP
Notification	eMail Notifications	SYSTEM_EMAIL_NOTIFICATION
NSE	Device Status	CONFIG_SYNC
		IPS_THREAT_DETECTED
		WANLB_LINK_UP
		WANLB_LINK_DOWN
		IPS_RULESET_UPDATE_FAILED
		IPS_RULESET_UPDATE
		IPS_START_FAILED
		IPS_INVALID_CONFIG
		SYSTEM_INVALID_LOGIN_ATTEMPT
		WIFI_RADIUS_SERVER_CONFIG_REQUIRED

PTP	Device Status	INCOMPATIBLE_REGULATORY_BANDS
		WIRELESS_LINK_STATUS
		NO_WIRELESS_CHANNEL_AVAILABLE
		SNTP_SYNC
		TDD_SYNC
		UNIT_OUT_OF_CALIBRATION
		CAPACITY_VARIANT_MISMATCH
		INCOMPATIBLE_MASTER_SLAVE
		INSTALL_ARM_STATE
		LICENSE_REMAINING_TRIAL_PERIOD
		LINK_MODE_OPTIMIZATION_MISMATCH
		REGULATORY_BAND
		DFS_IMPULSIVE_INTERFERENCE
		LBT_DETECTED
	Port Status	AUX_PORT_POE_OUTPUT_STATUS
		AUX_PORT_STATUS
		DATA_BRIDGING_STATUS
		MAIN_PSU_PORT_STATUS
		SFP_PORT_STATUS
		AUX_PORT_CONFIG_MISMATCH
		MAIN_PSU_PORT_CONFIG_MISMATCH
		SFP_PORT_CONFIG_MISMATCH
		SFP_ERROR
		PORT_ALLOCATION_MISMATCH
Radio	DFS	DFS_ST
	Radar	RADAR_DETECT
	Radio Link	LINK_ST
	Radio Performance	RF_OVER_LOAD
	Radio Status	LINK_UP
		LINK_DOWN
Rate_Limit	Status	EVENT_RATELIMIT
		EVENT_BLOCKED
		EVENT_UN_BLOCKED
		METRIC_RATELIMIT
		METRIC_BLOCKED
		METRIC_UN_BLOCKED
		CLIENT_EVENT_RATELIMIT
		CLIENT_EVENT_BLOCKED
		CLIENT_EVENT_UN_BLOCKED
SM	SM Events	STA_REG
		STA_DROP
		STA_REJECT

System	Login	SYSTEM_LOGIN
	Reboot	SYSTEM_ADMIN_REBOOT
	Status	SYSTEM_CPU_UTILIZATION
		SYSTEM_MEMORY_UTILIZATION
		SYSTEM_DISK_UTILIZATION
		DISK_NOT_AVAILABLE_BACKUP
		SYSTEM_BACKUP
		SYSTEM_RESTORE
		SYSTEM_ADD_AP_FIRMWARE
		SYSTEM_PROCESS_STATUS
		AUTHENTICATION_FAILURE
		CAEM_VOLTAGE_NOTIFICATION
	System Metrics	WEAK_ADMIN_PWD
		SYSTEM_INSUFFICIENT_POWER_MITIGATING
Upgrade	Site Upgrade	SITE_SW_SYNC
	Status	SYSTEM_UPGRADE
	Upgrade Fail	SYSTEM_FW_UPGRADE_SUCCESS
	Upgrade Status	FW_UPD_ST
	Upgrade Status	MIN_FW_VER
	Upgrade Success	SYSTEM_FW_UPGRADE_FAILED
Webhook	Web Hook Status	WEBHOOK_NOTIFY

WiFi	Client Association	WIFI_CLIENT_CONNECTED
	Client Dissociation	WIFI_CLIENT_DISCONNECTED
	RADIUS Events	WIFI_CLIENT_RADIUS_ACCT_TIMEOUT
		WIFI_CLIENT_RADIUS_AUTH_REJECT
		WIFI_CLIENT_RADIUS_AUTH_SUCCESS
		WIFI_CLIENT_RADIUS_AUTH_TIMEOUT
	Wi-Fi AP Status	THRESH_CLIENT_COUNT
		WIFI_MONITOR_HOST_DOWN
		WIFI_MONITOR_HOST_UP
		SYSTEM
		SECURITY
		SSID
	Wi-Fi Channel	WIFI_NF_CHANNEL_SWITCH
		WIFI_RADAR_DETECTED
		WIFI_ACS_CHANNEL_SWITCH
		WIFI_ACS_TRIGGERED_ON_RADIO
		WIFI_AUTO_DETECT_BACKHAUL
		WIFI_AUTORF_CHANNEL_SWITCH
		WIFI_AUTORF_TRIGGER
		WIFI_AUTORF_TXPOWER
		WIFI_CHANWIDTH_CHANGE
		WIFI_ACS_SELECTED_CHANNEL
		WIFI_ACS_TRIGGERED
	Wi-Fi Client	WIFI_CLIENT_DISCONNECT_INFO
		WIFI_CLIENT_EROAM_DISCONNECTED
		WIFI_CLIENT_GUEST_LOGIN_SUCCESS
		WIFI_CLIENT_GUEST_LOGOUT_SUCCESS
		WIFI_CLIENT_GUEST_SESSION_TIMEOUT
		WIFI_CLIENT_WPA2_INVALID_PSK
		WIFI_DISALLOW_CLIENT
		WIFI_DYN_AUTH_COA_REQ
		WIFI_DYN_AUTH_DISCONNECT_REQ
		WIFI_CLIENT_LDAP_AUTH_REJECT
		WIFI_CLIENT_LDAP_AUTH_SUCCESS
		WIFI_CLIENT_LDAP_AUTH_TIMEOUT
		WIFI_CLIENT

The following table describes the different types of system event categories and their descriptions.

Table 22: System Event Types and Definitions

System Event Category	Description
Infrastructure	Events related to infrastructure management – such as HA setup, interfacing with Message Bus or Database servers, Subscription, etc. Source: cnMaestro
Network	Events related to networking issues, such as link up/down. Source: Devices
Operations	Event related to system-level processes, such as pushing configuration, installing images, etc. Source: Devices
Other	Events related to miscellaneous categories. Source: Devices
Registration	Events related to managing/unmanaged devices. Source: Devices
Security	Events related to logging into the devices, establishing secure links, and potentially recognizing scans and security breaches in the future. Source: cnMaestro, Devices, and Clients
Services	Events related to additional services that may be added to the product in the future. There may not be any services events in the first release. Source: cnMaestro and Devices
Wireless	Events related to issues/notifications with the PTP/PMP radio connectivity, Wi-Fi Clients, etc. Source: Devices and Clients

Alarms

Alarm Life Cycle

The basic alarm life cycle has the following states:

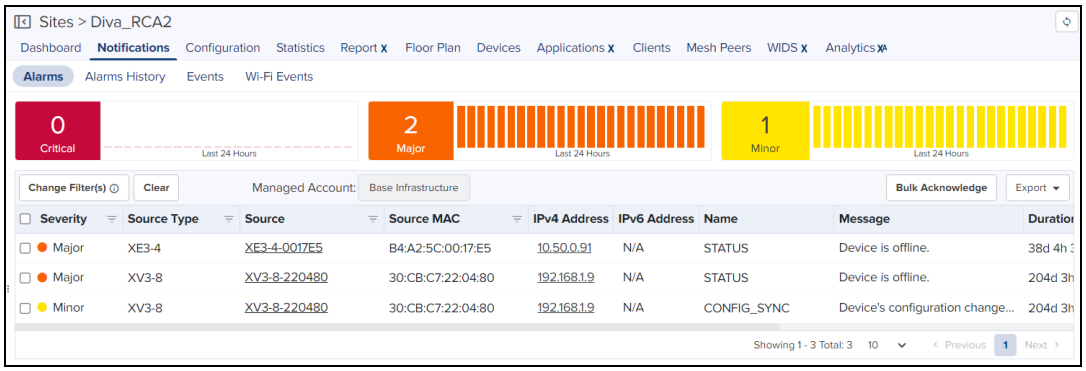


Table 23: Alarm Life Cycle

State	Description
Acknowledged	Active alarms can be acknowledged, which signifies they are known and being handled. Acknowledged alarms are not included in the total alarm count.
Active	The alarm remains active until the combination of inputs that generated it are cleared.
Inactive	Inactive alarms remain visible in the active Alarm Table for 10 minutes, before they are moved to Alarm History. An alarm becomes inactive when the inputs that generated it are no longer present. An Inactive alarm can be pulled back to the Active/Acknowledged states if a new event reactivates the alarm.
Raised	The creation of the alarm.

Alarm Severity

Alarms have a severity that determines how they are handled.

Table 24: Alarm Severity

	Severity	Definition
	Critical	Catastrophic problem that makes the product/feature unusable.
	Major	Significant issue that greatly degrades the product/feature, but it is still usable.
	Minor	Limited issue that alters product functionality in a targeted way.

Alarm Types

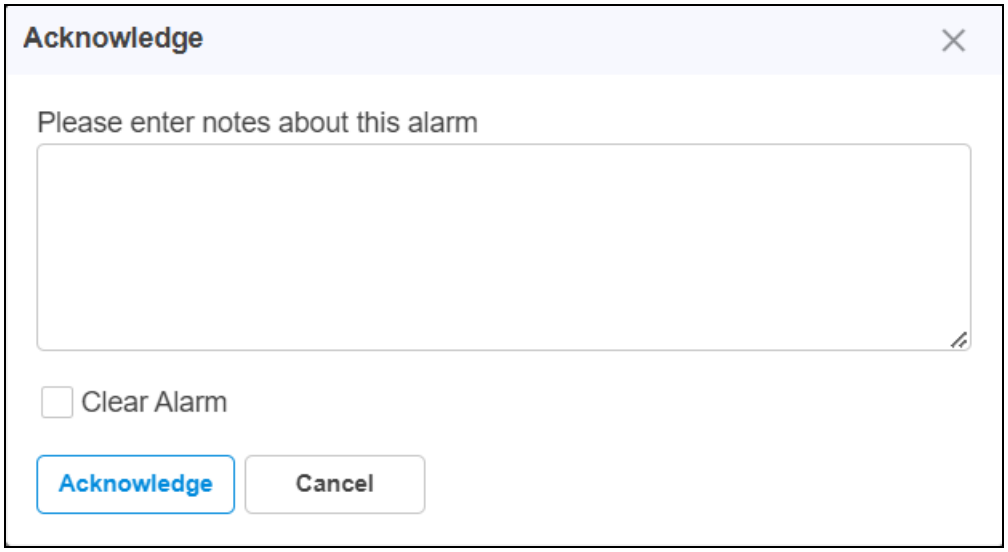
Table 25: Alarm Types

Alarm Type	Definition
Configuration	Issues encountered during a device configuration update.
DFS State	Issues related to DFS operational status.
GPS State	Issues related to GPS synchronization.
Link State	Issues related to the status of device interfaces.
Status	Connectivity between cnMaestro and a device is lost.
Upgrade	Issues encountered during device software upgrade.

Alarm Acknowledgment

Active alarms can be acknowledged in the Alarm Table. Acknowledgment makes the alarm less visible in the table, and the administrator can further add a note describing how the alarm is being resolved. Acknowledging an alarm will also remove it from the alarm counts. You can also select the **Clear Alarm** check box to clear the acknowledged alarm when acknowledging the alarms.

Figure 92 Alarm Acknowledgment

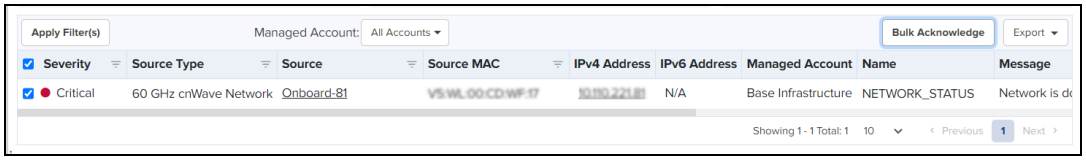


Alarm Bulk Acknowledgment

To acknowledge multiple alarms at the same time, follow these steps:

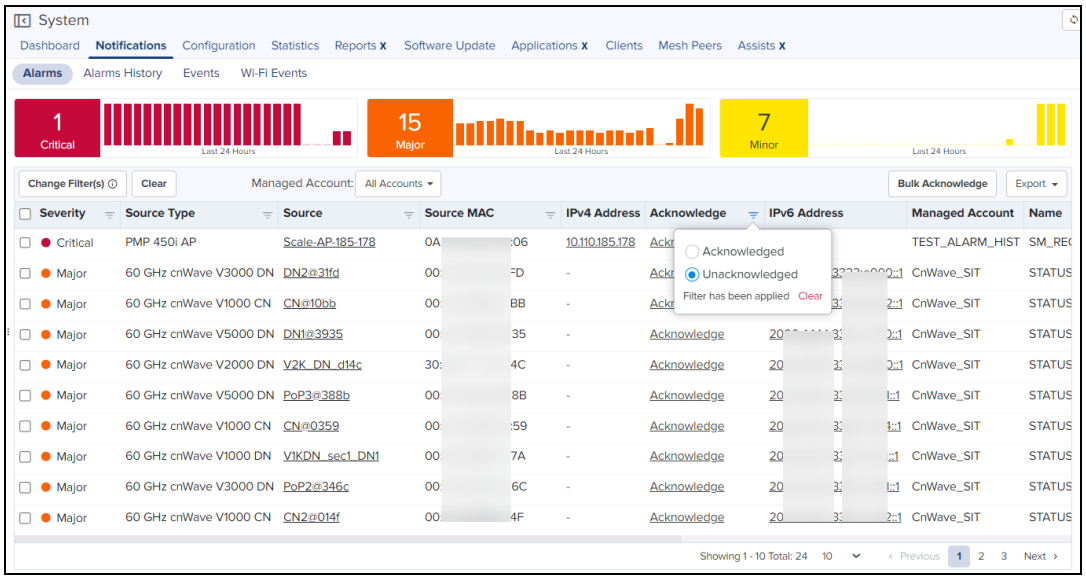
1. Navigate to the **Monitor and Manage > Notifications > Alarms** page.

Figure 93 Alarm Bulk Acknowledgment



2. Select the alarms from the alarms list and then click on the **Bulk Acknowledge** button on the top right corner of the list.
3. Enter **Notes** about the selected alarms.
4. (Optional) Select the **Clear Alarm** check-box if you would like to remove those alarms from the Alarms list after you acknowledge.
5. Click **Acknowledge**

You can filter the Acknowledged and Unacknowledged devices as shown below:



NOTE:

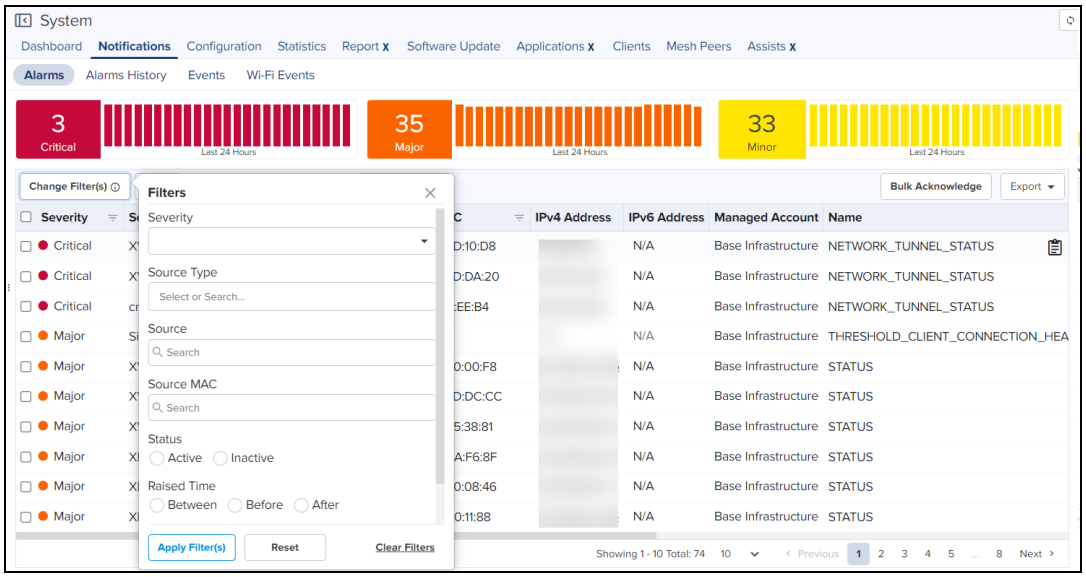
Acknowledged alarms are not shown in **Top Active Alarms**.

Alarm filters

You can create custom filters for **Alarms**. To create a custom filter, perform the following steps:

1. In the **Alarms** table, click **Apply Filter(s)**.
2. Enter the values in the fields for creating the filters.
3. Click **Apply Filter**.

Figure 94 Alarms: New Filter



You can manually filter or search by typing parameters in the column header of the Alarms table.

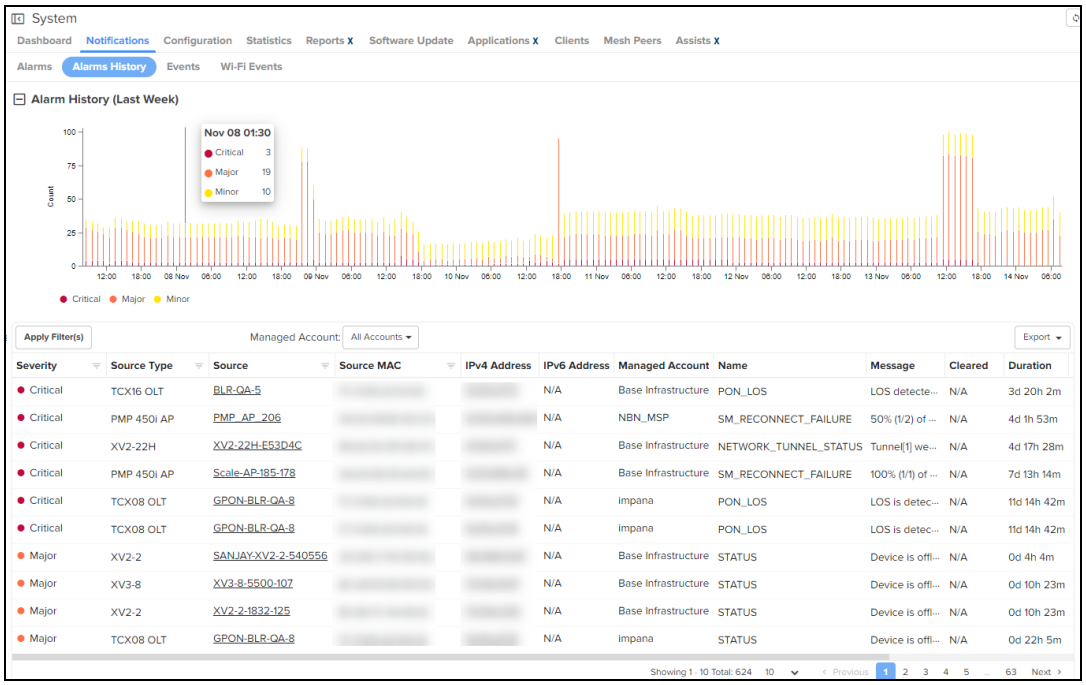
4. Click **Reset** to reset the filter option in the Alarms filter.
5. Click **Clear Filters** to clear all the filter options.

If you do not receive expected filter details, click **Change Filter(s)** in the Alarms table to apply new filters.

Alarm History

Expired Alarms are added to the Alarm History. The Alarm History displays historical active alarm counts. Clicking the bar chart filters the table data underneath, allowing you to view which alarms were active at a specific time in the past.

Figure 95 Alarm History

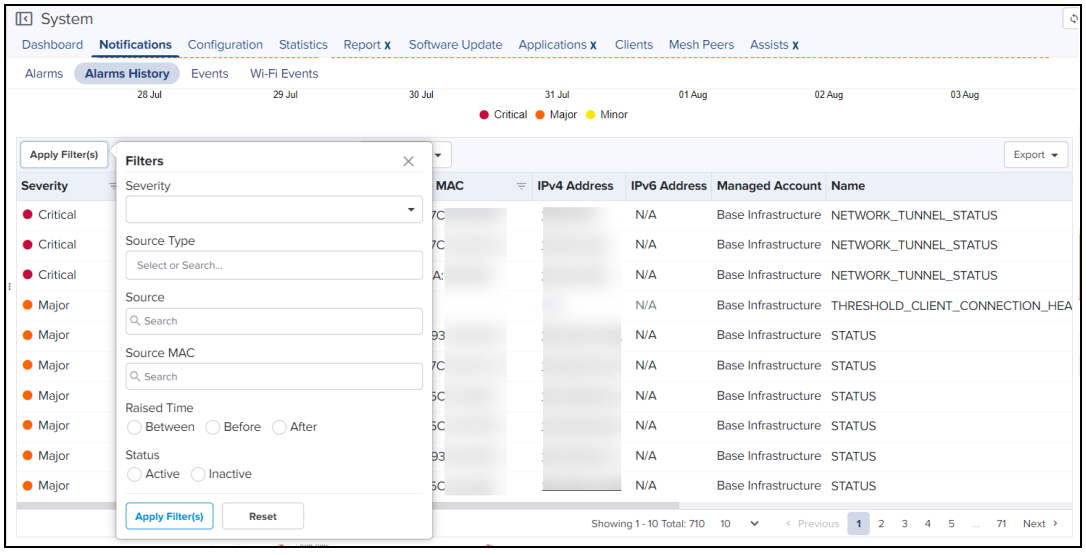


Alarm History filters

You can create custom filters for **Alarms History**. To create a custom filter, perform the following steps:

1. In the **Alarms History** table, click **Apply Filter(s)**.
2. Enter the values in the fields for creating the filters.
3. Click **Apply Filter**.

Figure 96 Alarm History: New Filter



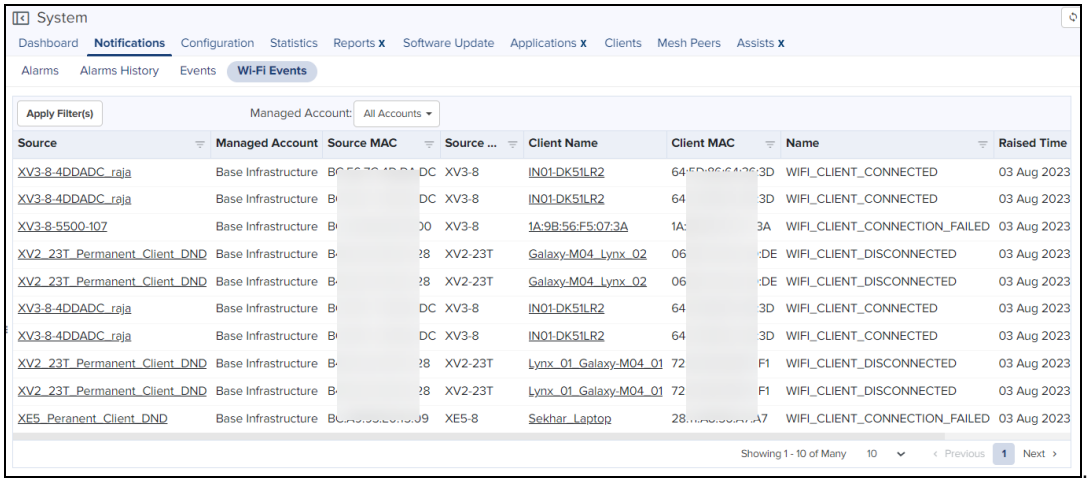
You can manually filter or search by typing parameters in the column header of the Alarm History table.

4. Click **Reset** to reset the filter option in the Alarms History filter.
5. Click **Clear Filters** to clear all the filter options.

If you do not receive expected filter details, click **Change Filter(s)** in the Alarm History table to apply new filters.

Wi-Fi Events

Wi-Fi Events are listed as below:



Statistics and Details

Statistics provide a tabular aggregation of data, including general information on the devices monitored, as well as Wireless, Network, and Traffic metrics. Details pages provide information on a single device, generally in a page format.

The following table highlights the type of information that is generally found in cnMaestro Statistics and Details sections (separated by Device Type):

Table 26: Device Statistics

60 GHz cnWave Nodes	**General** • Device • IPv6 Address • MAC • Mode • Model • PoP Node • Serial Number • Site • Software Version • Status • Status Time • Network **GPS** • Fix Type • Height • Latitude • Longitude • Satellites Tracked • Sync Mode **Network** • Ethernet Throughput (Rx) • Ethernet Throughput (Tx) • Main Aux SFP • Radio Channel • Sector Throughput (Rx) • Sector Throughput (Tx)
cnMatrix	**General** • Device • IP Address • MAC • Managed Account • Product Name • Serial Number • Status **Traffic** • Throughput (DL) • Throughput (Rx)
cnPilot Home	**General** • Device • IP Address • Product Name • Serial Number • Status **Wireless** • Radios (Channel)
cnRanger BBU	**General**

Table 26: Device Statistics

	• Device • IP Address • Registered SM Count • Serial Number • Status **Traffic** • Throughput (DL) • Throughput (UL)
cnRanger SM	**General** • Device • IP Address • IMSI • Serial Number • Status **Traffic** • Throughput (DL) • Throughput (UL) **Wireless** • Bandwidth • Frequency • MCS (DL) • MCS (UL) • RSRP • RSRQ • RSSI
cnReach	**General** • Device • IP Address • Neighbors • Radio • Role • Status **Radio** • Average Noise • Radio Temperature • RSSI • SNR • Tx Power **Traffic** • Throughput (DL) • Throughput (UL)
cnReach XIO	**General** • Active S/W Version • Device • IP Address • Product Name • Serial Number

Table 26: Device Statistics

	• Status
cnVision Client	**General** • Device • DFS Status • Distance • IP Address • Serial Number • Session Time • Status **Network** • LAN Interface • LAN Interface 2 • WAN IP Address **Traffic** • Retransmission Rate (DL) • Retransmission Rate (UL) • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • Capacity • Connected AP • MCS (DL) • MCS (UL) • Quality • RSSI (DL) • RSSI (UL) • SSID • Tx Power • Wireless MAC
cnVision Hub	**General** • Device • DFS Status • IP Address • Registered SM Count • Reregistration Count • Serial Number • Status **Network** • LAN Interface • LAN Interface 2 **Traffic** • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • Bandwidth • DL/UL Ratio

Table 26: Device Statistics

	• Frequency • Max Range • SSID • Tx Power
cnWave 5G Fixed BTS	**Overview** • Product Name • MAC Address • IPv4 Address • Serial Number • Software Version • Connected CPEs • Registered CPEs • Site Location • Site Contact • Description • Boot Loader details such as Git Tag, Build Name, and Hardware Version • Boot - Startup Reason and Startup Count • Shutdown date and time, reason, and detail **Interfaces** • Interface Configuration (SFP1 Speed and SFP2 Speed) • GNSS (Tracking, Altitude, Location, Satellites In View) • Tx/Rx Errors (In and Out Discards, In and Out Errors for Wireless, Main, SFP1, and SFP2) • Tx/Rx Counters (In and Out Octets, Unicast, Multicast, Broadcast packets for Wireless, Main, SFP1, and SFP2) **Radios** - Radio status of the BTS device • Frequency • Max EIRP • Polarisation • Link Symmetry • Bandwidth • Target Rx Power • UL Tx Pwr Ctrl Initial Adjust • UL Tx Pwr Ctrl Cont Adjust
cnWave 5G Fixed CPE	**Overview** • Product Name • MAC Address • IPv4 Address • Serial Number • Software Version • Site Location • Site Contact • Altitude • Coordinates • Radio Details such as DL EVM (dB), UL EVM (dB), DL Rx Power (Data), UL Rx Power (Data), DL MCS, and UL MCS • Session such as Registration State, Registration Count, Link Uptime, and IMSI **Interfaces** • Ethernet - Count of In and Out Discards, count of In and Out Errors, count of In and Out Octets, Unicast, Multicast, Broadcast packets

Table 26: Device Statistics

	• Wireless - Count of In and Out Discards, count of In and Out Errors, count of In and Out Octets, Unicast, Multicast, Broadcast packets **Radios** • Alignment Active • Range • Current EIRP (dBm) • UL Backoff (dB • DL Backoff (dB) • DL Sounding State • UL Sounding State • DL Channel Distortion (dB) • UL Channel Distribution (dB) • DL EVM (dB) • UL EVM (dB) • DL MCS • UL MCS • DL Rx Power (Data) • UL Rx Power (Data) • DL Spatial Frequency • UL Spatial Frequency • Polarization
Enterprise Wi-Fi	**General** • Device • IP Address • Product Name • Serial Number • Status **Wireless** • Radios (Channel)
ePMP AP	**General** • Device • DFS Status • IP Address • Registered SM Count • Reregistration Count • Serial Number • Status **Network** • LAN Interface • LAN Interface 2 **Traffic** • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • Bandwidth • DL/UL Ratio • Frequency • Maximum Range

Table 26: Device Statistics

	• SSID • Tx Power
ePMP SM	**General** • Device • DFS Status • Distance • IP Address • Serial Number • Session Time • Status **Network** • LAN Interface • LAN Interface 2 • WAN IP Address **Traffic** • Retransmission Rate (DL) • Retransmission Rate (UL) • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • Capacity • Connected AP • MCS (DL) • MCS (UL) • Quality • RSSI (DL) • RSSI (UL) • SSID • Tx Power • Wireless MAC
Machfu	**Cell** • Cell Enabled • Cell ICCID • Cell IMEI • Cell IMSI • Cell IP • Cell Link • Cell Manufacturer • Cell Model • Cell Network Type • Cell RSSI • Cell Rx Rate • Cell Software Version • Cell Tx Rate **Ethernet** • Ethernet • Ethernet Enabled • Ethernet Gateway • Ethernet IP Address

Table 26: Device Statistics

	• Ethernet Link • Ethernet Link Speed • Ethernet MAC • Ethernet Mask • Ethernet Mode • Ethernet Rx Rate • Ethernet Tx Rate **General** • Device • IP Address • Status **GPS** • GPS Accuracy • GPS Altitude • GPS Fix Time • GPS Satellites in use • GPS Status • GPS Time **Wireless Access Point** • WAP Enabled • WAP IP • WAP Link • WAP MAC • WAP Mask • WAP Mode • WAP Rx Rate • WAP SSID • WAP Tx Rate **Wireless Client** • WC Enabled • WC Gateway • WC IP • WC Link • WC MAC • WC Mask • WC RSSI • WC Rx Rate • WC SSID • WC Tx Rate
PMP AP	**General** • Device • DFS Status • IP Address • Reregistration Count • Registered SM Count • Serial Number • Status **Network** • LAN Interface **Traffic**

Table 26: Device Statistics

	• Busy Index (DL) • Busy Index (UL) • Frame Utilization (DL) • Frame Utilization (UL) • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • Bandwidth • Color code • Connection Slots • DL/UL Ratio • Frequency • Max Range • Tx Power
PMP SM	**General** • Device • DFS Status • Distance • IP Address • Serial Number • Session Time • Status **Network** • LAN Interface • WAN IP Address **Traffic** • Packet Loss (DL) • Packet Loss (Error Drop) (DL) • Packet Loss (Overcapacity) (DL) • Packet Loss (UL) • Packet Loss (Overcapacity) (UL) • Packet Loss (Error Drop) (UL) • Throughput (DL) • Throughput (UL) **Wireless** • Antenna Gain • BER (Average) • Color Code • Connected AP • Horizontal SNR (DL) • Horizontal SNR (UL) • LQI (DL) • LQI (UL) • Modulation (DL) • Modulation (UL) • RSSI (DL) • RSSI Imbalance • Tx Power • Vertical SNR (DL) • Vertical SNR (UL)

Table 26: Device Statistics

PTP 650/670/700	**System** • Device • IP Address • MAC • Managed Account • Product Name • Status **Network** • Aux Interface • Main PSU Interface • SFP Interface **Wireless** • Antenna Gain • Bandwidth • Errored Seconds • Licensed Country • Maximum Transmit Power • Receive Frequency • Severely Errored Seconds • Transmit Frequency • Unavailable Seconds
PTP 820/850	**General** • Device • Edge Controller • IP Address • Model • Radios • Serial Number • Status
RV22 Home Mesh	**General** • Device Name • MAC Address • Product Name • Serial Number • IPv4 Address • IPv6 Address • Status **Wireless** • Radios

Performance

Performance pages display a synchronized view of time-series data for devices. The data can be filtered using the interval ranges in the upper left (last 1 hours to last 1 year) , or by dragging the cursor on the graph to select a specific range. The data presented varies based upon device type.

	NOTE: cnMaestro supports 14 months of historical data for devices: • cnPilot Home (R-Series) • Enterprise devices (Enterprise Wi-Fi and cnMatrix) • IIoT devices cnMaestro supports 26 months of historical data for devices: • Fixed Wireless Period = 1 day is available for a Time Range of more than 24 hrs.

The following images represent the sample performance graphs for 60 GHz cnWave, cnMatrix, cnPilot Enterprise, cnPilot Home, cnRanger, cnReach, cnVision, cnWave 5G Fixed, ePMP AP, ePMP SM, Machfu, PMP AP, PMP SM, PTP 650/670/700, and PTP 820/850 .

Table 27: Performance graph

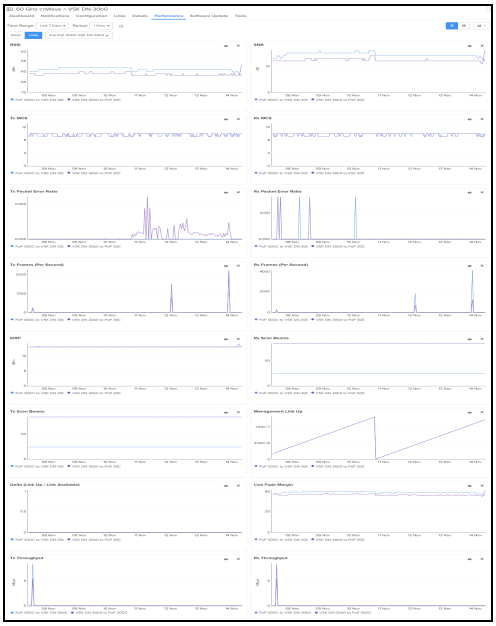
Device	Fields
60 GHz cnWave (Links)	Displays the following graphs: • Delta (Link Up/Link Available) • EIRP • Link Fade Margin • Management Link Up • RSSI • Rx Frames (Per Second) • Rx MCS • Rx Packet Error Ratio • Rx Scanbeams • Rx Throughput • SNR • Tx Frames (Per Second) • Tx MCS • Tx Packet Error Ratio • Tx Scanbeams • Tx Throughput 
60 GHz cnWave (Node)	Displays the following graphs: • Ethernet Throughput (Rx) • Ethernet Throughput (Tx) • Sector Throughput (Rx) • Sector Throughput (Tx)

Table 27: Performance graph

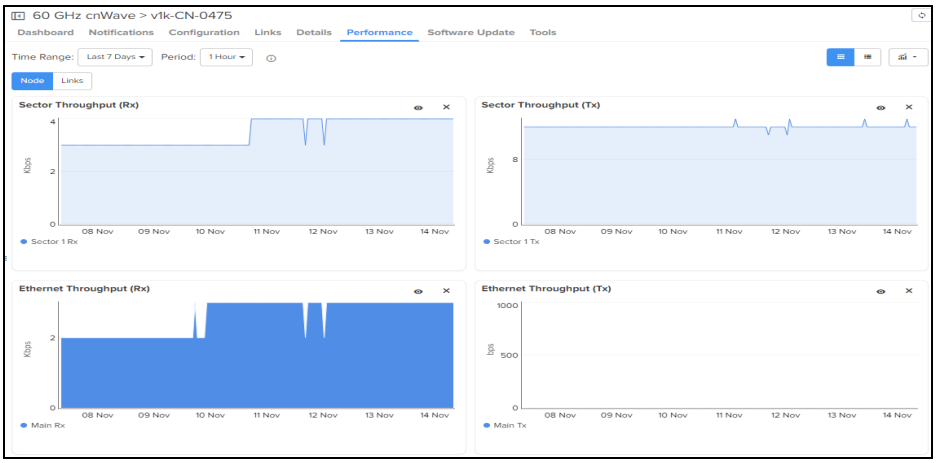
Device	Fields
	
cnMatrix	Displays the following graphs: • CPU • Packet Error • Rx Packets • Throughput • Tx Packets 
cnPilot Home	Displays the following graphs: • CPU • Stacked Clients by Band • Stacked Clients by Radio • Stacked Throughput by Band (Downlink) • Stacked Throughput by Band (Uplink) • Stacked Throughput by Radio (Downlink) • Stacked Throughput by Radio (Uplink)

Table 27: Performance graph

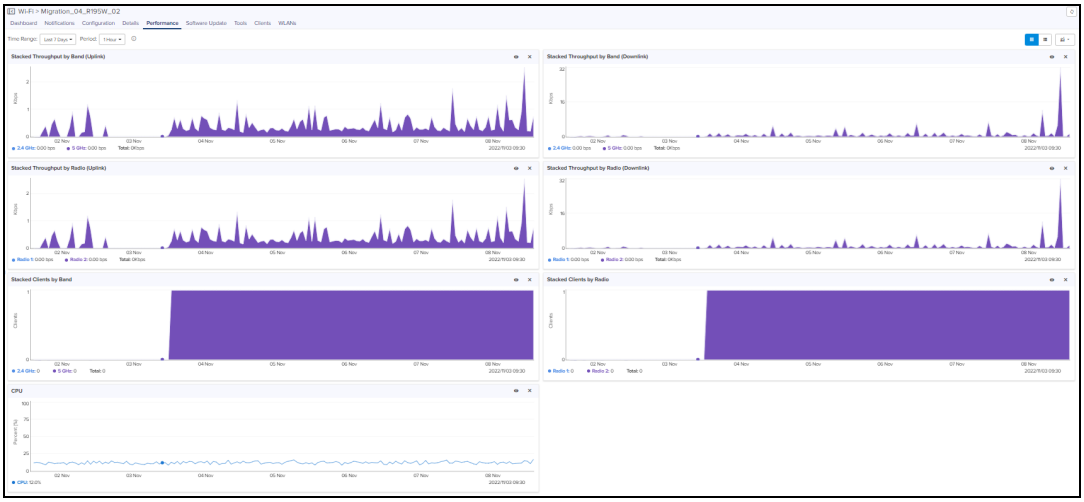
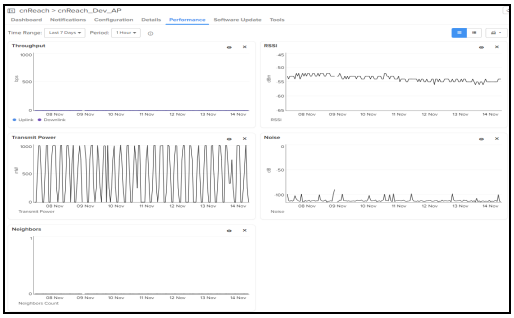
Device	Fields
	
cnReach	Displays the following graphs: • Neighbors • Noise • RSSI • Throughput • Transmit Power 
cnRanger BBU	Displays the following graphs: • Available Memory • CPU • Interface (eth1) • Interface (eth2) • SMs Registered • Temperature • Throughput

Table 27: Performance graph

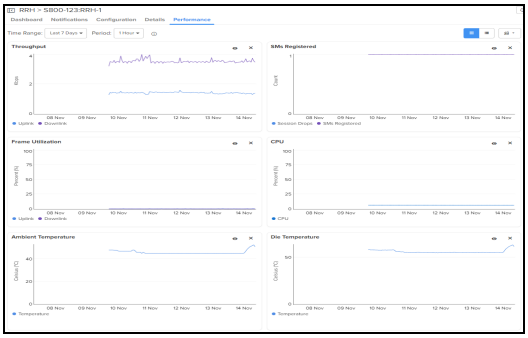
Device	Fields
	
cnRanger RRH	Displays the following graphs: • Ambient Temperature • CPU • Die Temperature • Frame Utilization • SMs Registered • Throughput 
cnRanger SM	Displays the following graphs: • Available Memory • CPU • MCS • RSRP • RSRQ • RSSI • SINR • Throughput

Table 27: Performance graph

Device	Fields
	
cnVision Client	Displays the following graphs: • CPU • MCS • Retransmission • RSSI • Session Drops • SNR • Throughput 

Table 27: Performance graph

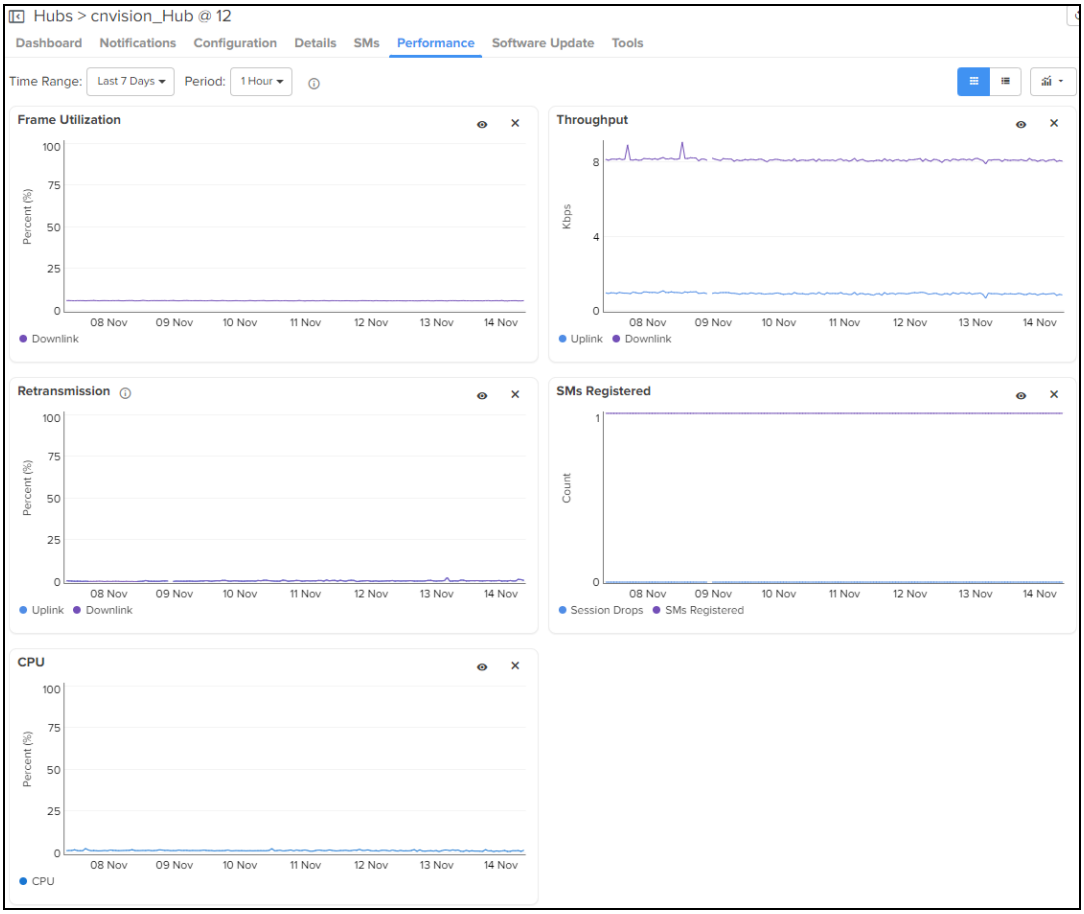
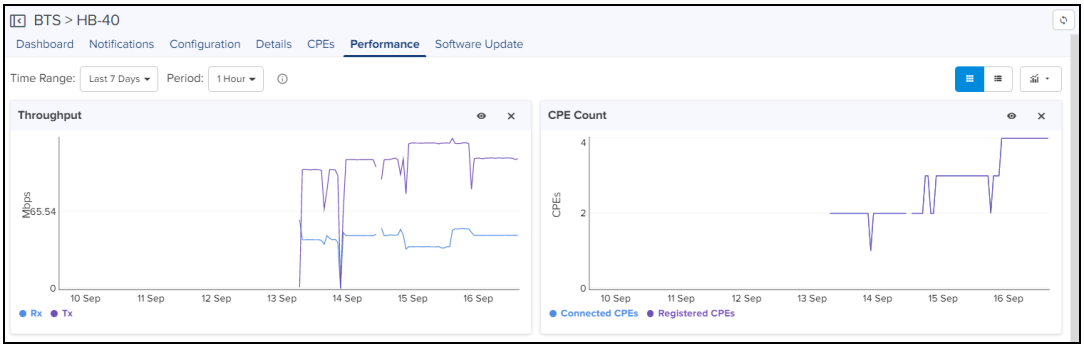
Device	Fields
cnVision Hub	Displays the following graphs: • CPU • Frame Utilization • Retransmission • SMs Registered • Throughput 
cnWave 5G Fixed BTS device	Displays the following graphs: • Throughput • CPE Count 

Table 27: Performance graph

Device	Fields
cnWave 5G Fixed CPE device	Displays the following graphs: • EVM • MCS • Throughput • Rx Power • Registration Count 
Enterprise Wi-Fi	Displays the following graphs: • Airtime Radio 1 • Airtime Radio 2 • Available Memory • Clients by Band • Clients by Radio • CPU • Interference • Noise Floor • Stacked Clients by Band • Stacked Clients by Radio • Stacked Packet Rate by Band (Downlink) • Stacked Packet Rate by Band (Uplink) • Stacked Packet Rate by Radio (Downlink) • Stacked Packet Rate by Radio (Uplink) • Stacked Throughput by Band (Downlink)

Table 27: Performance graph

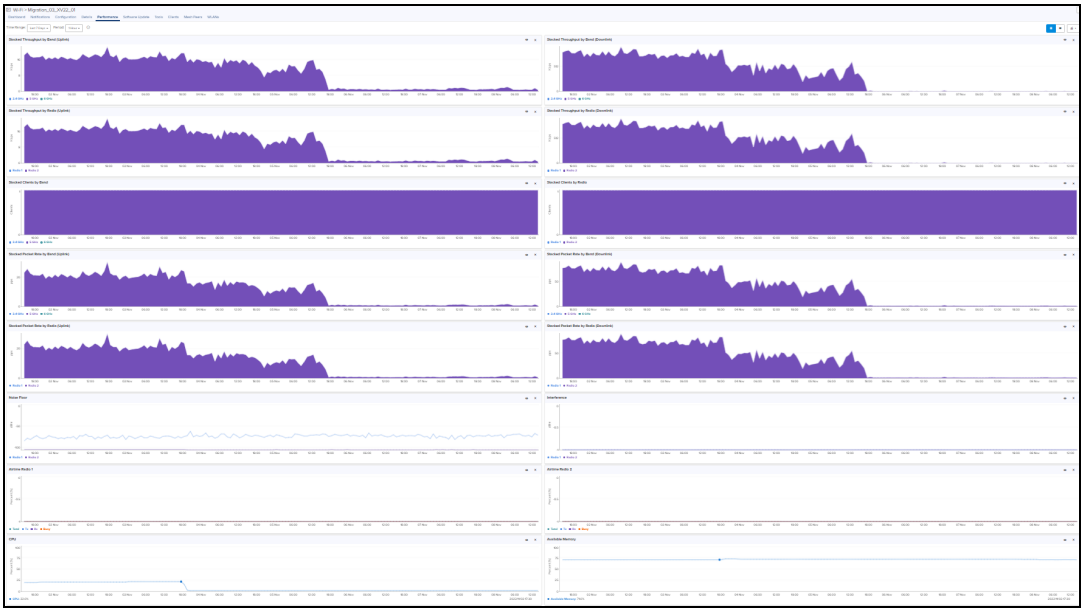
Device	Fields
	• Stacked Throughput by Band (Uplink)) • Stacked Throughput by Radio (Downlink) • Stacked Throughput by Radio (Uplink) 
Enterprise Wi-Fi (Xirrus-Series)	Displays the following graphs: • Available Memory • Clients by Band • Clients by Radio • CPU • Stacked Packet Rate by Band (Downlink) • Stacked Packet Rate by Band (Uplink) • Stacked Packet Rate by Radio (Downlink) • Stacked Packet Rate by Radio (Uplink) • Stacked Throughput by Band (Downlink) • Stacked Throughput by Band (Uplink)) • Stacked Throughput by Radio (Downlink) • Stacked Throughput by Radio (Uplink)

Table 27: Performance graph

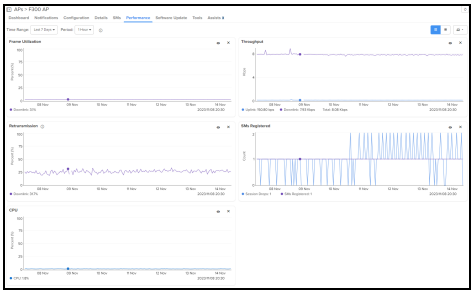
Device	Fields
	
ePMP AP	Displays the following graphs: • CPU • Frame Utilization • Retransmission • SMs Registered • Throughput 
ePMP SM	Displays the following graphs: • CPU • MCS • Modulation

Table 27: Performance graph

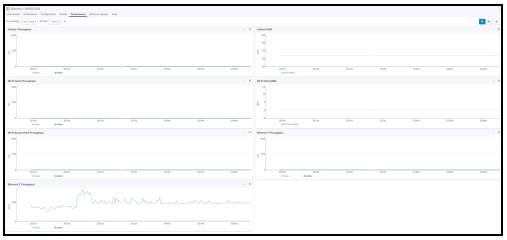
Device	Fields
	• Retransmission • RSSI • Session Drops • SNR • Throughput 
MachFu	Displays the following graphs: • Cellular RSSI • Cellular Throughput • CPU Load • Disk Storage • Ethernet 1 Throughput • Ethernet 2 Throughput • Flash Memory • Wi-Fi Access Point Throughput • Wi-Fi Client RSSI • Wi-Fi Client Throughput 
NSE 3000	Displays the following graphs: • Available Memory • CPU

Table 27: Performance graph

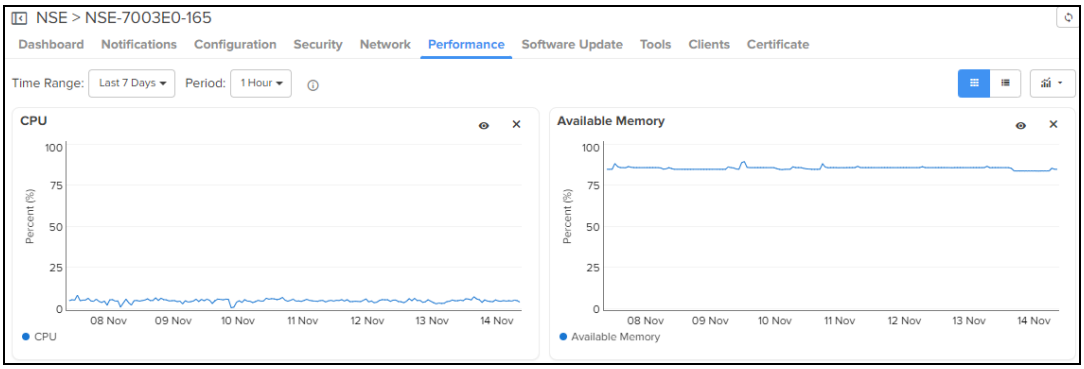
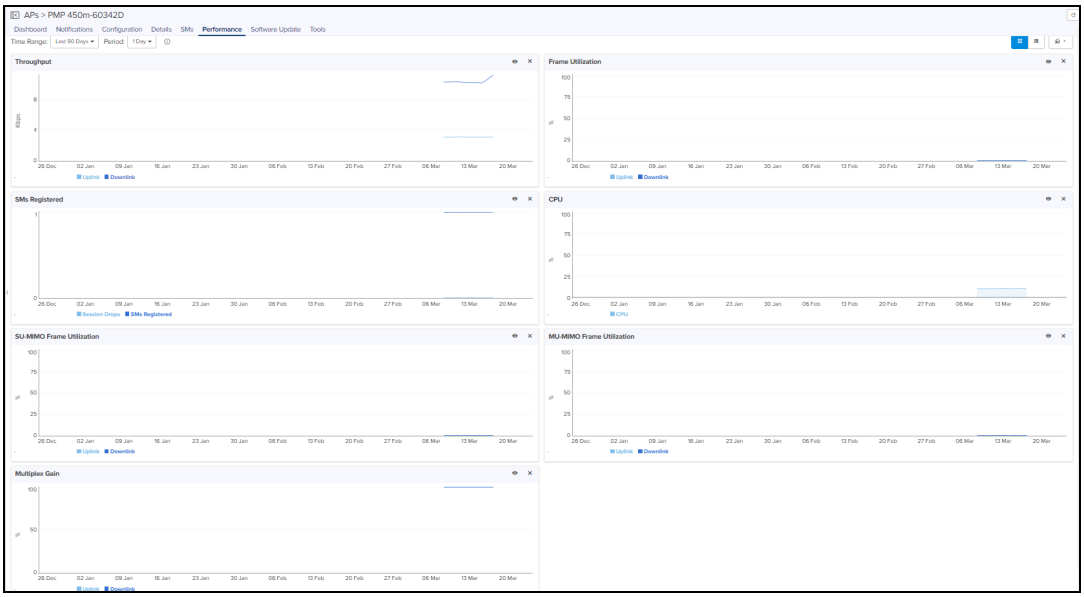
Device	Fields
	
PMP AP	Displays the following graphs: • CPU • Frame Utilization • MU-MIMO Frame Utilization (for 450m) • Multiplex Gain (for 450m) • SMs Registered • SU-MIMO Frame Utilization (for 450m) • Throughput 
PMP SM	Displays the following graphs: • BER • CPU • DL RSSI Imbalance • LQI (Link Quality Indicator) • Modulation • RSSI • Session Drops • SNR (Vertical) • SNR (Horizontal) • Throughput

Table 27: Performance graph

Device	Fields
	

NOTE:

BER with zero values are not plotted on the logarithmic scale graphs.

Table 27: Performance graph

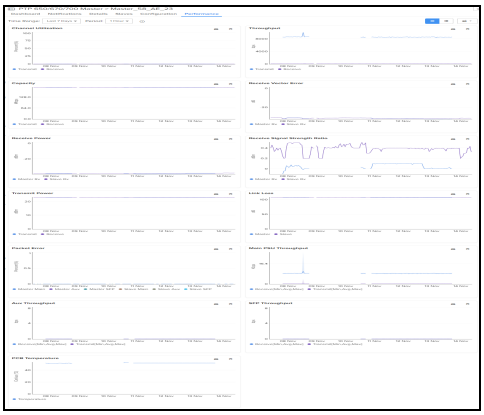
Device	Fields
PTP and HCMP Masters	Displays the following graphs: • Aux Throughput • Capacity • Channel Utilization • Link Loss • Main PSU Throughput • Packet Error • PCB Temperature • Receive Power • Receive Signal Strength Ratio • Receive Vector Error • SFP Throughput • Throughput • Transmit Power 
PTP and HCMP Slaves	Displays the following graphs: • Aux Throughput • Capacity • Channel Utilization • Link Loss • Main PSU Throughput • Packet Error • PCB Temperature • Receive Power • Receive Signal Strength Ratio • Receive Vector Error • SFP Throughput • Throughput • Transmit Power

Table 27: Performance graph

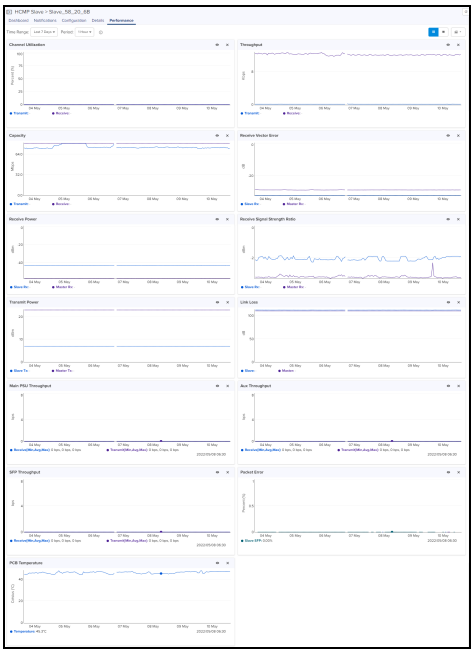
Device	Fields
	
PTP 820/850	Displays the following graphs: • Modem MSE • Modem XPI • MRMC Profile • Peak Throughput By Groups • Peak Throughput By Radios • Signal Level - RSL • Signal Level - TSL • Throughput By Groups • Throughput By Radios

Table 27: Performance graph

Device	Fields
	
PON	Displays the following graphs: • ONUs • Memory • CPU • Temperature 
RV22 Home Mesh	Displays the following graphs: • Stacked Throughput by Band (Downlink)

Table 27: Performance graph

Device	Fields
	• Stacked Throughput by Band (Uplink) • Stacked Clients by Band • Noise Floor • Interference • Airtime 2.4 GHz • Airtime 5 GHz • Available Memory • CPU • SNR • RSSI • Data Rate

Table 27: Performance graph

Device	Fields
	

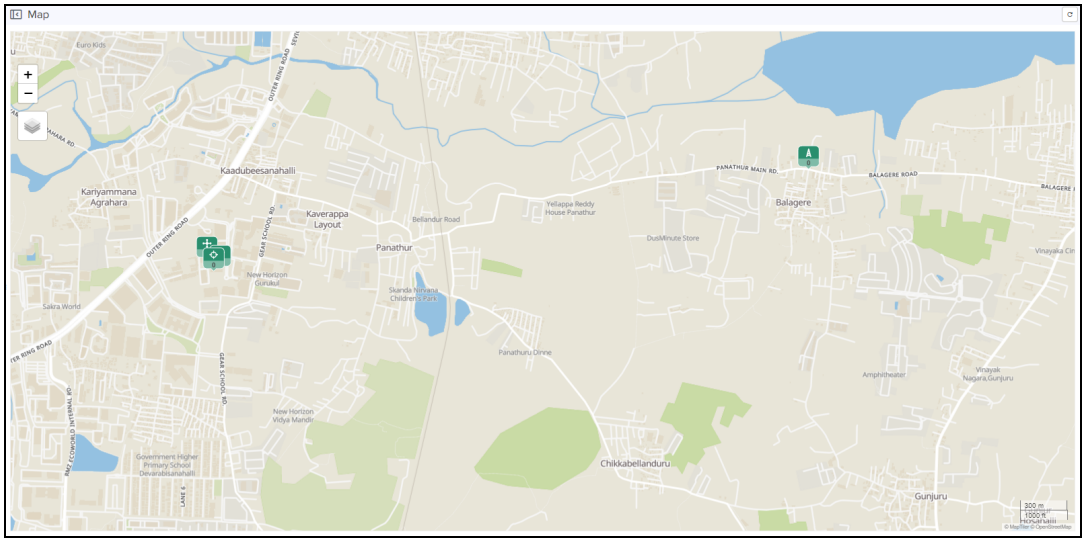
Maps

Maps provide visualization for Towers, Sites, and Devices. They display proximity to other devices, connectivity between devices, device health, and selectable status parameters. An example Map is presented below.

Three views are supported in System Maps and Network/Tower Dashboard Maps:

- Street View
- Satellite View
- Terrain View

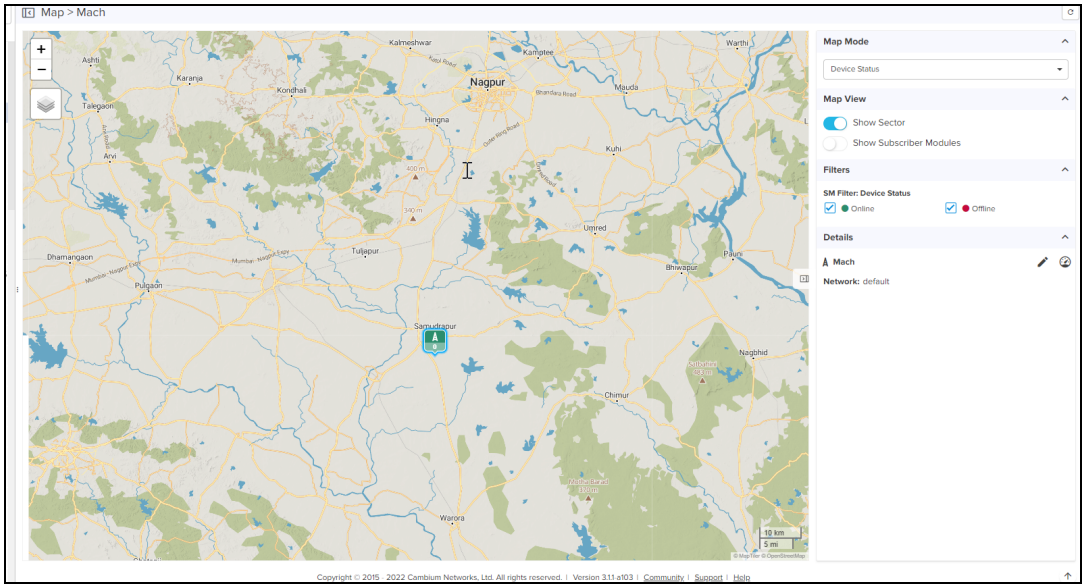
Figure 97 Map Street View



The Satellite View is supported in limited US and EU regions.

Figure 98 Map Satellite View

Figure 99 Map Terrain View



If latitude or longitudinal of Site or Tower or Device is (-90°, 90°, -180°, 180°) or (0,0) then they will not display in the map.

	NOTE: • (0,0) is the default value for devices that do not have a location set cnMaestro does not plot devices with this location. • (x, 180°) and (x, -180°) require the user to zoom out in order to see the markers. • (90°, y) and (-90° ,y) also displays incorrectly.

Map Navigation

There are a various ways to navigate the map display.

Action	Description
Click	Click the following items on the Map to auto-select the same item in the Tree. • ePMP SM • Tower
Double-click	Double-click on the following items on the Map to auto-navigate to the Dashboard of that item. • ePMP SM • Site • Tower
Hover	Hovering over a tower or device displays a tool tip that provides basic status information. Hovering over an RF link displays status on the link.
Standard Components	In the upper-left corner are generic map navigation components that allow one to zoom in and out. Use the mouse to drag and reposition the view. as well as turn on the satellite display.

Mode

The map can be placed in a number of different modes, which define how the device status is presented.

Table 28: Mode

Mode	Details
Alarm Status	Highlights devices based upon alarm count (Critical, Major, Minor).
Average MCS	Displays the Uplink or Downlink average MCS per device.
Device Status	Displays whether a device is Up (Green) or Down (Red).
Frequency	Displays the device sector frequency.
Link Quality Indicator (PMP)	Displays the Uplink or Downlink status.

Table 28: Mode

Mode	Details
Packet Loss	Displays the Uplink or Downlink packet loss per device.
Reregistration Count	Displays the nodes based upon the number of re-registrations in the last 24 hours. The more re-registrations, the larger the node is display.
Retransmission Percentage (ePMP and cnVision)	Displays the Uplink or Downlink percentage status.

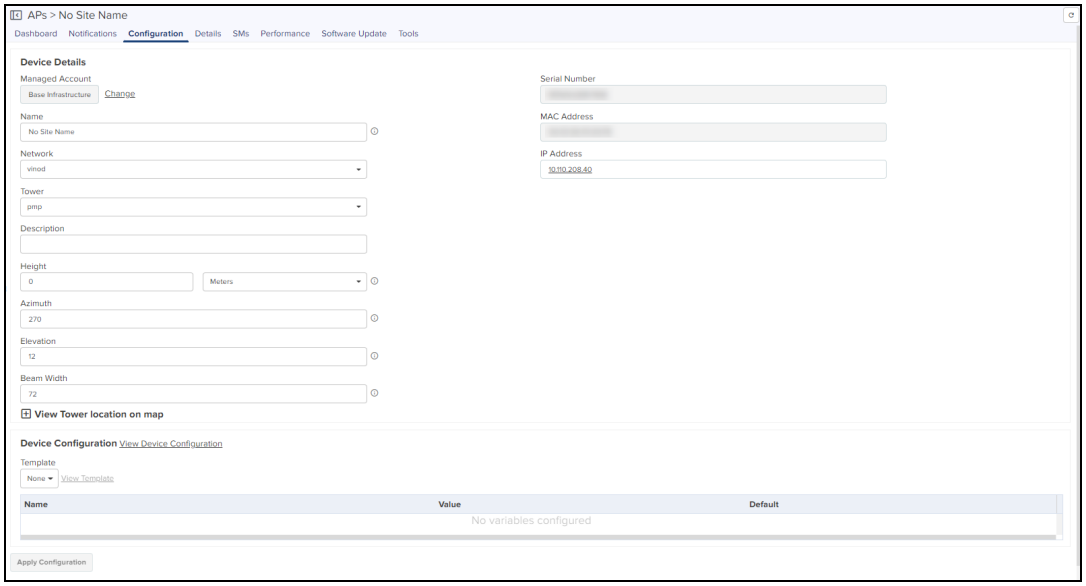
Embedded Maps

Maps are embedded into some additional UI views (most notably, the Dashboard). These embedded maps do not provide the full feature set of the map view.

Sector Visualization

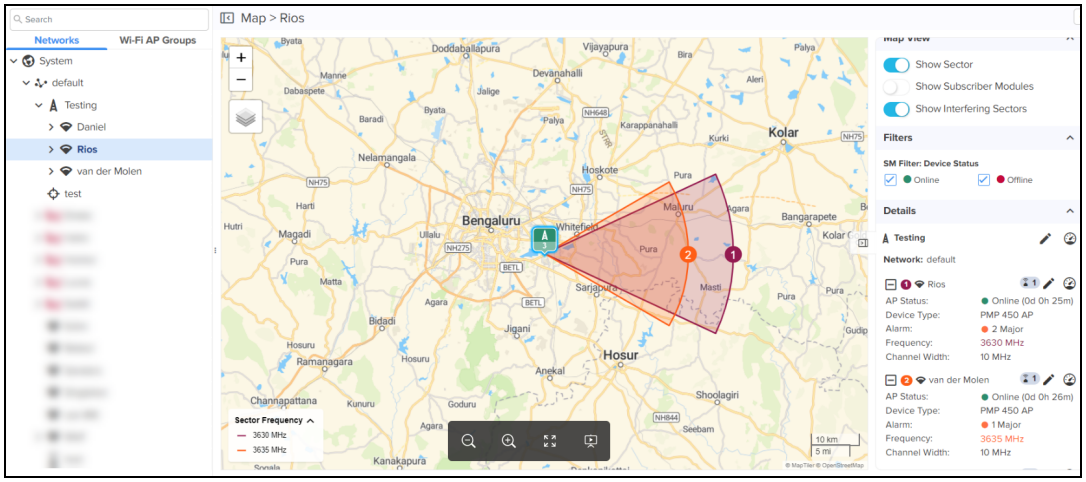
cnMaestro presents a basic sector View for ePMP and PMP fixed wireless devices. This requires configuration of Height, Azimuth, Elevation, and Beamwidth under cnRanger ePMP/PMP AP configuration. This configured data is used to generate the Sector View. The presentation is not based upon link planning or geographic topology.

Figure 100 AP Configuration



Sector Visualization is available in **Map View**. By selecting the **Show Sector** option, the following map is displayed:

Figure 101 Sector Visualization

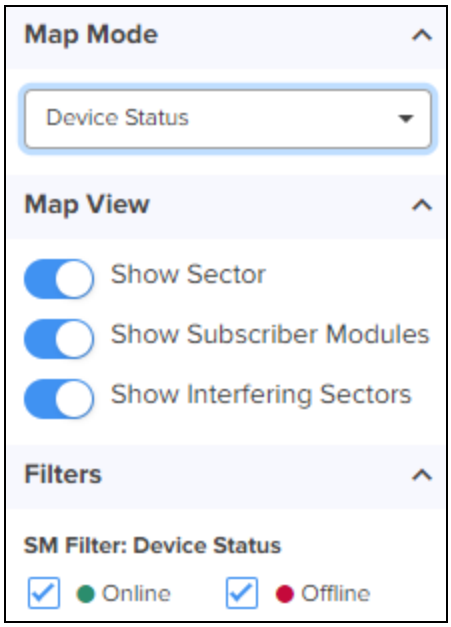


Show Subscriber Modules option is available at System, Network, Tower, and AP levels. User can also choose to set the color of SMs based upon frequency or Online or Offline Status.

	NOTE: • By default **Show Subscriber Modules** is disabled. • Map view is supported for PMP, ePMP, cnRanger, cnPilot Home, PTP, 60 GHz cnWave, cnVision, cnMatrix, Enterprise Wi-Fi Series, and RV22 Home Mesh at site- and device-levels.

The **Show Interfering sector** option compares the frequency and bandwidth with all other devices in the network. The map displays the devices that have overlapping frequencies.

	NOTE: **Show Interfering Sectors** is applicable only for PMP devices and is enabled only if the **Show Sector** button is **ON**.



Maps are available for the Site and Device levels. The right pane displays the device details in the map. To view the map device details, do one of the following:

- Click the (+) plus sign, next to Site or Device in the right pane of the Map page, to view the device and site details as shown in Figure 102.
- Click the Dashboard( ) icon next to the Site or Device name, to view the site or device dashboard details.

Figure 102 Map: Enterprise Site level

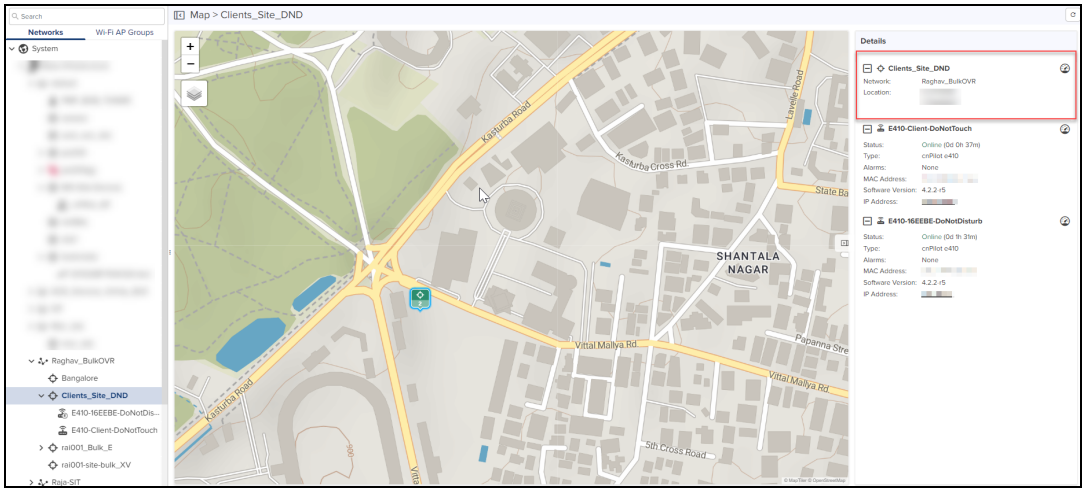


Figure 103 Map: Home Site level

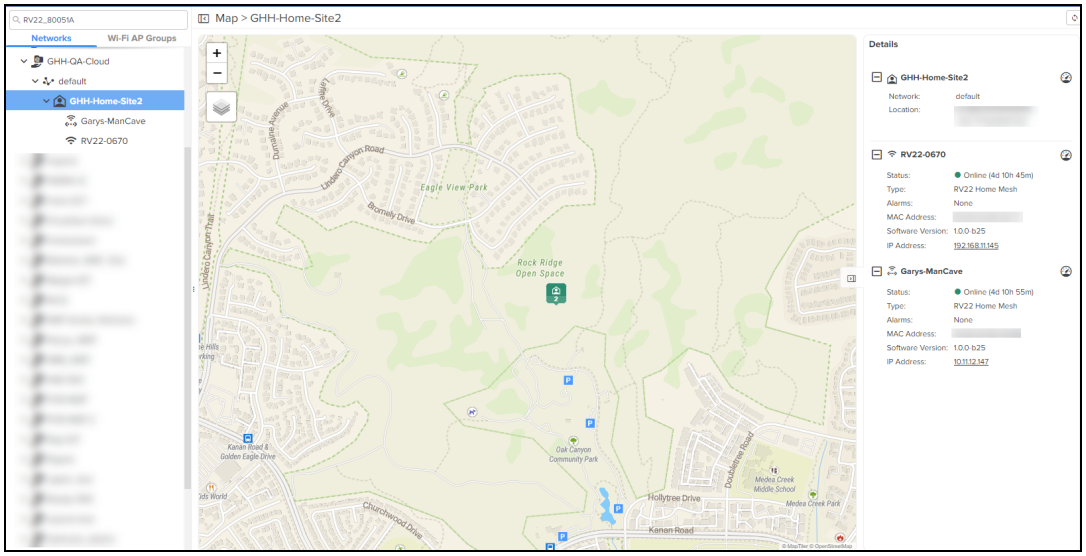


Figure 104 Map: Device level

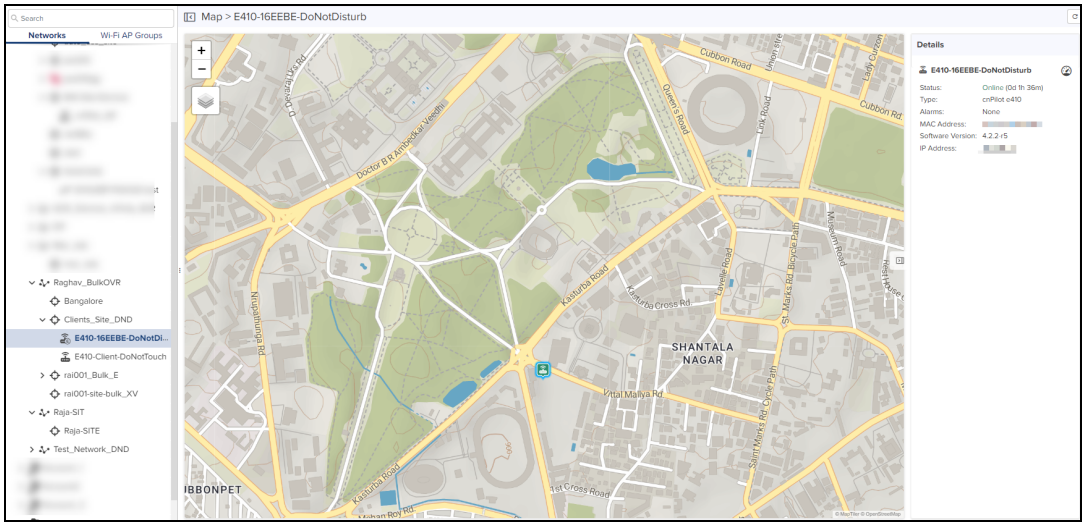


Figure 105 Map view: cnMatrix

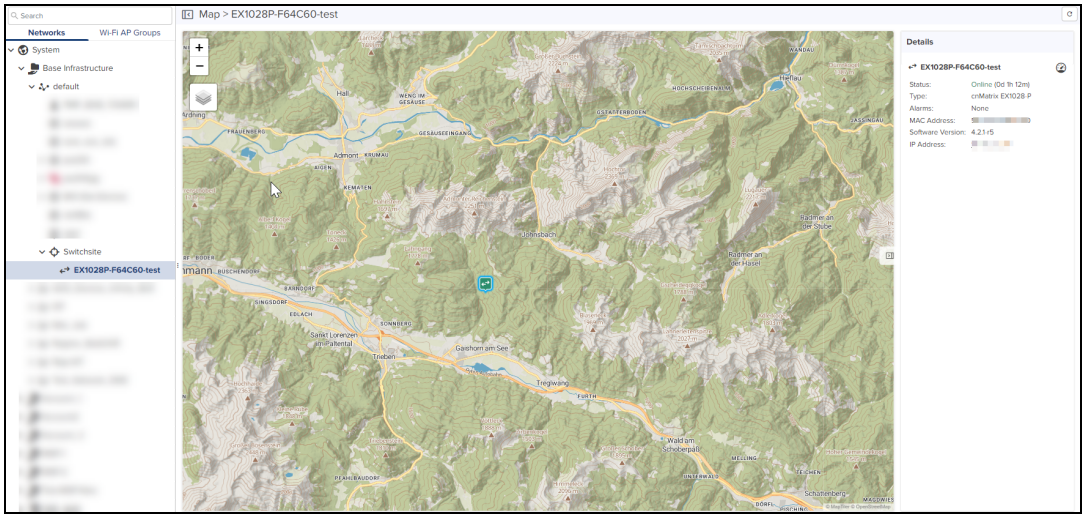


Figure 106 Map view: Enterprise Wi-Fi (Xirrus-Series)

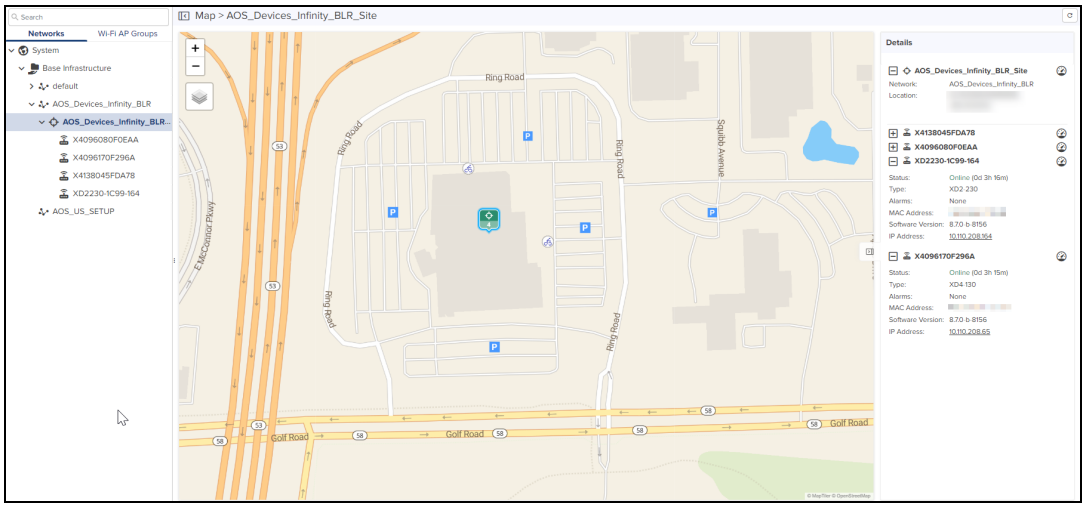
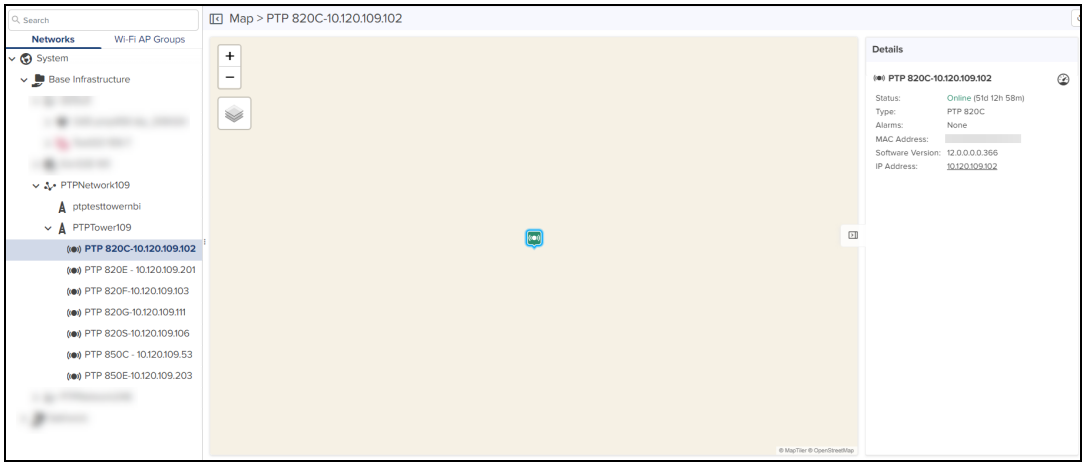


Figure 107 Map View: PTP 820/850



Tools

This section provides the following details:

- 60 GHz cnWave Tools
- cnMatrix Tools
- cnPilot Home Tools
- cnRanger Tools
- cnReach Tools
- cnVision Tools
- Edge Controller Tools
- Enterprise Wi-Fi Tools
- ePMP Tools
- Machfu Tools
- PMP Tools
- cnWave 5G Fixed Tools
- RV22 Home Mesh Tools

60 GHz cnWave Tools

In E2E Network **Tools** tab you can view Operations, Diagnostics, Debug, Remote Command, Services, and Settings. Refer to E2E Network Tools.

In Nodes **Tools** tab you can view the Status, Debug, and Remote Command of the device. Refer to Node Tools.

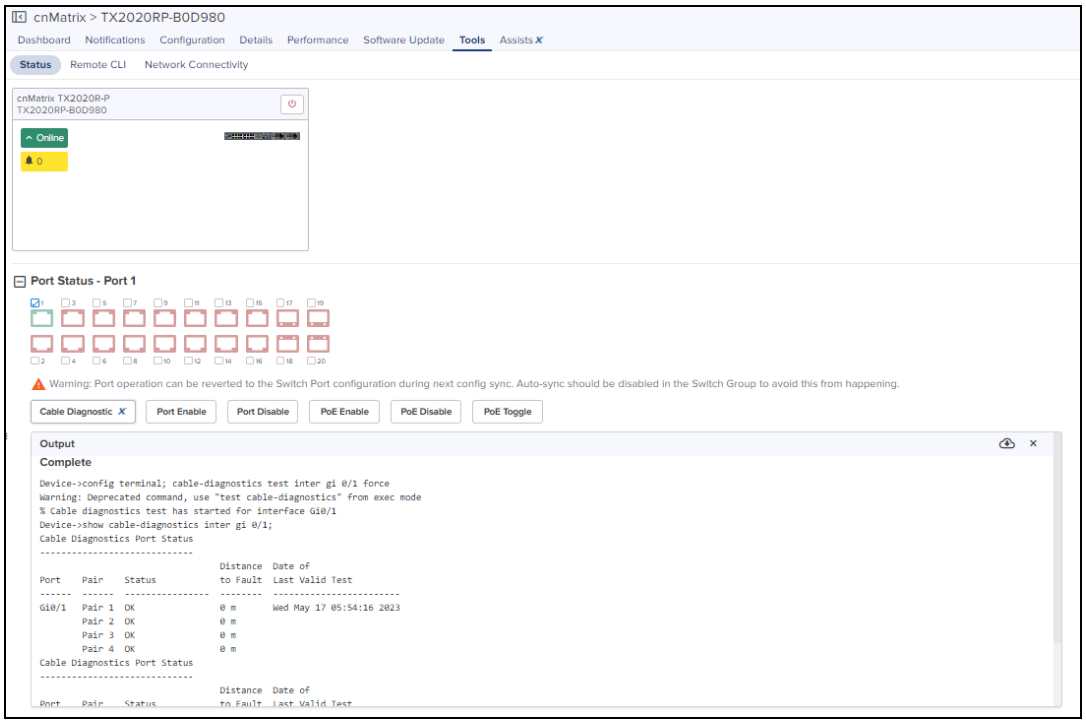
cnMatrix Tools

In **Status** tab you can view the status of the device (either Online or Offline). It allows one to reboot the device.

Table 29: cnMatrix Tools

Field	Description
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Remote CLI	Enter CLI command in the command text box to execute on device. • Only Show command is allowed for Operator users. • All CLI commands are supported by Super Admin and Admin users.
Status	Displays the Status and Port Status.

The **Status** tab displays the status of the device (either Online or Offline). It also allows one to reboot the device.

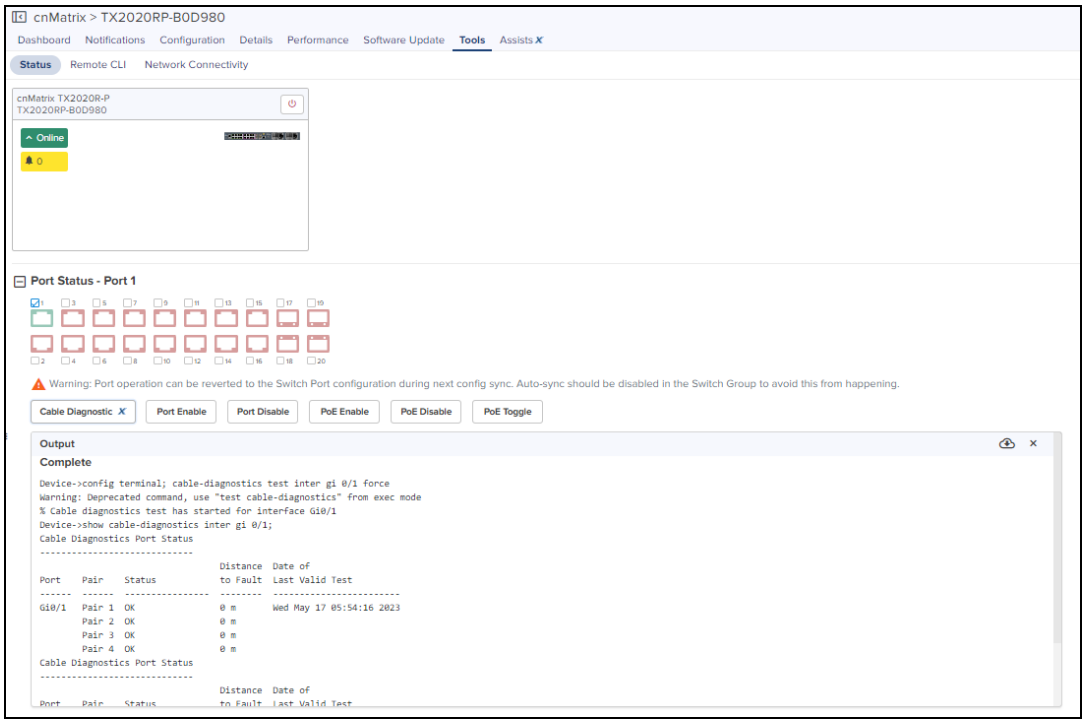


Port Status, presents the following data for the **PoE Switches**:

- Cable Diagnostic
- Port Enable
- Port Disable
- PoE Enable
- PoE Disable
- PoE Toggle

Cable Diagnostic

Navigate to **Tools > Status > Port Status**, select the Port and click **Cable Diagnostic**, the following output is displayed:

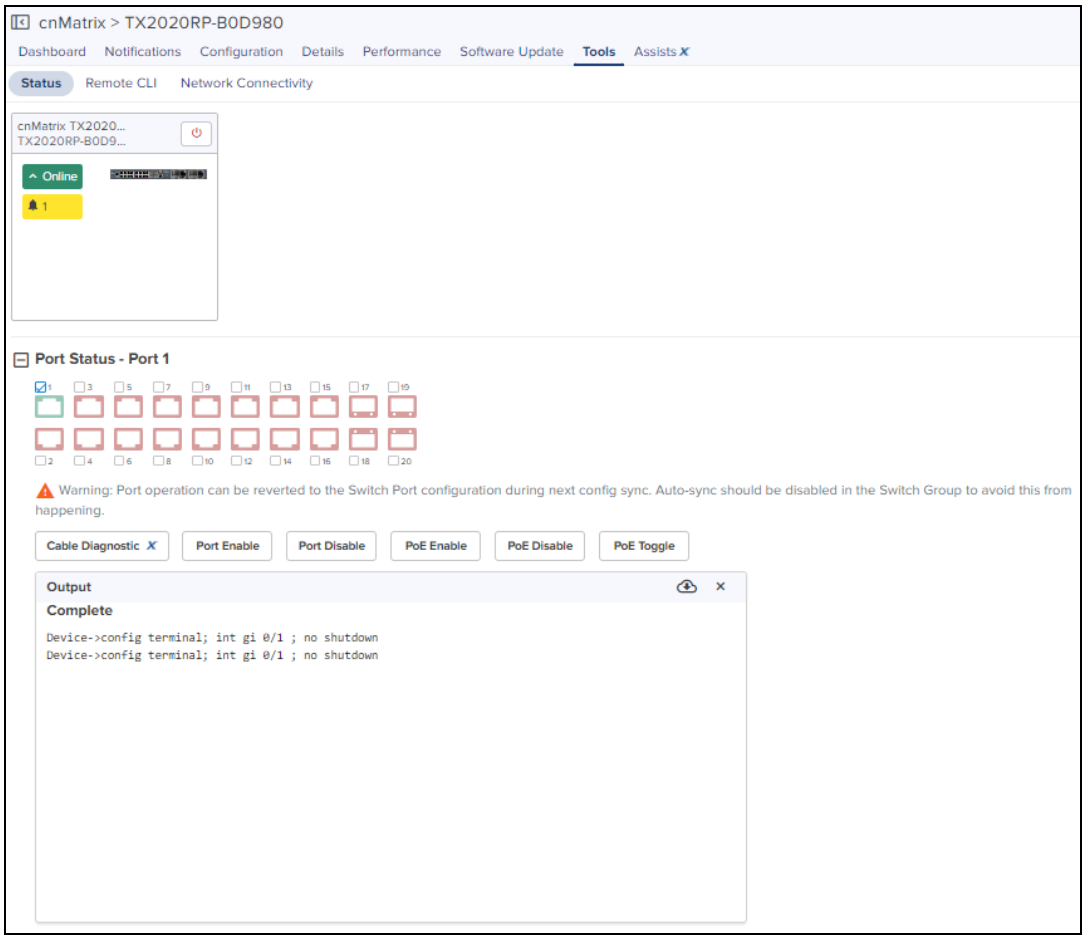


- Download the generated output by clicking the download ( ) icon.
- Clear the generated output by clicking the delete ( ) icon.

Note: Cable Diagnostic is a cnMaestro X feature.

Port Enable or Port Disable

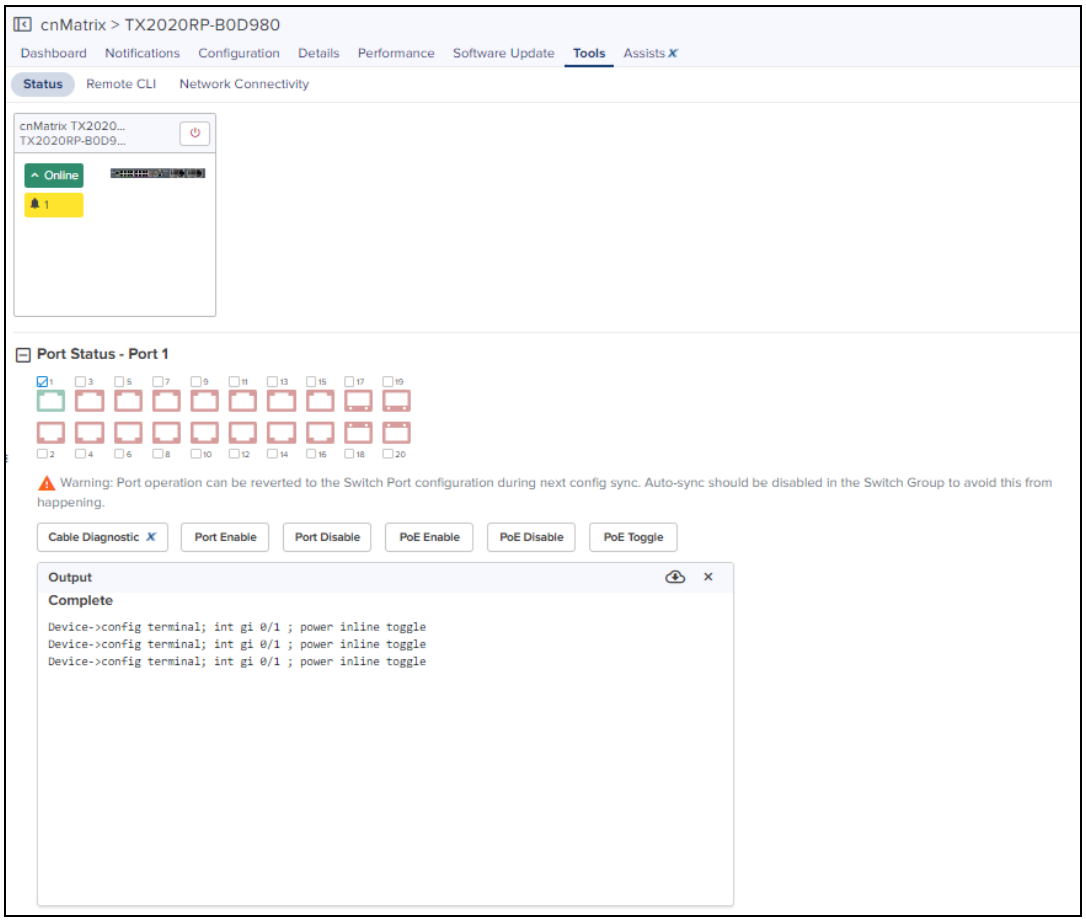
Navigate to **Tools > Status > Port Status**, select the Port and click **Port Disable** or **Port Enable**, the following output is displayed:



- Download the generated output by clicking the download ( ) icon.
- Clear the generated output by clicking the delete ( ) icon.

PoE Toggle

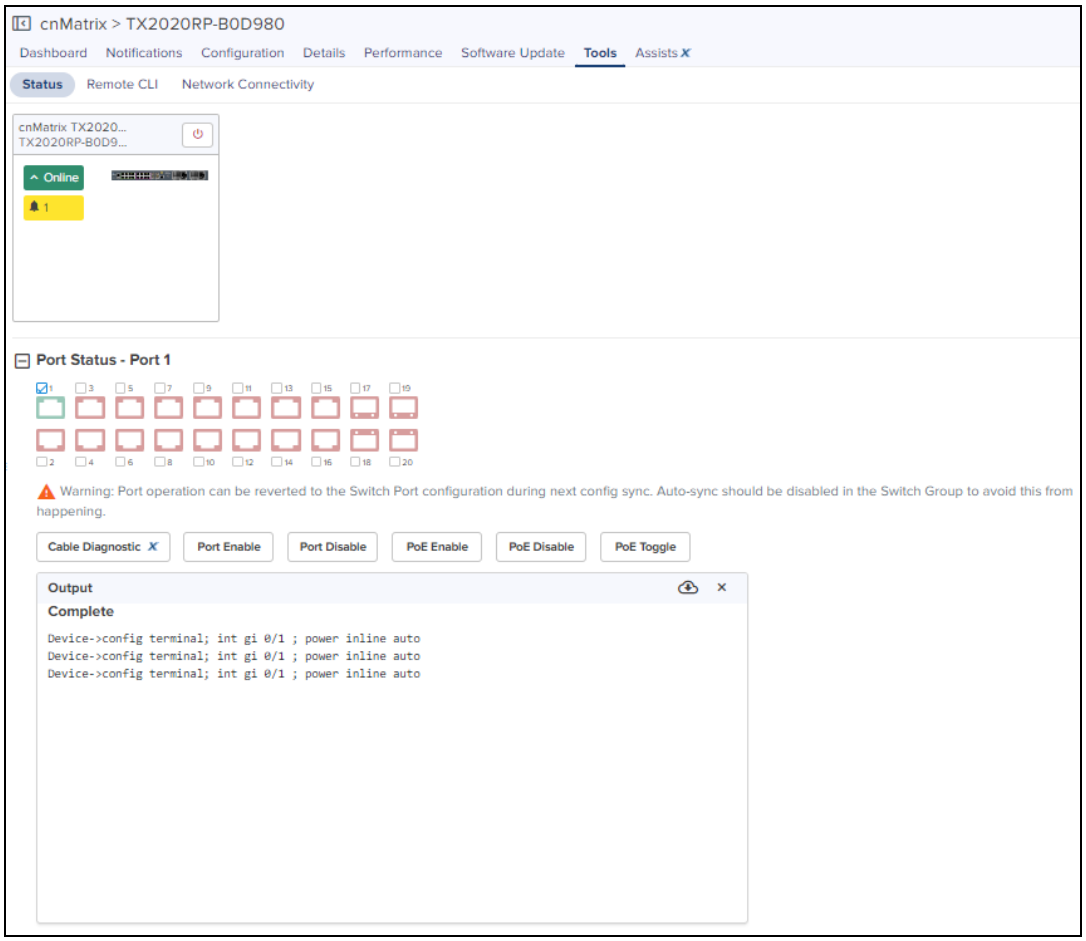
Navigate to **Tools > Status > Port Status**, select the Port and click **PoE Toggle**, the following output is displayed:



- Download the generated output by clicking the download ( ) icon.
- Clear the generated output by clicking the delete (✕) icon.

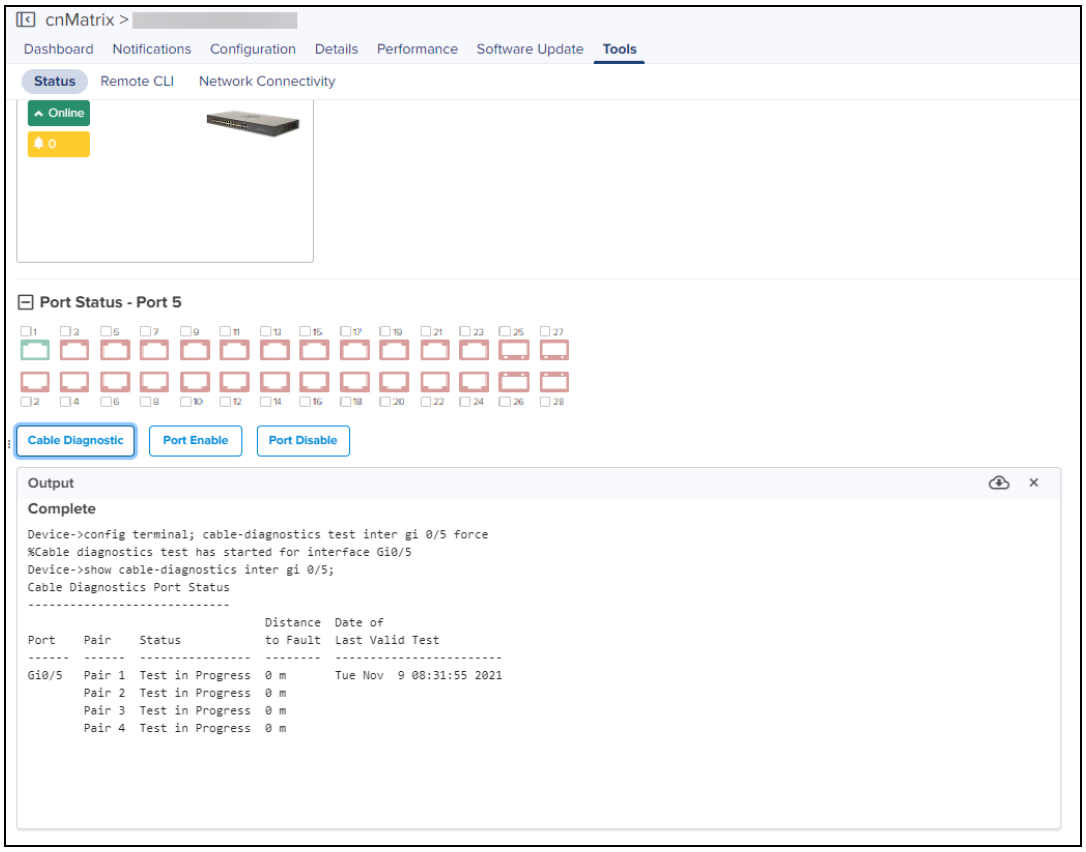
PoE Enable or PoE Disable

Navigate to **Tools > Status > Port Status**, select the Port and click **PoE Enable** or **PoE Disable**, the following output is displayed:



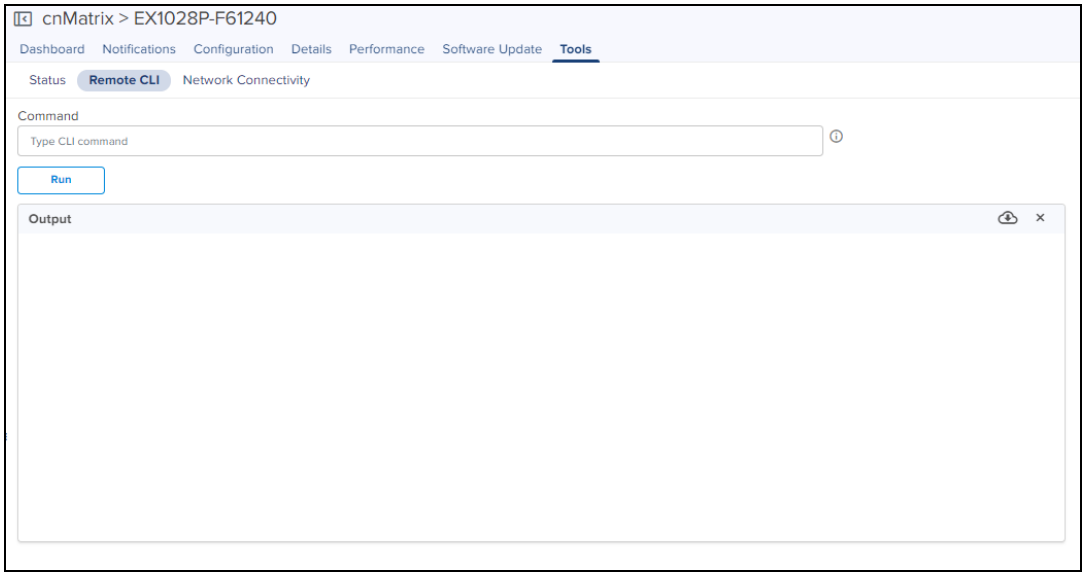
Port Status, presents the following port status for the **non-PoE Switches**:

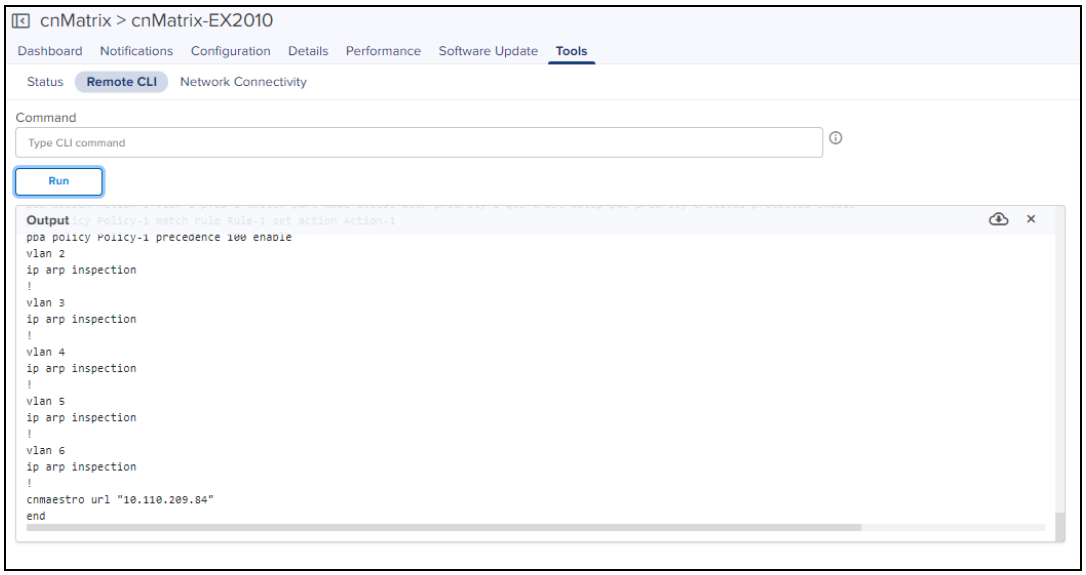
- Cable Diagnostic
- Port Enable
- Port Disable



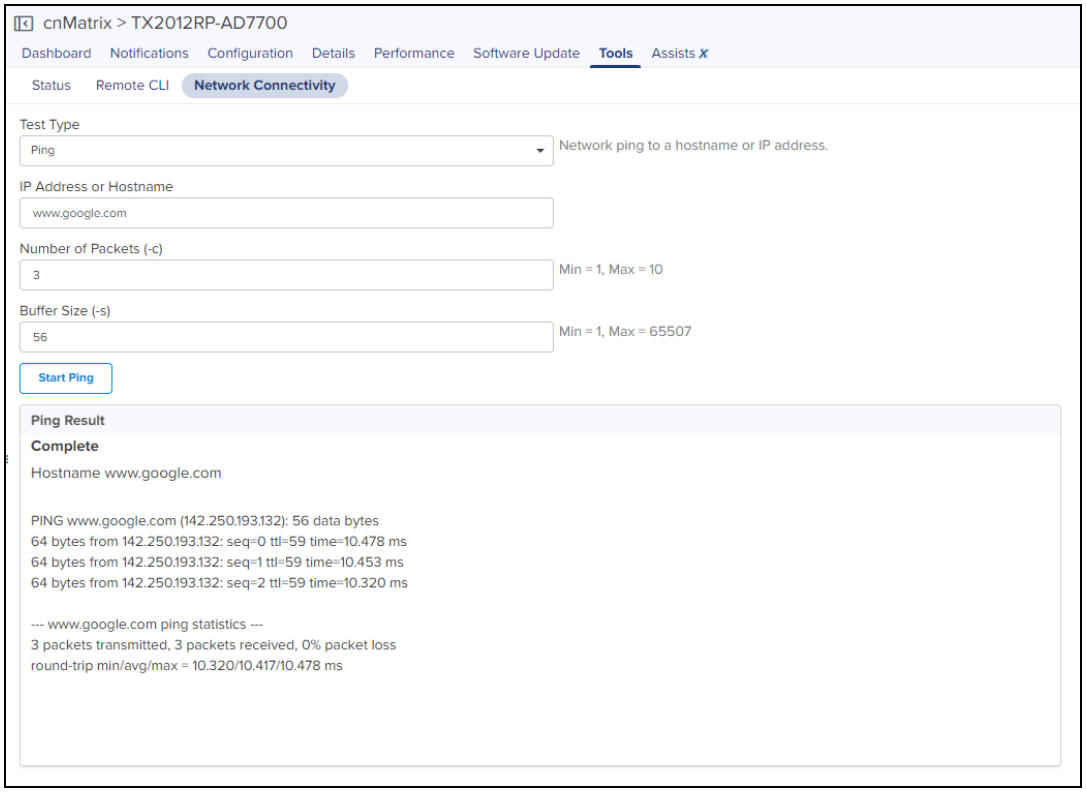
Remote CLI

Navigate to **Tools > Remote CLI**, when you select a command type and click **Run**, the following output is displayed:





- Download the generated output by clicking the download ( ) icon.
- Clear the generated output by clicking the delete ( ) icon.



cnPilot Home Tools

The Tools page for cnPilot Home devices consolidates a number of operations into a single troubleshooting interface. The operations of cnPilot Home are listed in the table below:

Table 30: cnPilot Home

Tools	Description
Debug	Displays the log details.
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Packet Capture	Lists packet capture details.
Status	Displays the Status of device.
Wi-Fi Analyzer	Displays radio traffic and signal.
Wi-Fi Performance	Wi-Fi performance measures the backhaul speed across devices with respect to cnMaestro.

Figure 108 cnPilot Tools

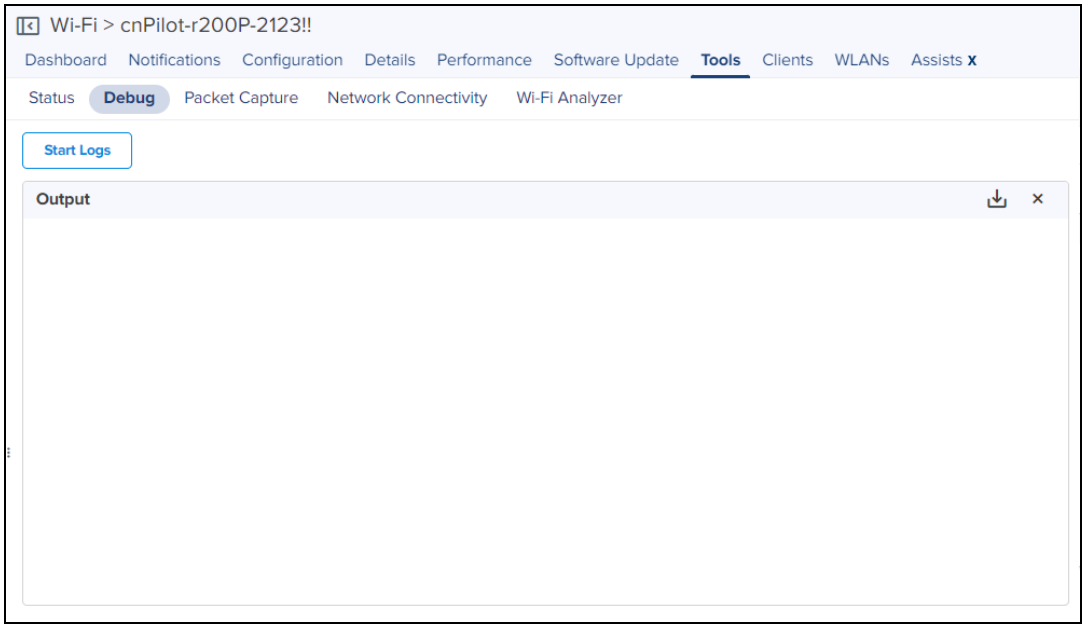


Figure 109 cnPilot Debug Tools

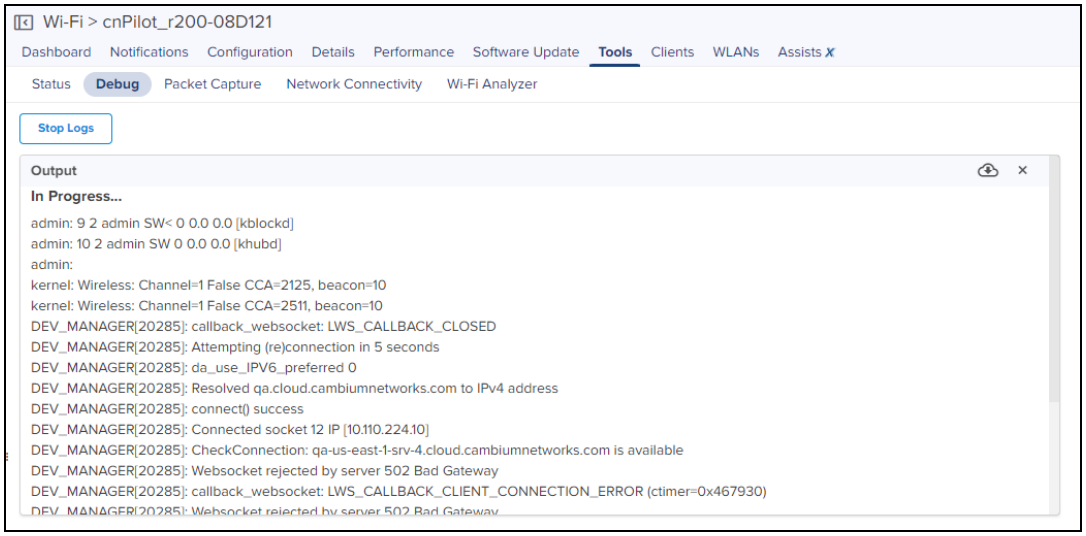


Figure 110 cnPilot Tools Status

Figure 111 cnPilot Tools > Packet Capture

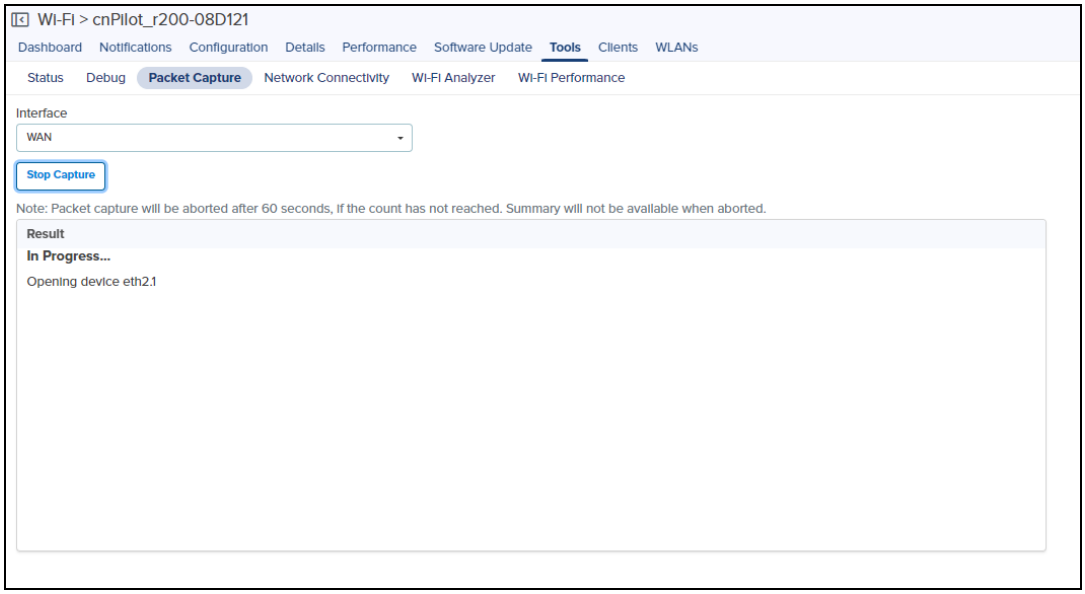


Figure 112 cnPilot Tools > Network Connectivity

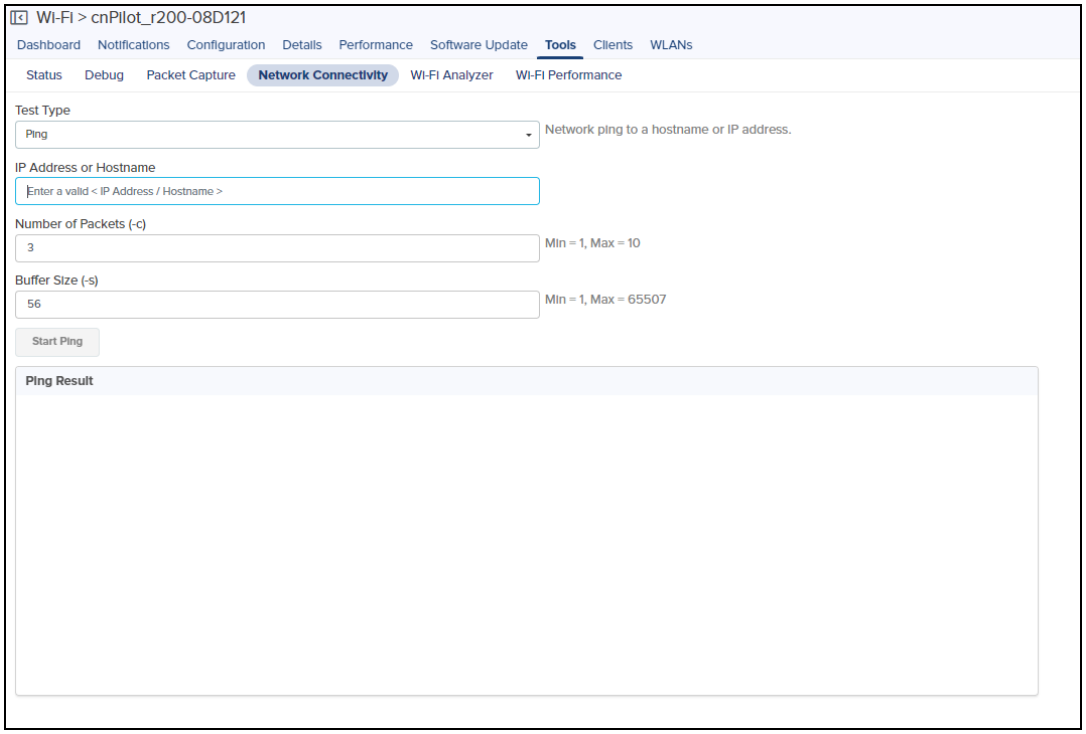
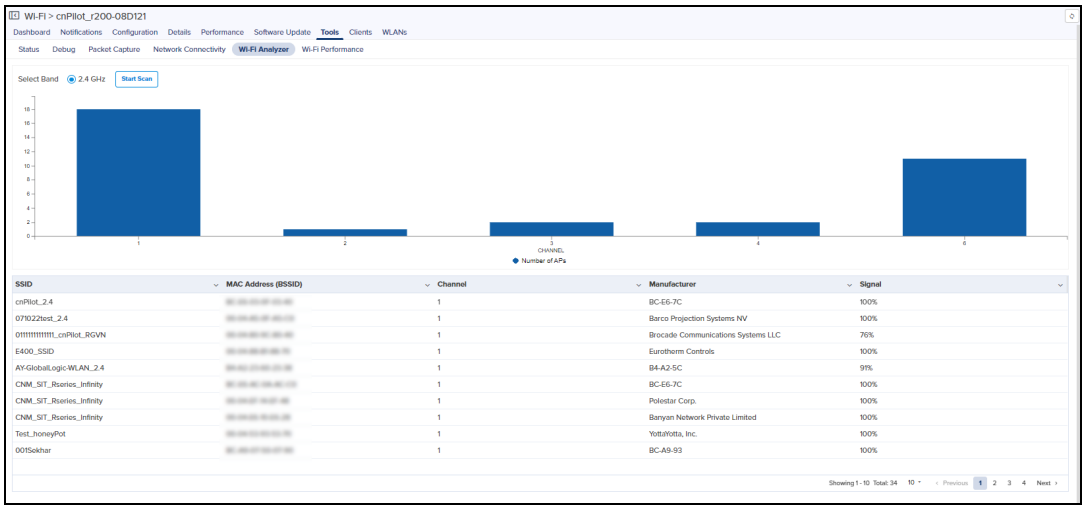


Figure 113 cnPilot Tools > Network Connectivity



cnRanger Tools

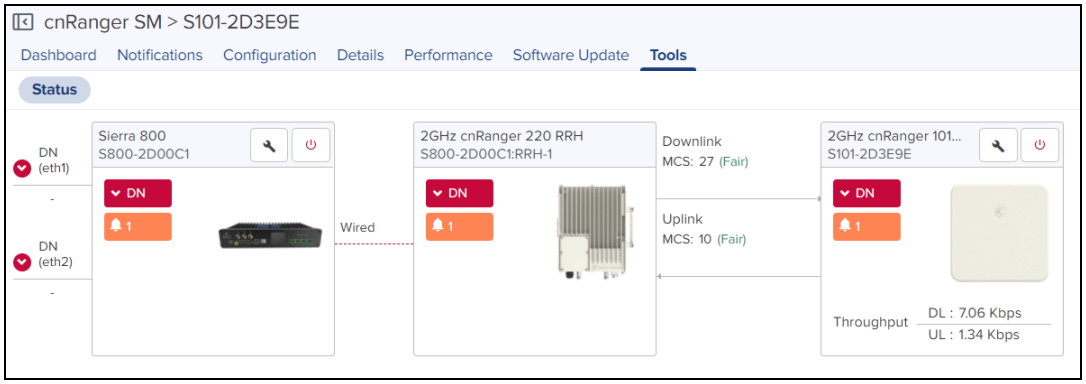
	NOTE: cnMaestro supports the tools page of cnRanger from device version 2.1.0.0-r3.

cnRanger BBU

In **Status** tab, user can view the status of the device either Online or Offline. It also supports downloading Tech Support File and rebooting the device.

cnRanger SM

In **Status** tab, user can view the status of the device (either Online or Offline), It also supports downloading the Tech Support File, displaying the wired connectivity status, and rebooting the device.



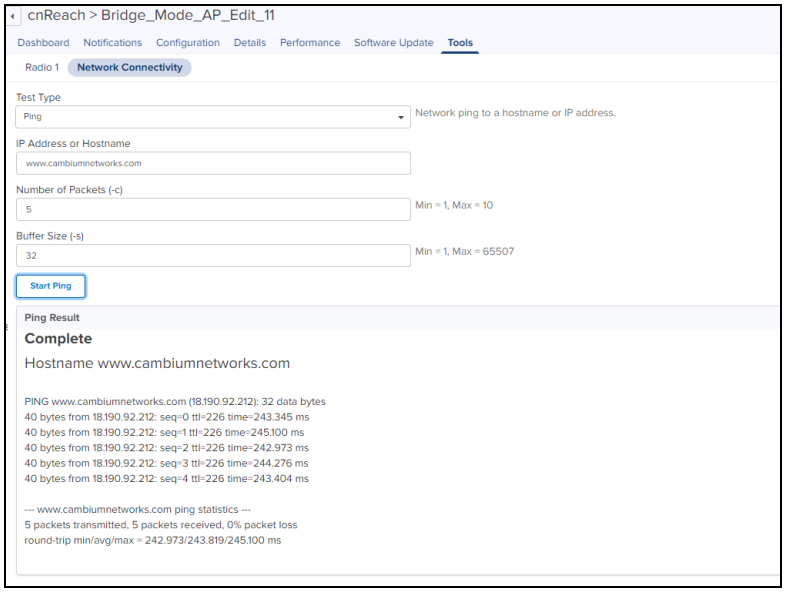
cnReach Tools

The Tools page for cnReach devices consolidates a number of operations into a single troubleshooting interface. The operations are listed below:

Table 31: cnReach Tools

Tools	Description
Ping	Network ping to a hostname or IP address.
RF Ping	RF reachability test between local radios that provides details on signal quality.
RF Throughput	RF throughput test between local radios that provides details on throughput.

Figure 114 cnReach Tools



cnVision Tools

The Tools page for cnVision devices consolidates a number of operations into a single troubleshooting interface. The operations are listed below:

Table 32: cnVision Tools

Field	Description
Debug	Displays the log details.
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Status	Displays the Status.

Table 32: cnVision Tools

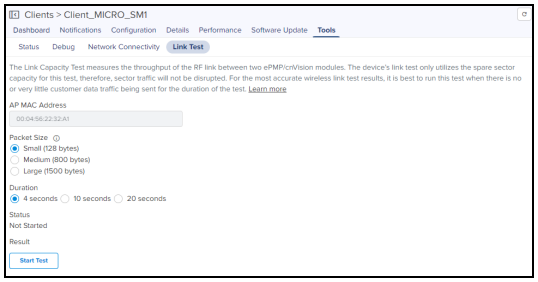
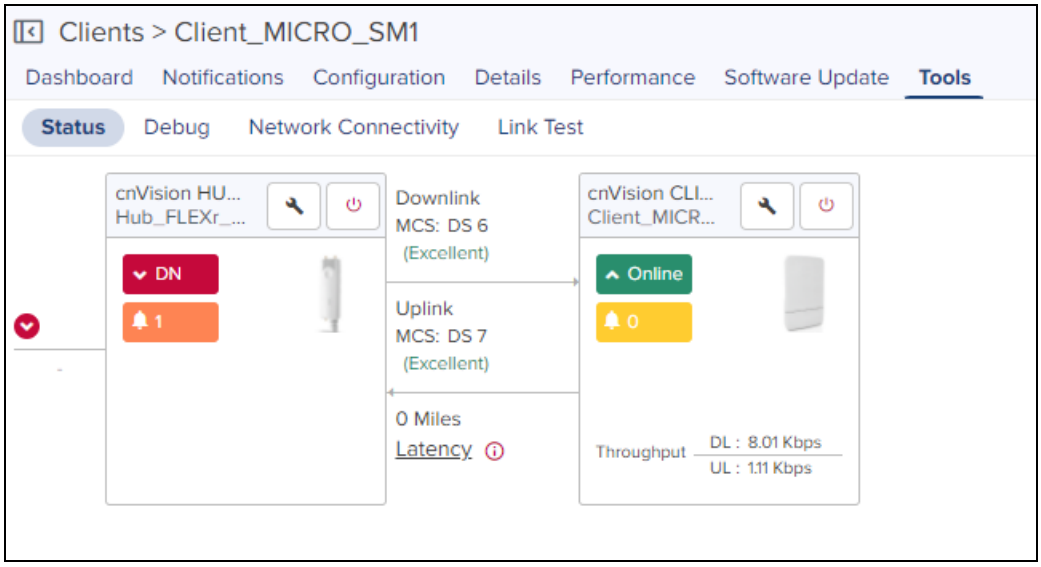
Field	Description
Subscriber Modules	Displays the SM linked to the Hub and supports reboot and download the Tech Support File.
Link Test	The Link Capacity Test measures the throughput of the RF link between two cnVision modules. cnVision Link Test only utilizes the spare sector capacity for this test; therefore, sector traffic will not be disrupted. For the most accurate wireless link test results, it is best to run this test when there is minimal customer data traffic. Displays the link related test result for Throughput. Link Test can be performed on the cnVision Hub and its SM link. To run this operation, select the device and then the **Tools** tab. • If cnVision Hub is selected you can choose the SM from the list and start the test.  Displays the following fields: **Packet Size**: Choose the Packet Size to use for the throughput test. **Duration**: Choose the time duration in seconds to use for the throughput test. • If a cnVision Client is selected, click **Start Test** to run the Link Test.  Displays the following fields: **Packet Size**: Choose the packet size to use for the throughput test. **Duration**: Choose the time duration in seconds to use for the throughput test.

Figure 115 cnVision Tools



Edge Controller Tools

For details on Tools section, refer to Edge Controller User Guide.

Enterprise Wi-Fi Tools

The Tools page for Enterprise Wi-Fi devices consolidates a number of operations into a single troubleshooting interface.

	NOTE: Both IPv4 and IPv6 addresses are supported for all the troubleshooting operations.

The operations of Enterprise Wi-Fi are listed below:

Table 33: Enterprise Wi-Fi Tools

Tools	Description
Debug	Displays the log details.
Flash LEDs (only Enterprise Wi-Fi devices)	Flash LED indicates that a device is ready to receive the signal.
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Packet Capture	Lists packet capture details.
Remote CLI	Enter CLI command in the command text box to execute on device. • Only Show command is allowed for Operator users. • All CLI commands are supported by Super Admin and Admin users.

Table 33: Enterprise Wi-Fi Tools

Tools	Description
Status	Displays the Status of device.
Wi-Fi Analyzer	Displays radio traffic and signal.
Wi-Fi Performance	Wi-Fi performance measures the backhaul speed across devices with respect to cnMaestro.

Figure 116 Enterprise Wi-Fi Tools

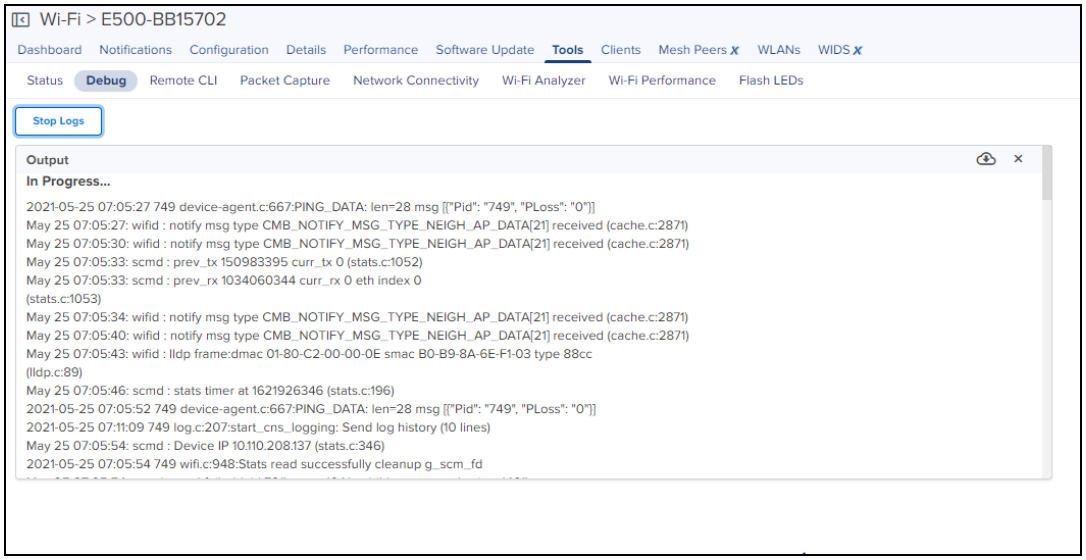


Figure 117 Enterprise Wi-Fi Packet Capture

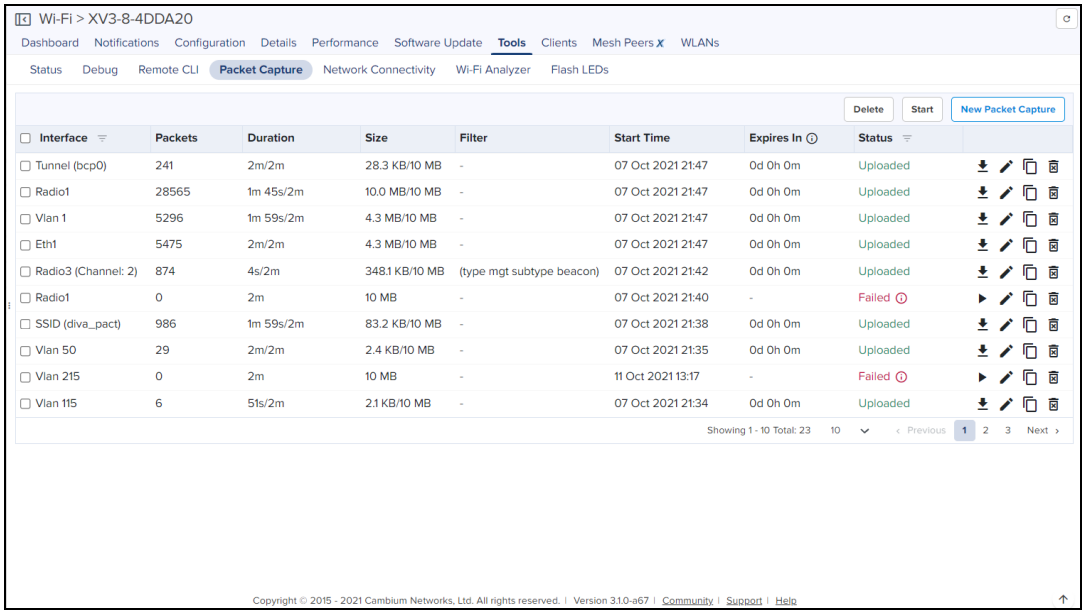


Figure 118 Enterprise Wi-Fi Remote CLI Tools

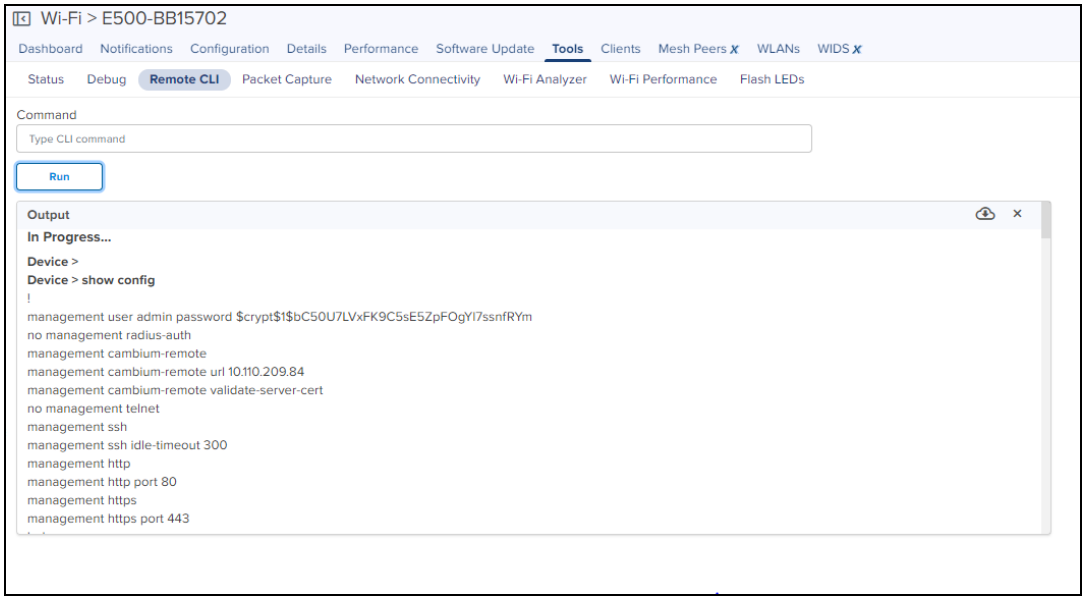
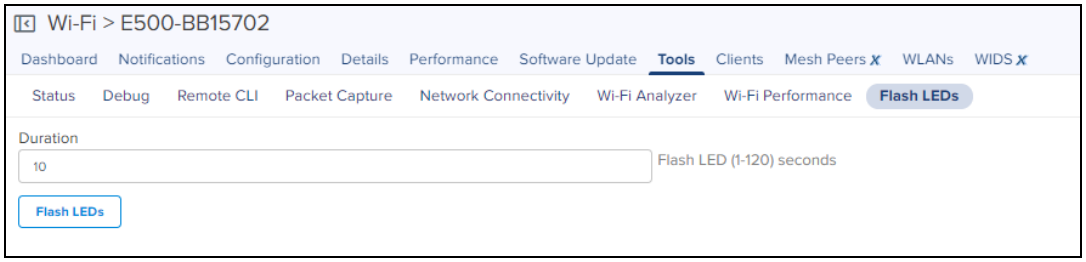


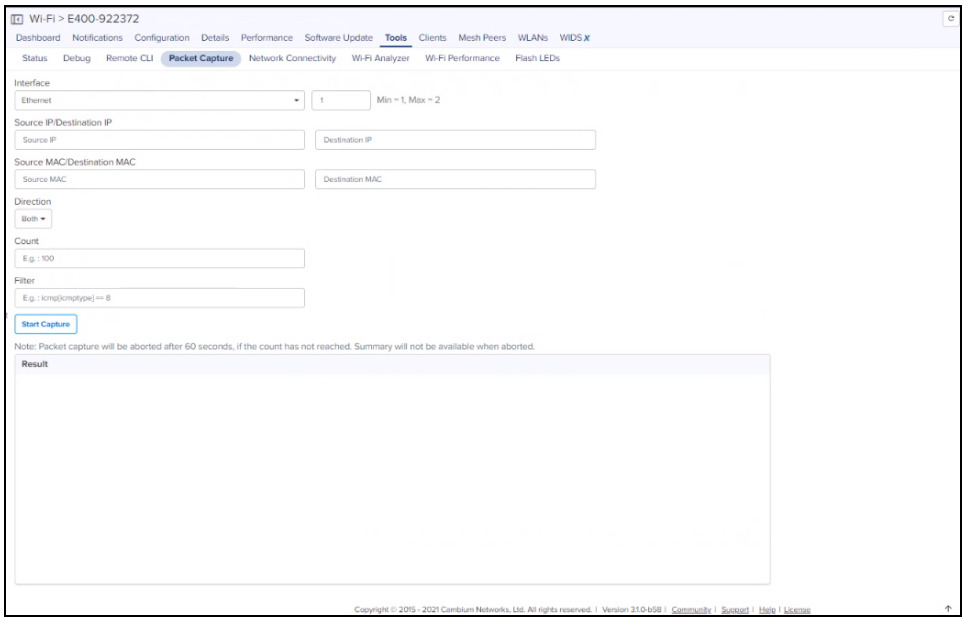
Figure 119 Flash LEDs



Packet Capture

Packet Capture allows the user to capture all packets on a specified interface. The user can trigger packet capture on an interface (or multiple interfaces simultaneously).

	NOTE: Enhanced packet capture is available for version 6.4 or higher in Enterprise devices.



To view Packet Capture, navigate to **Network** or **Site** > **Wi-Fi AP** > **Tools** > **Packet Capture**.

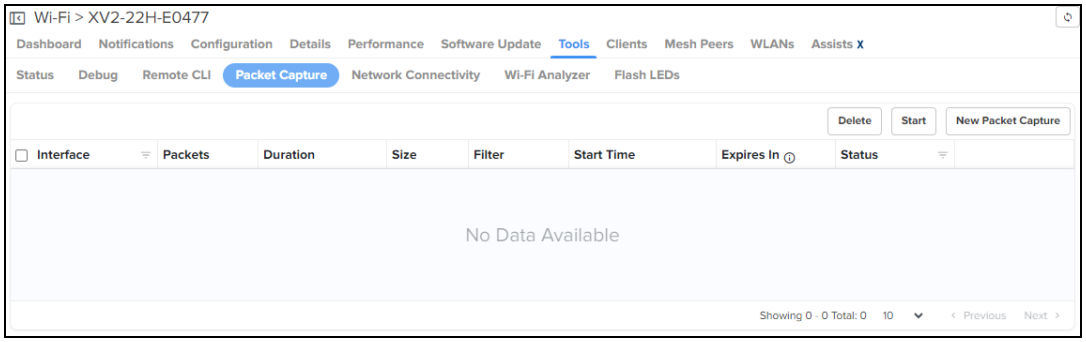


Table 34: Packet Capture fields

Field	Description
Duration	Represents packet capture running duration in seconds versus maximum duration configured.
Expires In	Expiry time of packet capture. The default is 24 hours.
Filter	Type of filter.
Interface	The following interfaces are supported: • BRIDGE • Ethernet • PPPoE • Radio • SSID • TUNNEL • VLAN • Wireless LAN
Packets	Represents number of packets captured versus maximum limit of packet count configured.

Table 34: Packet Capture fields

Field	Description
Size	Current packet capture size versus maximum packet capture size configured.
Start Time	Start time of the capture.
Status	Status of packet captured is as follows: • Aborted • Failed • Queued • Skipped

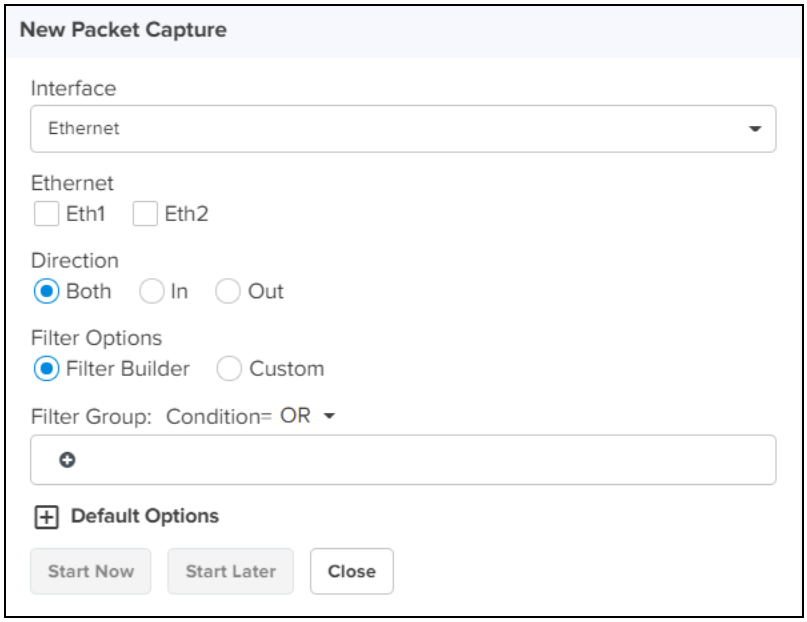
New Packet Capture

Perform the following steps to start a new packet capture:

NOTE:

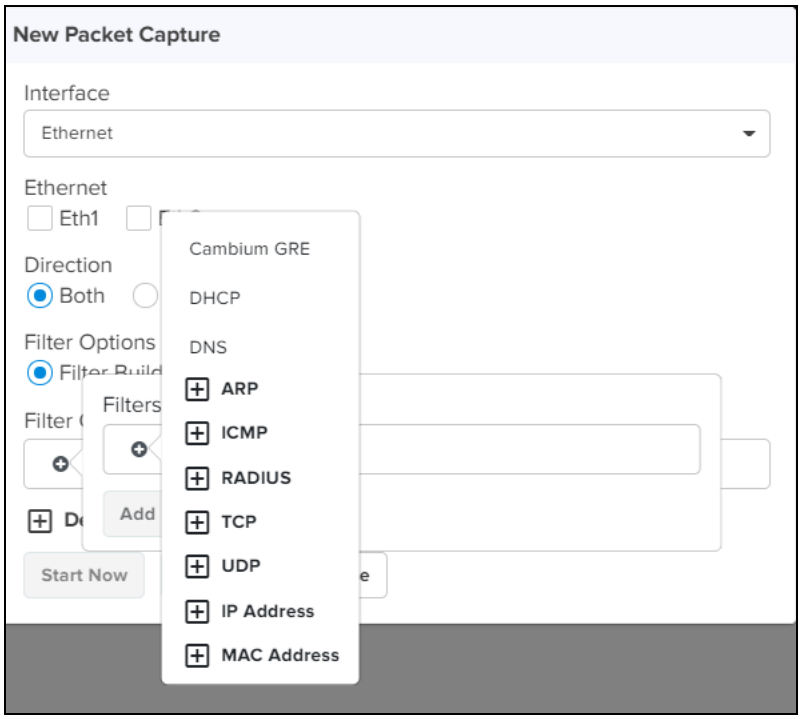
- Filter options vary for different interfaces (Radio, Wireless LAN, VLAN, SSID, TUNNEL, BRIDGE, and PPPoE. Radio, SSID has wireless 802.11 filters, other interfaces has wired 802.3 filters).
- User can also add custom filters if needed.
- Packet Capture on **Radio** interface is available only for online Enterprise Wi-Fi XV-Series and XE-Series.

1. Click **New Packet Capture** to start packet capture.

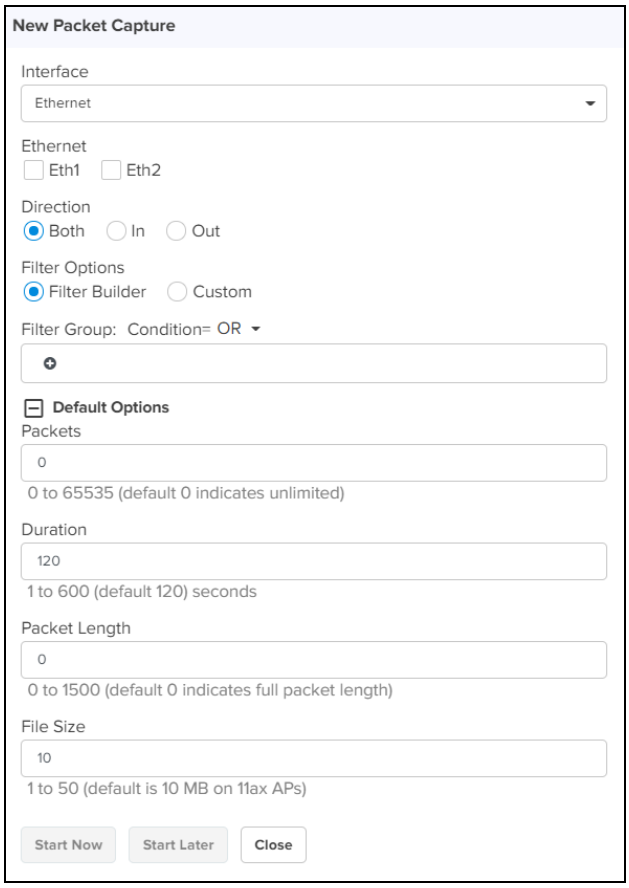


2. Select the **Interface** type from the drop-down.
3. Select **Ethernet** as **Eth1** or **Eth2**.
4. Choose the **Direction** as **Both**, **In**, or **Out**.
5. Select **Filter options** as **Filter Builder** or **Custom**.

You can filter the packets captured by specifying Cambium GRE, DHCP, DNS, ARP, ICMP, Radius, TCP, UDP, IP Address, and MAC Address.



6. Click **Default Options** to configure **Packets**, **Duration**, **Packet Length**, and **File Size**.

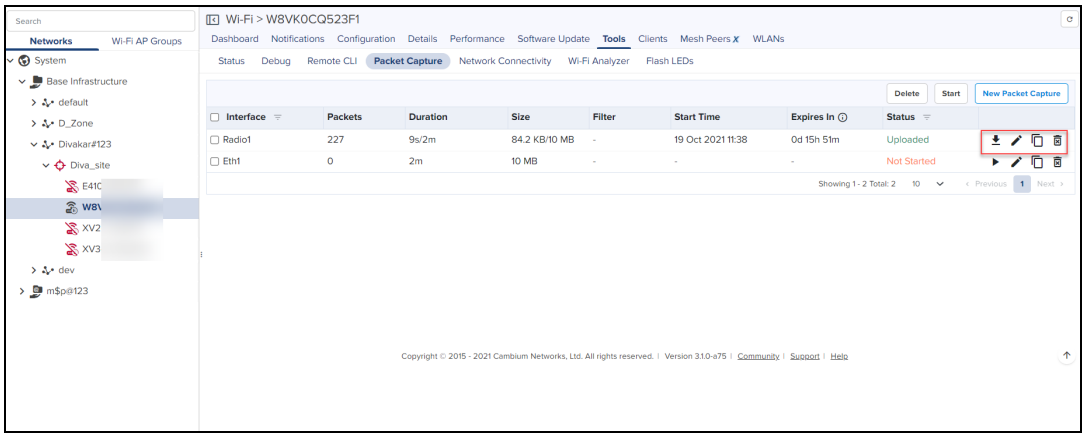


7. Click **Start Now** to capture the packets immediately, or start the capture later by selecting **Start Later** option. The progress of packets captured can be seen in the **Status** field.

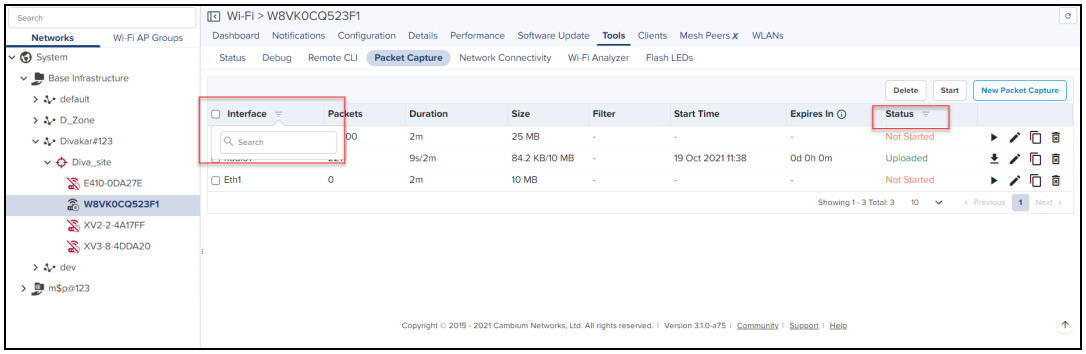
8. Click download icon to download the capture in **PCAP** file format.

	NOTE: For cnMaestro X, a maximum of four packet capture sessions are supported, whereas for cnMaestro Essentials a maximum of two packet capture sessions are supported.

The user can **Edit**, **Clone**, and **Delete** the packets capture entry. Packet Capture entries can be cloned depending on the type of interface selected for the capture.



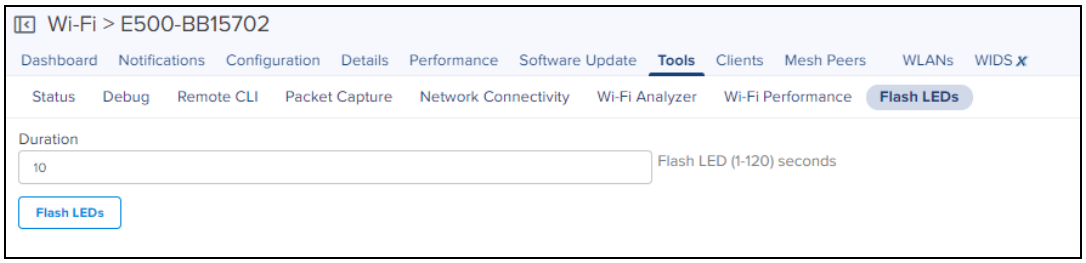
The user can search the packet capture by **Interface** type and **Status.**



NOTE:

- User can start packet capture by clicking the **Play** button. This also works if the packet capture is stopped at **Not Started**/**Failed**/ **Expired**.
- **Bulk Start** and **Bulk Delete** are performed by selecting multiple packet capture.
- Expired packet capture is deleted from cnMaestro after 7 days.
- Packet capture is removed immediately, when device (AP) is deleted from cnMaestro.
- Packet captures cannot be started on same interface simultaneously.
- Only **Show** command works for the Operator user.

Figure 120 Flash LEDs



ePMP Tools

The Tools page for ePMP devices consolidates a number of operations into a single troubleshooting interface. The operations are listed below:

Table 35: ePMP Tools

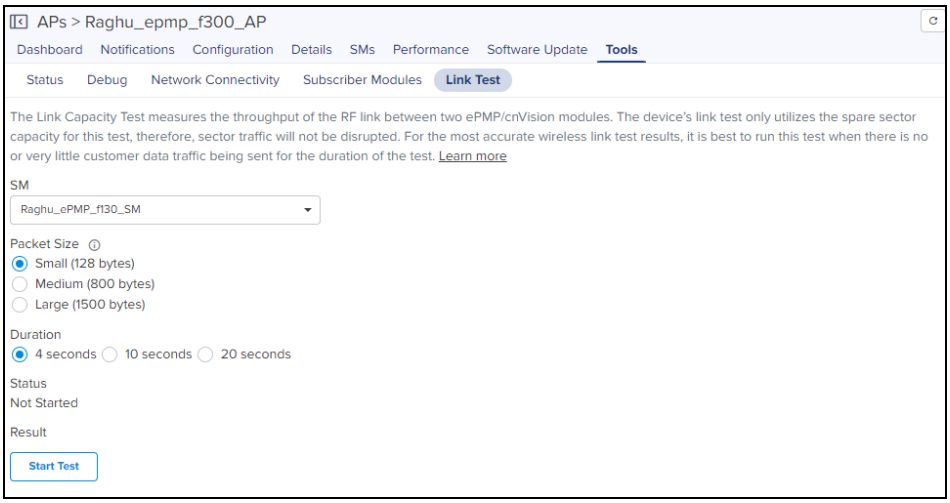
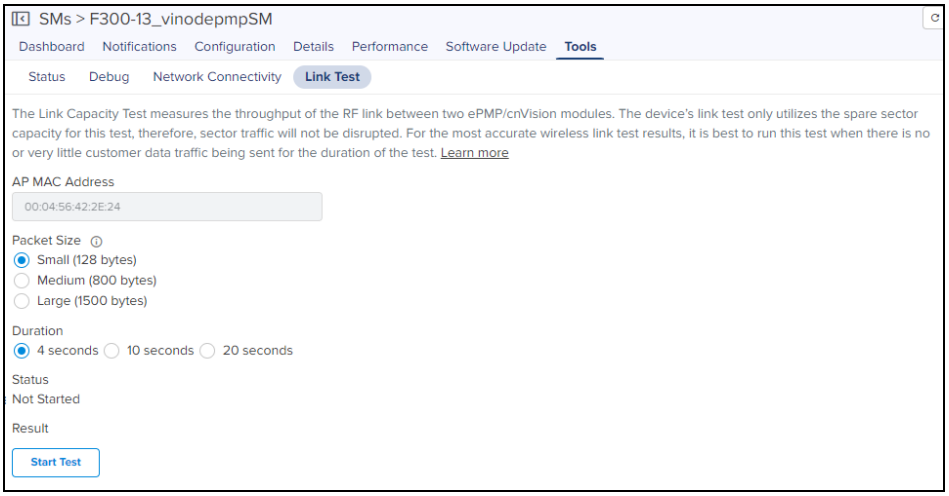
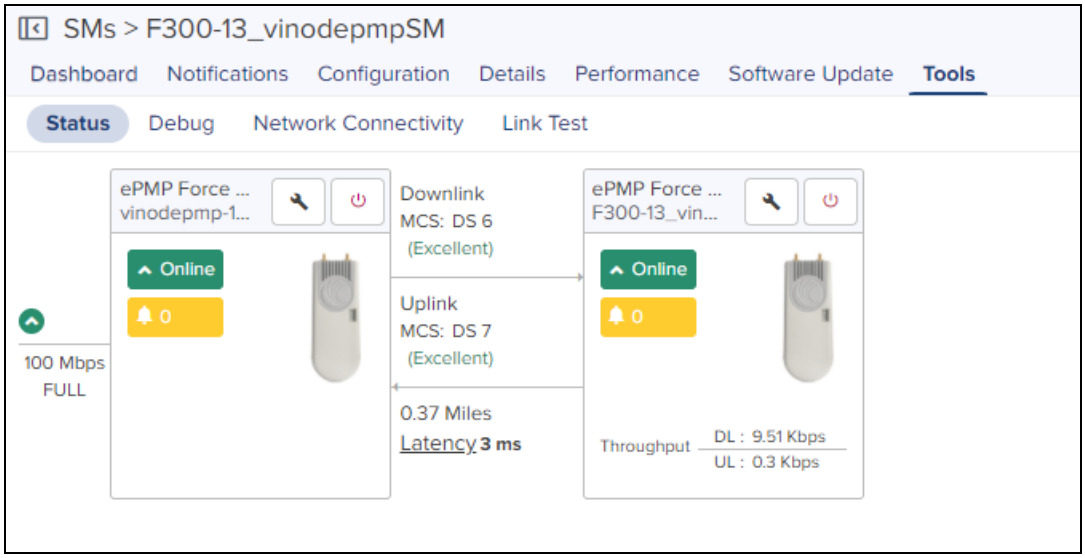
Field	Description
Debug	Displays the log details.
Link Test	The Link Capacity Test measures the throughput of the RF link between two ePMP modules. ePMP Link Test only utilizes the spare sector capacity for this test, therefore, sector traffic will not be disrupted. For the most accurate wireless link test results, it is best to run this test when there is minimal customer data traffic. Displays the link related test result with respect to Throughput. Link Test can be performed on the ePMP AP and its SM link. In order to run this operation, select the device and then the **Tools** tab. • If an ePMP AP is selected, choose the SM from the list and start the test.  Displays the following fields: **Packet Size**: Choose the Packet Size to use for the throughput test. **Duration**: Choose the time duration in seconds to use for the throughput test. • If an ePMP SM is selected, click Start Test to run the link test.  Displays the following fields:

Table 35: ePMP Tools

Field	Description
	Packet Size: Choose the Packet Size to use for the throughput test. **Duration**: Choose the time duration in seconds to use for the throughput test.
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Status	Displays the status.
Subscriber Modules	Displays the Subscriber Modules details.

Figure 121 ePMP Tools



Machfu Tools

The **Status** tab, displays the status of the device and allows downloading Tech Support File and rebooting.

PMP Tools

The Tools page for PMP devices consolidates a number of operations into a single troubleshooting interface. The operations are listed below:

Table 36: PMP Tools

Field	Description
Debug	Displays the log details.
Link Test	The Link Capacity Test measures the throughput and efficiency of the RF link between two PMP modules. Many factors, including packet length, affect throughput. Packets are added to one or more queues in the AP to fill the frame. Throughput and efficiency are then calculated during the test. The Link Capacity Test tool has the following modes: • **Flood Link Test**: Tests the link's performance by flooding it with heavy traffic and assesses link's behavior under extreme network loads. An addition **Multiple LUIDs** option is available in the Current SM drop-down list. The Multiple LUIDs feature allows users to specify LUIDs, including single numbers (for example, 23, 32), or to conduct the flood test with ranges (for example, 2-22) as shown in Figure 122. **Figure 122** Flood Link Test: PMP 450m AP  **NOTE:** **Flood Link Test** is applicable only for 450m APs. • **Link Test without Bridging**: Tests radio-to-radio communication, but does not bridge traffic. • **Link Test with Bridging**: Bridges traffic to “simulated” Ethernet ports, providing a status of the bridged link. • **Link Test with Bridging and MIR:** Bridges the traffic during test and also adheres to any MIR (Maximum Information Rate) settings for the link. • **Extrapolated Link Test**: Estimates the link capacity by sending few packets and measuring link quality.

Table 36: PMP Tools

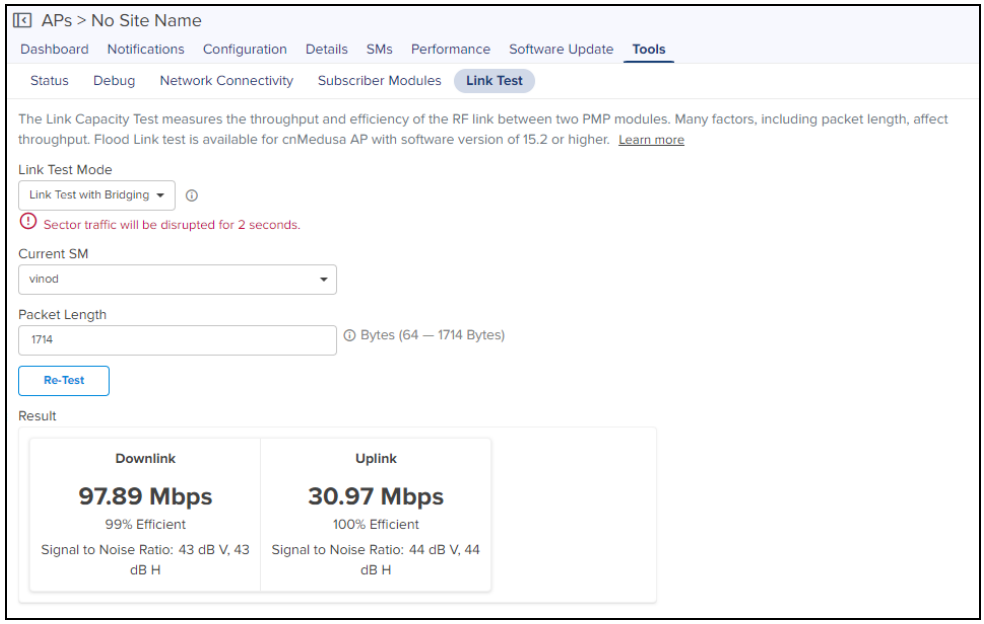
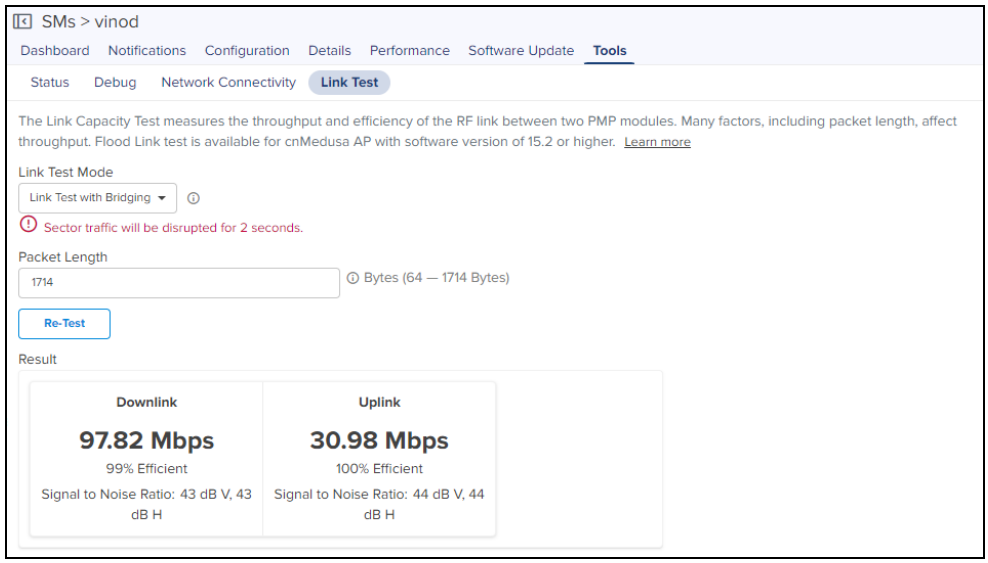
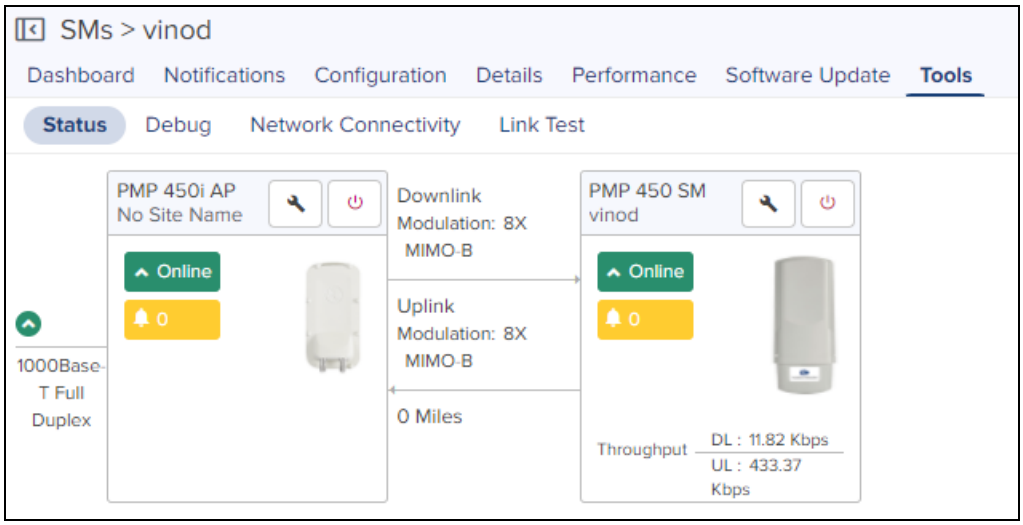
Field	Description
	Displays the link related test result with respect to Throughput and Interference. Link Test can be performed on the PMP AP and its SM link. To run this operation, select the device and then the **Tools** tab. • If a PMP AP is selected you can choose the SM from the list and start the test.  • If a PMP SM is selected, click **Start Test** to run the Link Test. 
Network Connectivity	Executes Ping, DNS, or Traceroute tests.
Status	Displays the status.
Subscriber Modules	Lists all the SMs connected to the selected AP. This is available for PMP APs only.

Figure 123 PMP Tools



cnWave 5G Fixed Tools

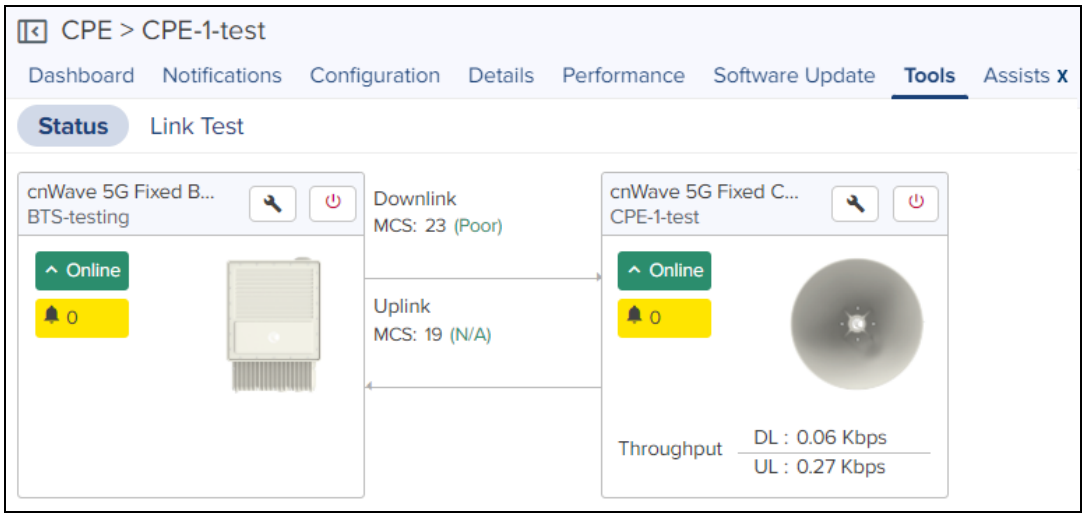
For cnWave 5G Fixed products (BTS and CPE), the **Tools** page in cnMaestro contains the following tabs:

- **Status**: Displays device connection state (online or offline) for the BTS and a CPE.
- **Link Test** (applicable only to the BTS device): Allows you to test the links (uplink, downlink, or both), and analyze the link performance for a CPE. The test output helps in managing the traffic and troubleshooting the links for the selected CPE.

Status

To access the cnWave 5G Fixed BTS Tools page, go to **Monitor and Manage > BTS > Tools.**

To view the status of the link between the BTS and CPE modules, access the **Status** page under **Monitor and Manage > BTS CPE > Tools > Status.**



Link Test

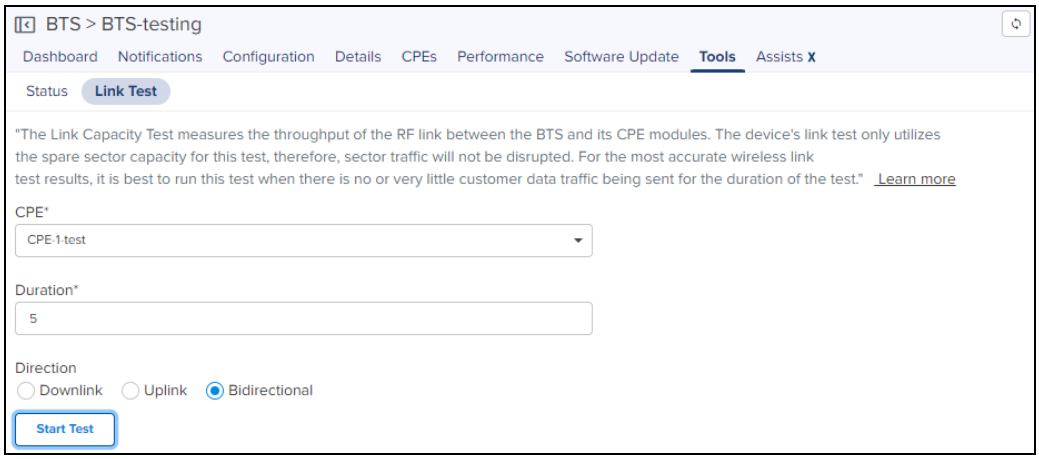
NOTE:

Link Test is supported only on cnWave 5G Fixed devices running System Release version 3.1 or later.

Link test measures the throughput and utilization of RF link between the BTS and its CPE modules

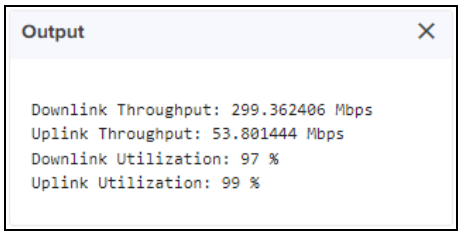
To conduct a link test between a BTS and its CPE modules:

1. Go to **Monitor and Manage > BTS > Tools > Link Test**.



2. Select appropriate values in **CPE**, **Duration** (between 5 and 60 seconds), and **Direction** (Downlink, Uplink, and Bidirectional) fields.
3. Click **Start Test**.

   After the set duration completes, the **Output** window displays the results.



RV22 Home Mesh Tools

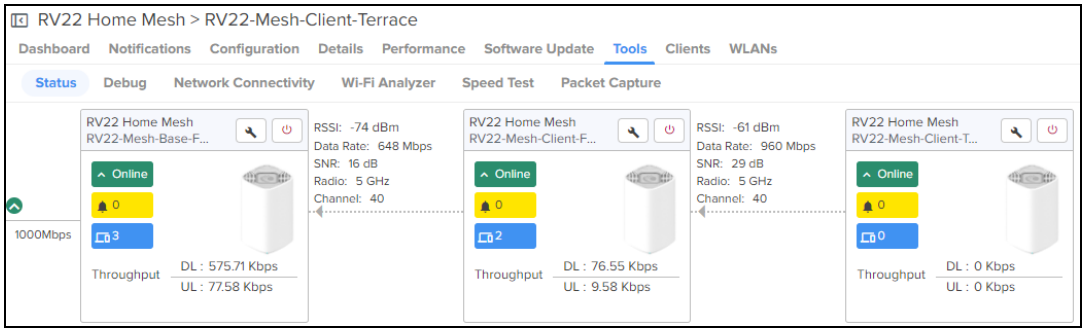
cnMaestro provides the following tools to troubleshoot and debug RV22 Home Mesh routers:

- Status
- Debug
- Network Connectivity
- Wi-Fi Analyzer
- Speed Test
- Packet Capture

To access these tools, navigate to **Monitor and Manage >** <RV22-router-name> **> Tools**.

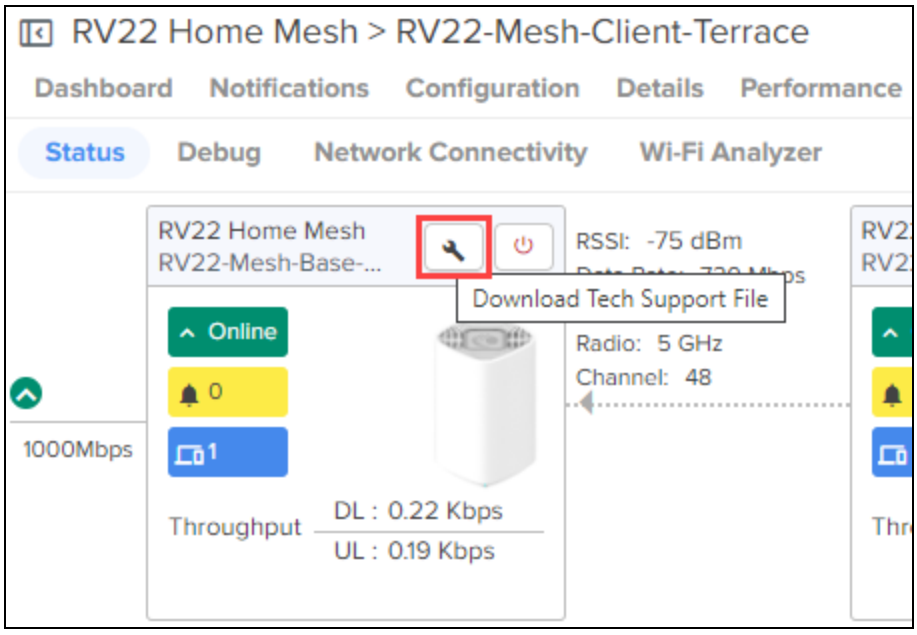
Status

To view the status of the link between the RV22 Home Mesh base and client routers, access the **Status** page under **Monitor and Manage >** <RV22-router-name> **> Tools.**



Downloading tech support file

To download the tech support file, on the **Status** page, click the **Download Tech Support File** ( ) icon.



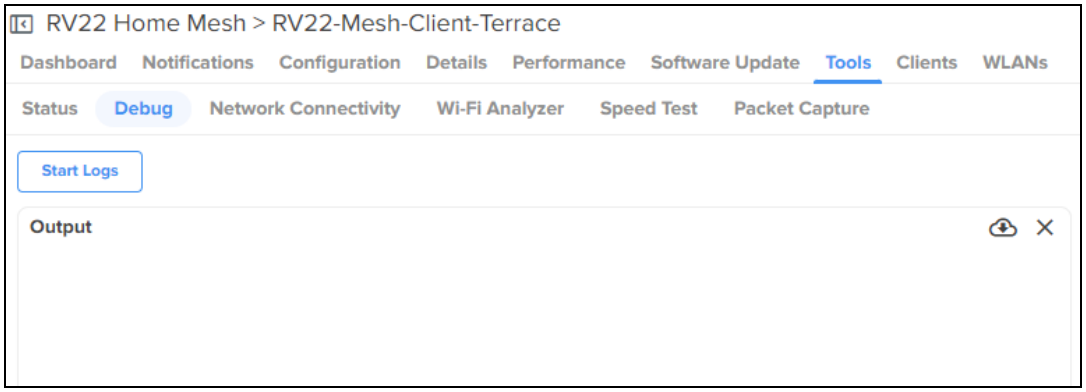
Debug

Displays log information of the RV22 Home Mesh router. To view the debug information:

1. Navigate to **Monitor and Manage >** <RV22-router-name> **> Tools** > **Debug**.

2. Click **Start Logs**.

   The log information is displayed in the **Output** window.



Network Connectivity

Provides network connectivity information of the RV22 Home Mesh routers.

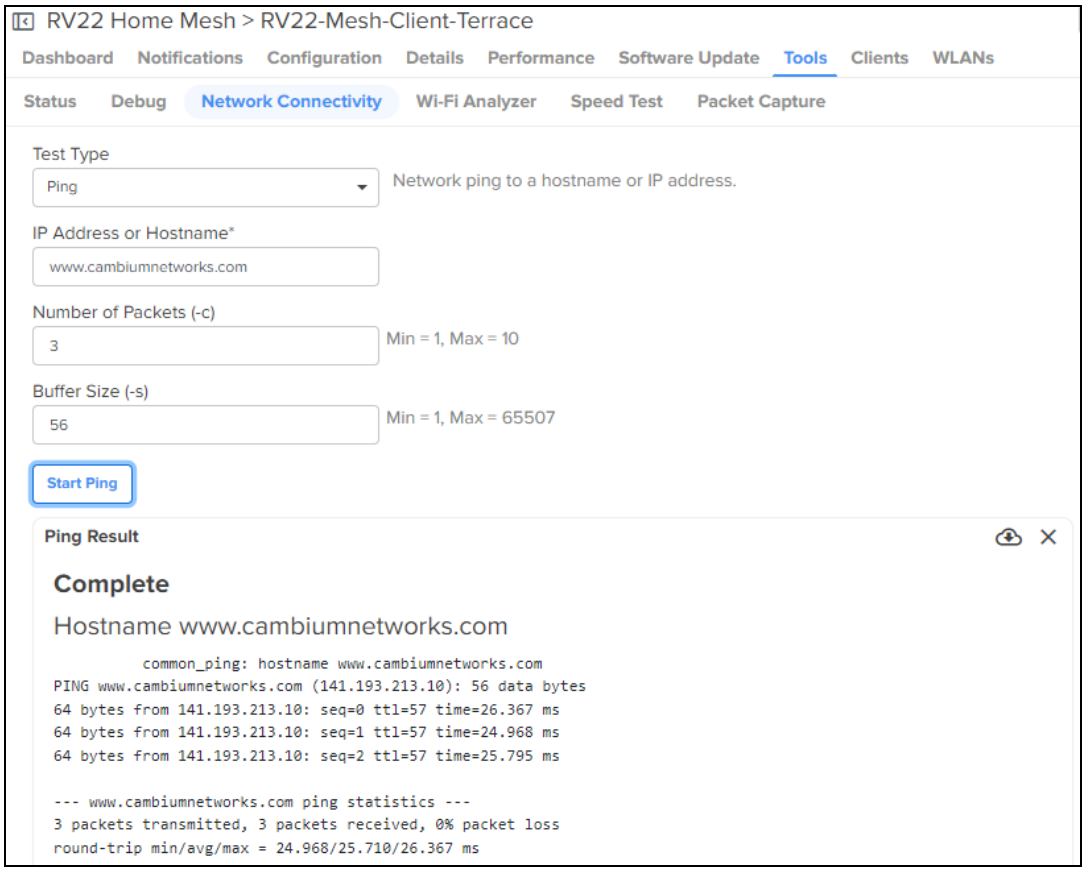
The following connectivity tests are available:

- Ping
- DNS Lookup
- Traceroute

To test network connectivity of the router:

1. Navigate to **Monitor and Manage >** <RV22-router-name> **> Tools** > **Network Connectivity**.
2. Select the test type and provide the corresponding parameters required for the test.
3. Click **Start Test**.

   cnMaestro initiates the test and displays the result in the **<Test Type> Result** window as shown below.



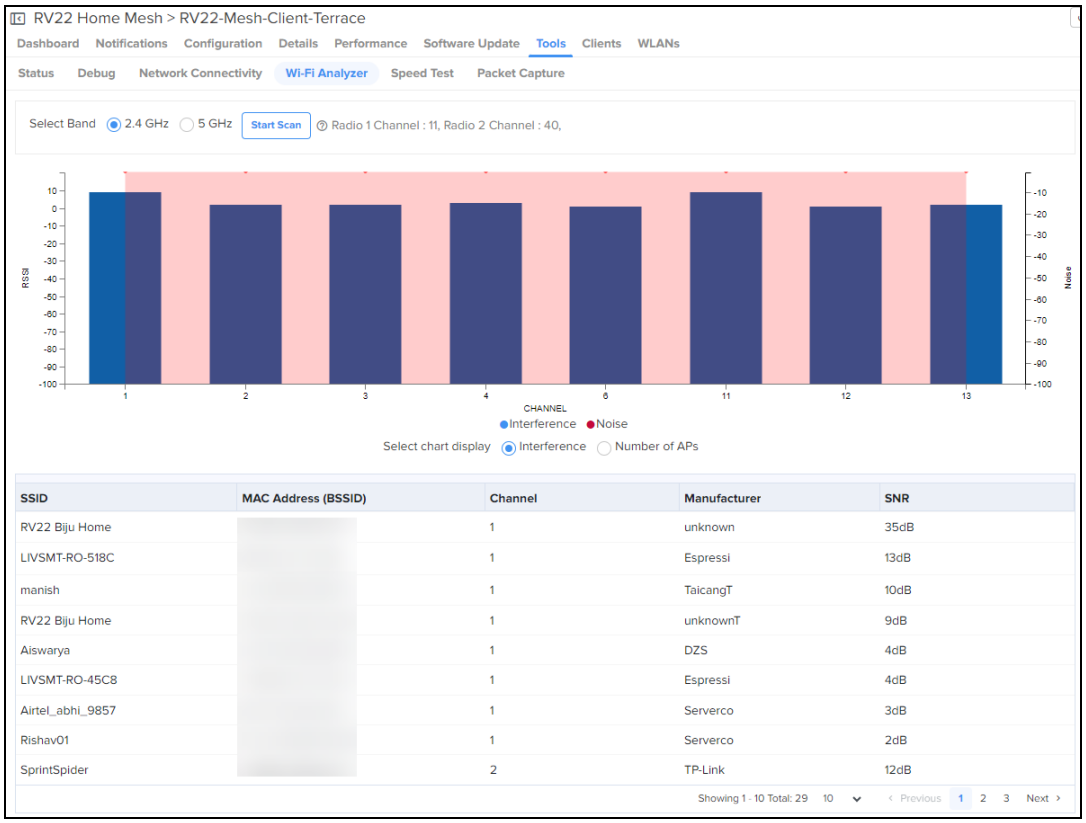
Wi-Fi Analyzer

Displays radio traffic and signal information for the selected band. It displays the interference and noise measured for the selected band.

To view the Wi-Fi Analyzer details:

1. Navigate to **Monitor and Manage >** <RV22-router-name> **> Tools** > **Wi-Fi Analyzer**.
2. Select the required band (2.4 or 5 GHz).
3. Click **Start Scan**.

   cnMaestro analyzes the band and displays the result in table as shown below.



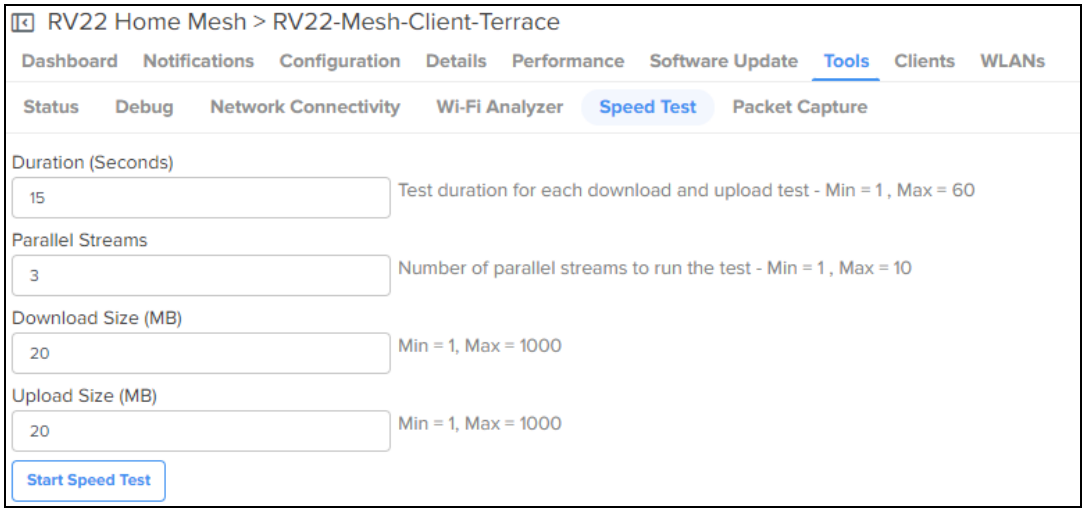
Speed Test

Displays the internet speed provided by the RV22 Home Mesh router.

To know the speed of the router:

1. Navigate to **Monitor and Manage >** <RV22-router-name> **> Tools** > **Speed Test**.
2. Provide the details in the fields provided.
3. Click **Start Speed Test**.

   cnMaestro checks the speed and displays both download and upload speeds in megabytes per second (MBps).



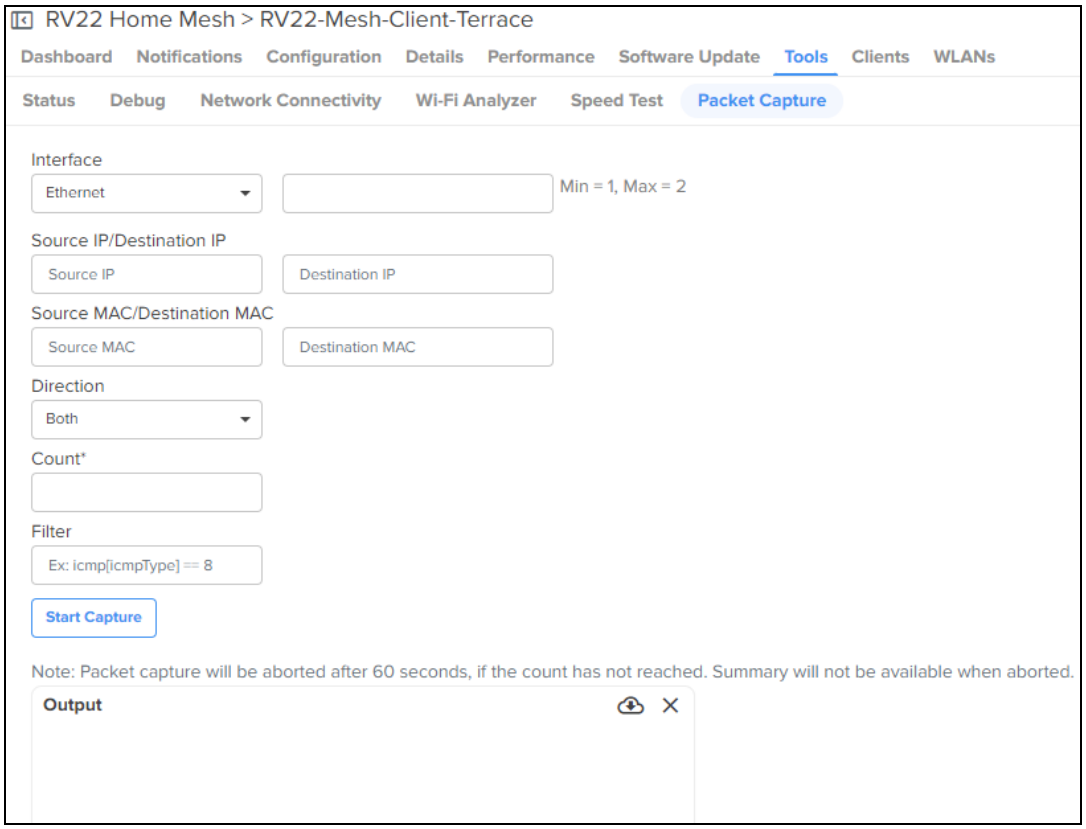
Packet Capture

Packet Capture allows the user to capture all packets on a specified interface.

To capture packet data:

1. Navigate to **Monitor and Manage >** <RV22-router-name> **> Tools** > **Packet Capture**.
2. Select the required interface and provide the source and destination IP address or MAC address.
3. Provide the number of packets to be captured.
4. Click **Start Capture**.

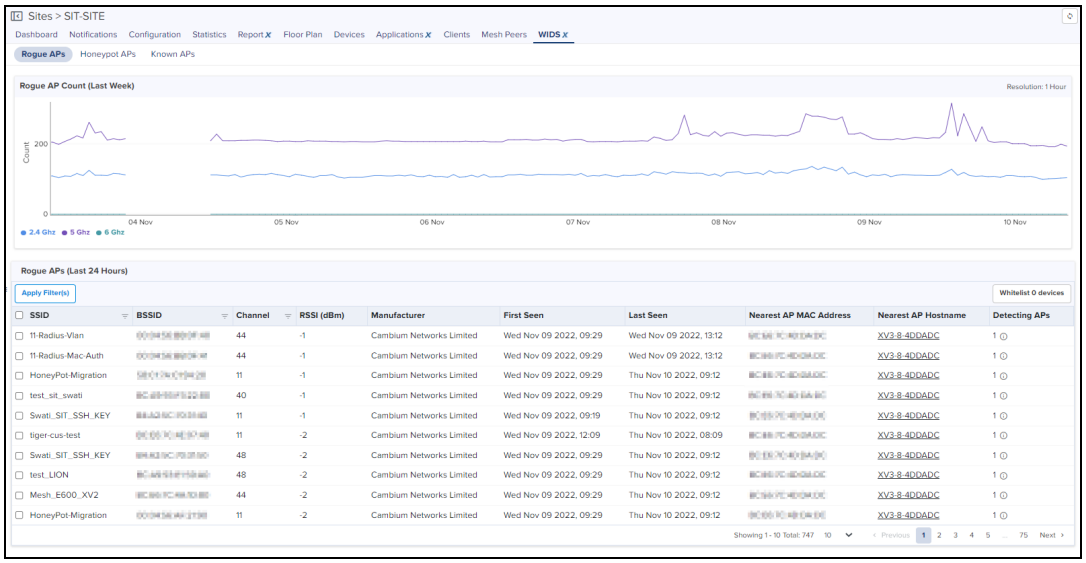
   cnMaestro displays the information in the **Ouput** window.
5. To download the PCAP file, click the download ( ) icon.



Wireless Intrusion Detection System (WIDS)

This section provides the monitoring details of Rogue APs, Honeypot APs, and Known APs.

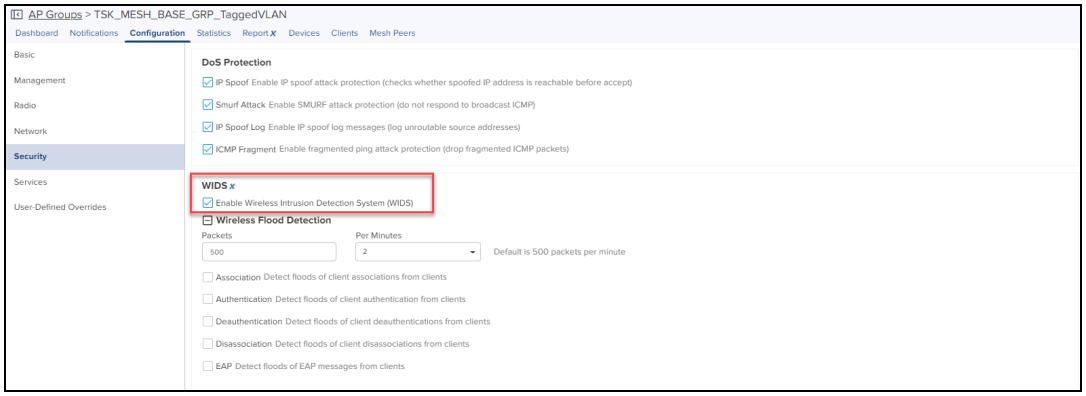
To view WIDS page, navigate to **Network** > **Site** > **WIDS** page.



Configuring WIDS

To enable WIDS feature perform the following steps:

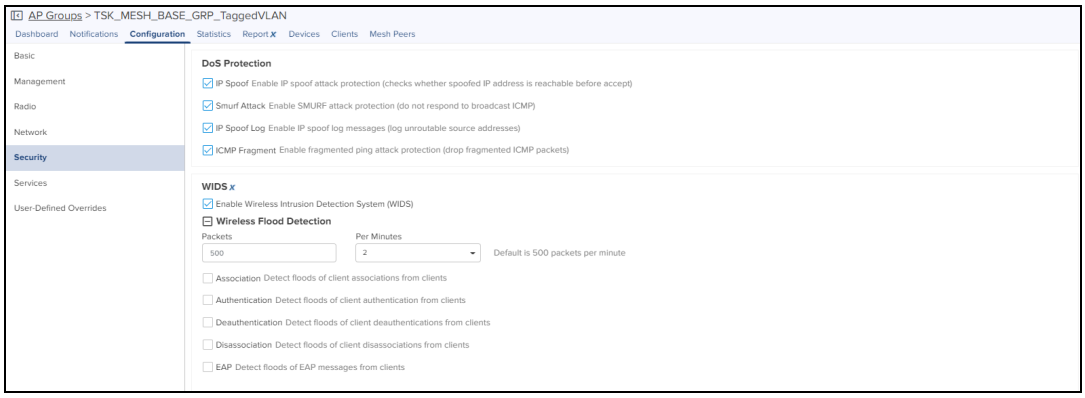
1. Navigate to **Configuration > Wi-Fi Profiles > AP Groups** tab
2. Select the **AP Group** and navigate to **Security** page.
3. Enable the Wireless Intrusion Detection System (WIDS).



Wireless Flood Detection

	NOTE: You need to enable the WIDS to configure the Wireless Flood Detection and Rouge AP detection.

Wireless Flood Detection is used to detect the flood attacks of Association, Authentication, Deauthentication, Disassociation, and EAP.



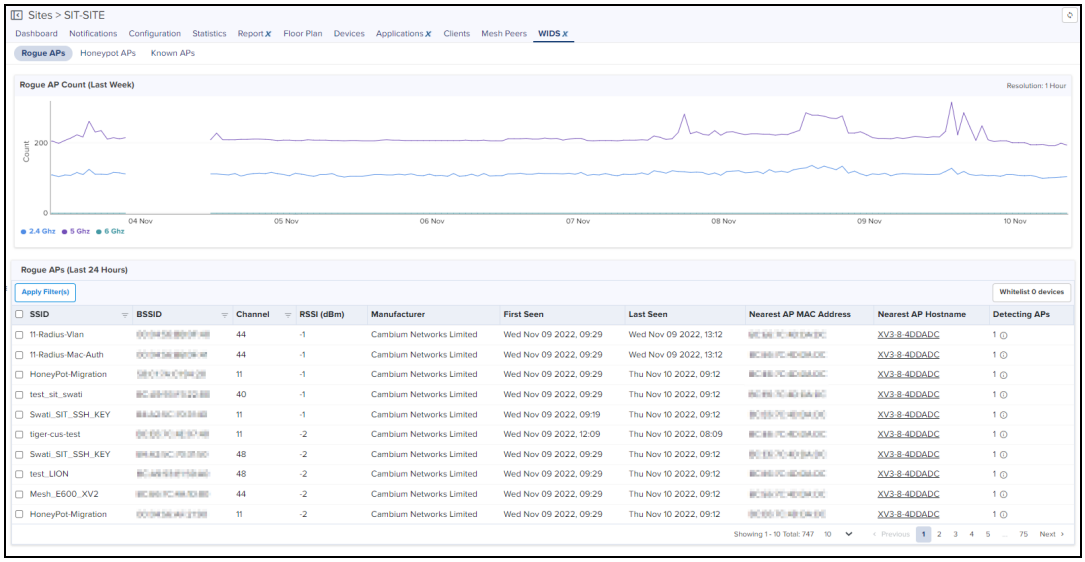
Wireless Flood Detection displays the following parameters:

Table 37: Wireless Flood Detection parameters

Field	Description
Association	Detect floods of client associations from clients.
Authentication	Detect floods of client authentication from clients.
Deauthentication	Detect floods of client deauthentications from clients.
Disassociation	Detect floods of client disassociations from clients.
EAP	Detect floods of EAP messages from clients.

Rogue APs

A Rogue AP is an unsanctioned AP, which is not onboarded to cnMaestro, which can be any Cambium or non Cambium device interfering. The AP scans all the channels, collects the details about the neighbor APs and sends them to cnMaestro.



Rogue APs scans for every 20 minutes and Count represents graphical data for every last week and list the data.

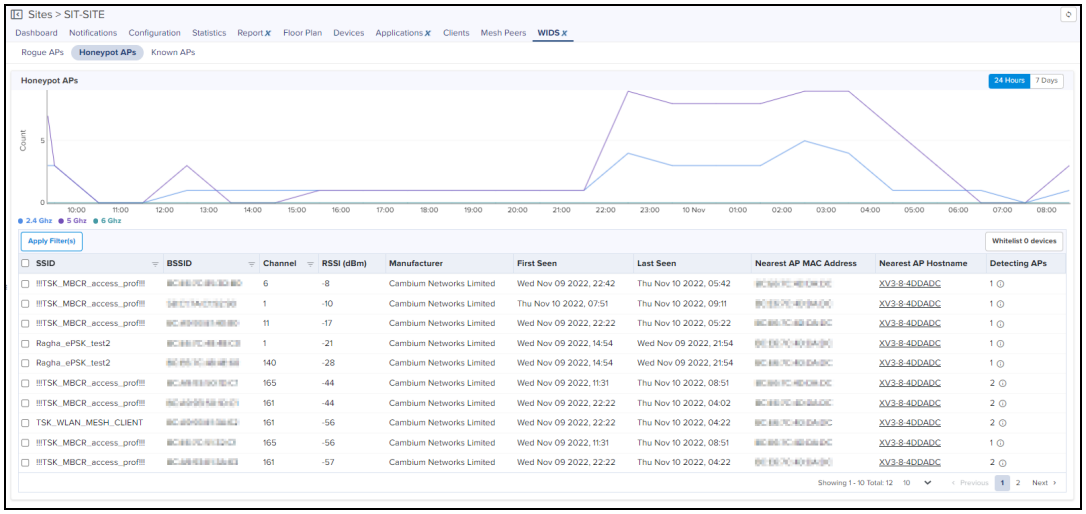
The following Rouge APs parameters are displayed:

Table 38: Rogue APs parameters

Field	Description
SSID	SSID of the Rogue AP.
BSSID	AP MAC address.
Channel	Channel in which the Rogue AP operates.
First Seen	Time at which the Rogue AP is detected for the first time.
Last Seen	Time at which the Rogue AP is detected last.
RSSI	Signal strength of the Rogue AP detected by the device.
Nearest AP MAC Address	AP MAC address nearby.
Nearest AP Host name	AP host name nearby.
Detecting APs	AP detection.
Manufacturer	Manufacturer of the Rogue AP (Cambium, Cisco, Aruba and Others).
Whitelist	Select the detected Rogue APs and mark them as Known APs.

Honeypot APs

Honeypot APs are unauthorized APs advertising with same SSID as managed or onboarded APs. It should be detected and monitored to prevent threats to the network.



The following Honeypot APs parameters are displayed:

Table 39: Honeypot APs parameters

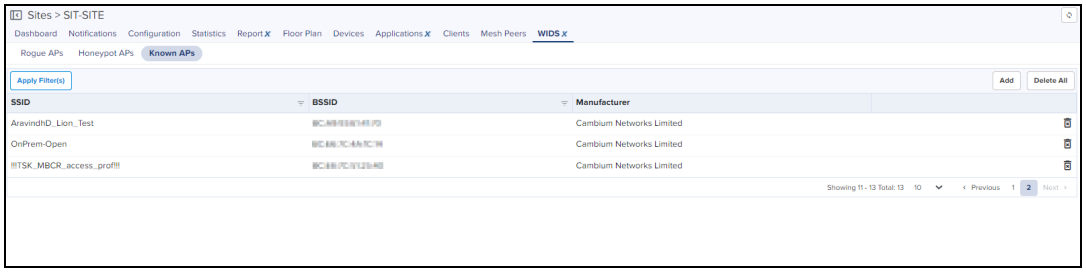
Field	Description
SSID	SSID of the Honeypot AP.
BSSID	AP MAC address.
Channel	Channel in which the Honeypot AP operates.
First Seen	Time at which the Honeypot AP is detected for the first time.
Last Seen	Time at which the Honeypot AP is detected last.
Manufacturer	Manufacturer of the Honeypot AP (Cambium, Cisco, Aruba and Others).
RSSI	Signal strength of the Honeypot AP detected by the device.
Nearest AP MAC Address	AP MAC address nearby.
Nearest AP Host name	AP host name nearby.
Detecting APs	AP detection.
Whitelist	Select the detected Honeypot APs and change them as Known APs.

Known APs

Known APs allows you to configure the SSID and MAC of Whitelist APs.

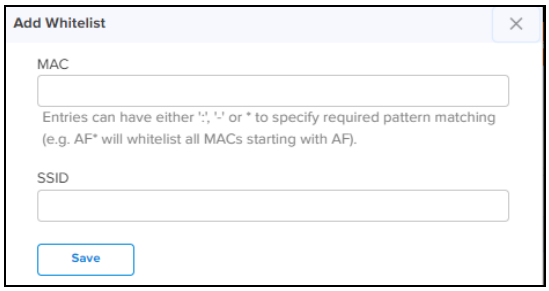
To add the Known APs, perform the following steps:

1. Navigate to **WIDS** > **Known APs**.



2. Click **Add**.

   Add Whitelist window appears.



3. Enter the **MAC**.
4. Enter **SSID**.
5. Click **Save**.

The following Known APs parameters are displayed:

Table 40: Known APs parameters

Field	Description
BSSID	AP MAC address.
Delete	Click delete icon to delete the selected Known AP.
Delete ALL	Allows to delete all Known APs in the list.
Manufacturer	Manufacturer of the Known AP (Cambium, Cisco, Aruba and Others).
SSID	SSID of the Known AP.

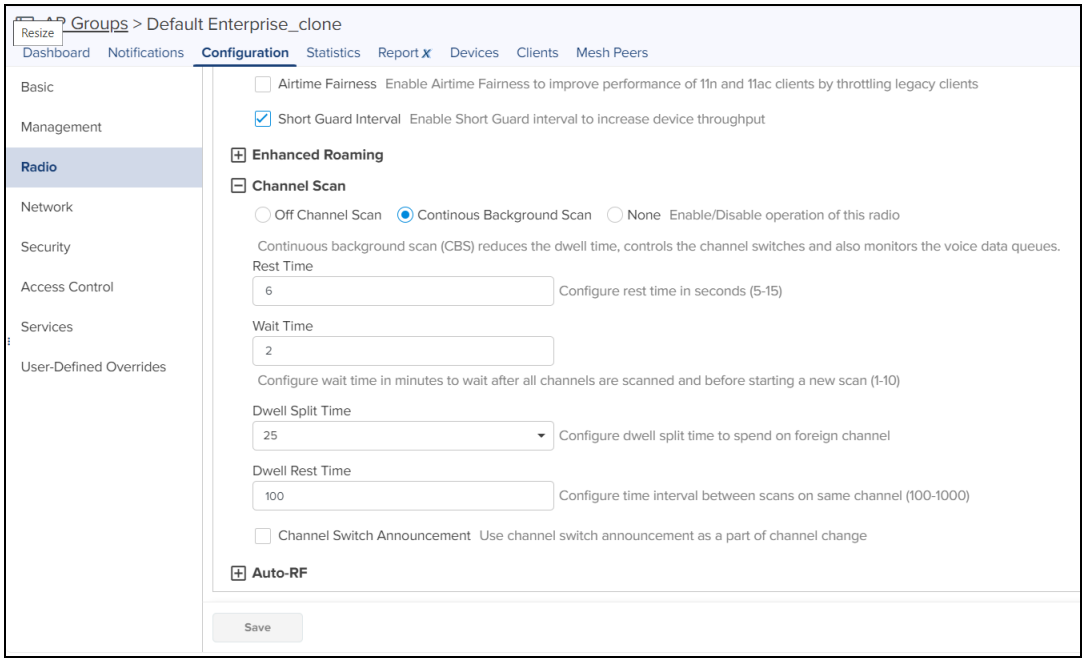
Off Channel Scan

NOTE:

- OCS (on 2.4 GHz, 5 GHz and 6 GHz) and Rogue AP detection should be enabled for WIDS option to work at Site level in cnMaestro.
- It will take 20 minutes to detect Rogue AP on AP boot up.

To enable OCS (Off Channel Scan):

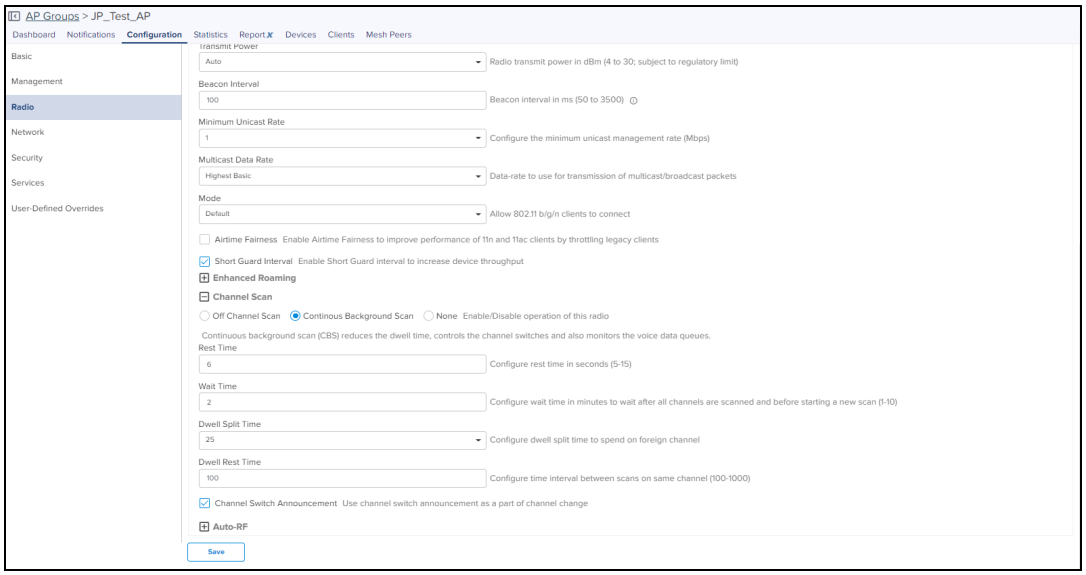
1. Navigate to **Configuration > Wi-Fi Profiles > AP Groups > Radio** (Available on both radio 2.4 GHz and 5 GHz) page.
2. Expand **Channel Scan** section and select **Off Channel Scan** option.
3. Click **Enable OCS** to periodically scan the network.



4. Enter **Dwell time** as required.
5. Click **Save**.

Continuous Background Scan (CBS)

CBS reduces the dwell time, controls the channel switches and also monitors the voice data queues.



To enable CBS:

1. Navigate to **Configuration > Wi-Fi Profiles > AP Groups> Radio** (Available on both radio 2.4 GHz, 5 GHz, and 6 GHz) page.
2. Expand **Channel Scan** section and select **Continuous Background Scan** option.
3. Configure rest time in seconds (5-15).
4. Configure wait time in minutes to wait after all channels are scanned and before starting a new scan (1-10).
5. Configure dwell split time to spend on foreign channel.
6. Configure time interval between scans on same channel (100-1000).
7. Enable Channel Switch Announcement.
8. Click **Save**.

Network Service Edge

The Network Service Edge (NSE) delivers advanced security, routing and SD-WAN policies for small and medium enterprises. NSE 3000 model has two Gigabit WAN ports and four Gigabit LAN ports. If offers WAN throughputs of up to 1 Gbps. NSE 3000 is managed using the cloud-hosted cnMaestro (a management solution from Cambium Networks).

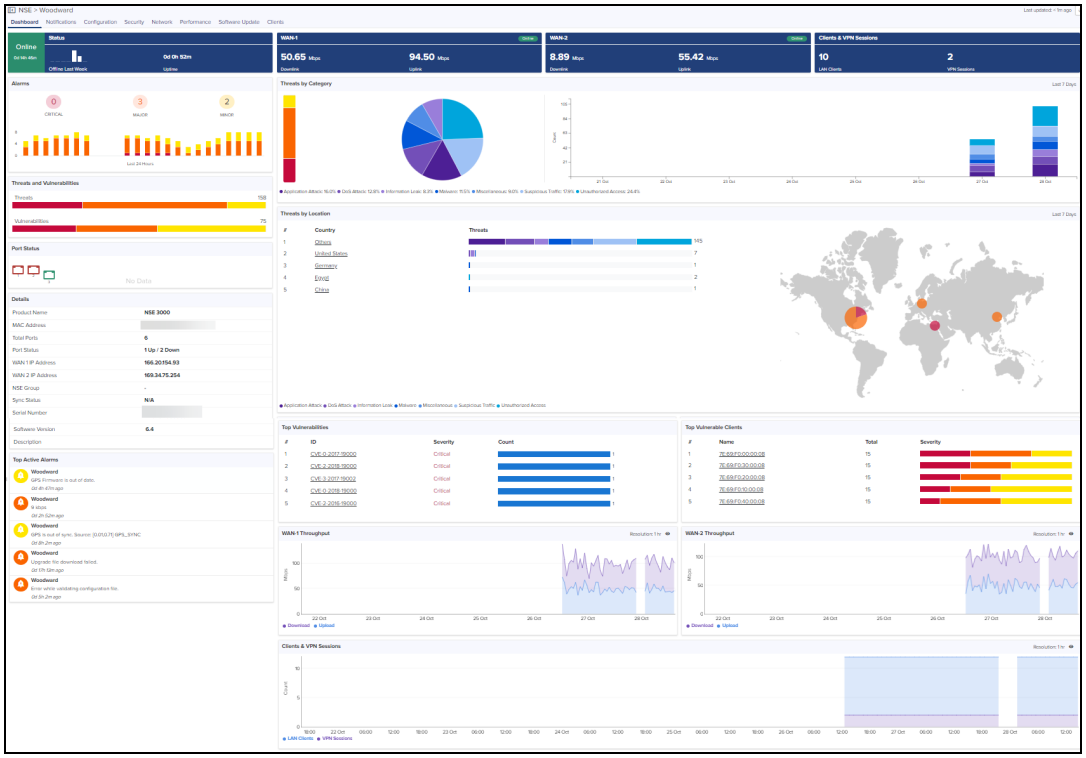
This section describes the following tabs available in cnMaestro for NSE 3000 model:

- Dashboard
- Notifications
- Configuration
- Security
- Network
- Tools
- Clients
- Certificate

Dashboard

Dashboard widgets provides you a comprehensive overview of NSE device and network health. The dashboard displays **Details** of NSE device, status of **WAN-1** and **WAN-2** usage, number of **LAN Clients & VPN Sessions**, **Alarms**, **Threats by Category**, **Threats and Vulnerabilities** categorized as **Critical, Major** and **Minor**, **Port Status**, **Top Vulnerabilities**, **Top Vulnerable Clients**, **Top Active Alarms**, **WAN-1 and WAN-2 Throughput**, and **Clients and VPN Sessions**.

Figure 124 The NSE dashboard page



Notifications

Notifications consist of Alarms, Alarms History, and Events. They are synchronous messages that provide real-time system status.

Figure 125 The Notifications page

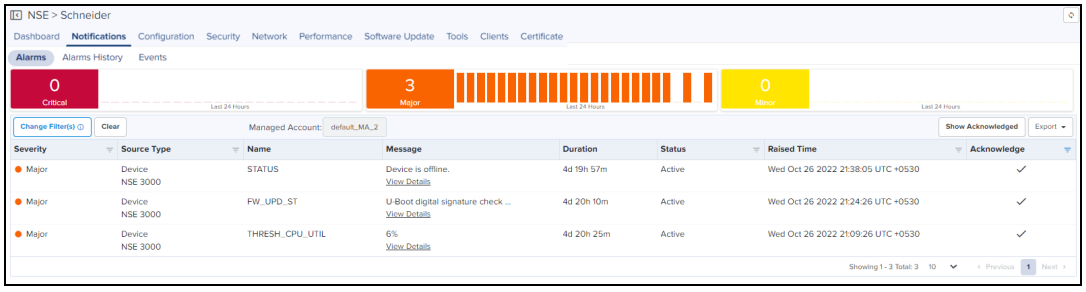


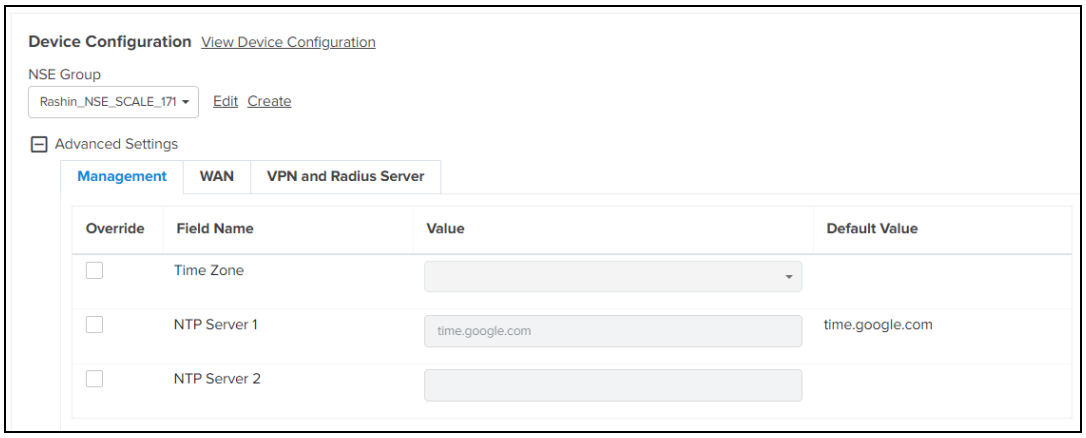
Table 41: Notification overview

Type	Description
Alarms	Alarms have a state and persist as long as the problematic activity continues; they reflect the current health of the devices in the network. The inactive alarms are removed from the alarms page after 10 minutes.
Alarms History	Expired Alarms are added to the Alarm History. The Alarm History displays historical active alarm counts. The history contains both the outstanding (active) and inactive alarms.
Events	Events are stateless, transient messages that occur in response to an input or action, such as if the CPU exceeds a threshold or a device association fails. Events are fire-and-forget; they are stored in an Event Table and provide a history of device activity.

Configuration

To apply the Configuration Method, perform the following:

1. Navigate to **Configuration** page.
2. In the **Device Configuration** method, select **NSE Group** option from the drop-down list.



To view the jobs, click **View Configuration Jobs** or navigate to **Administration** > **Jobs** > **Configuration Update**.

In the **Advanced Settings** you can configure the following tabs:

- Management
- WAN
- VPN and Radius Server

Management

1. In the **Management** tab, select the **Field Name** to override the settings.

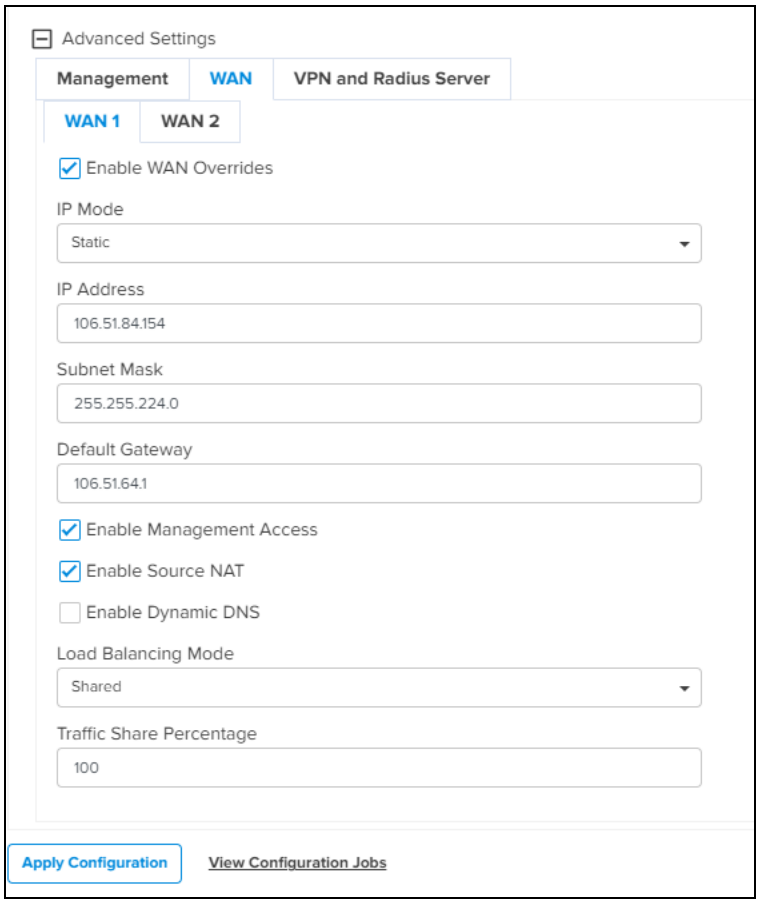
2. Click **Apply Configuration**.

WAN

In the **WAN**, you can override settings for **WAN 1** and **WAN 2.**

WAN 1

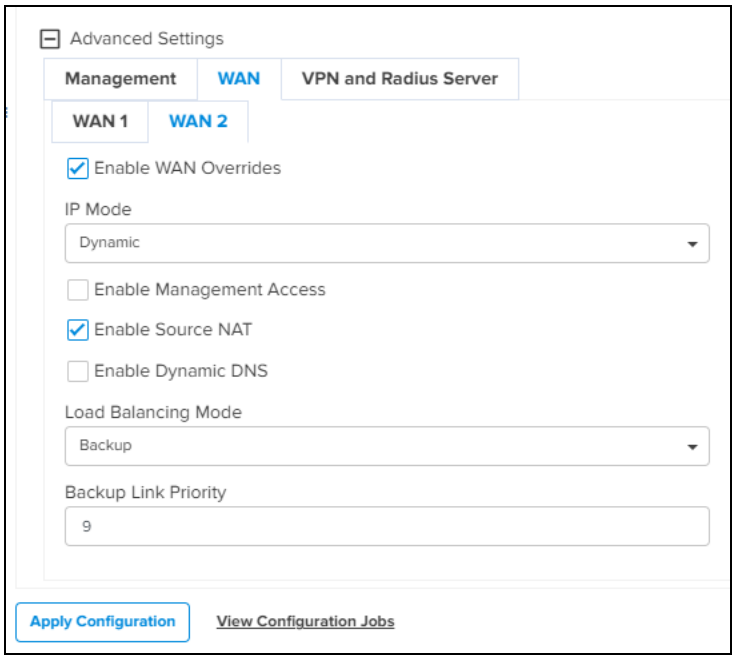
1. Select **Enable WAN Overrides** option.



2. Select the fields to override.
3. Click **Apply Configuration**.

WAN 2

1. Select **Enable WAN Overrides** option.

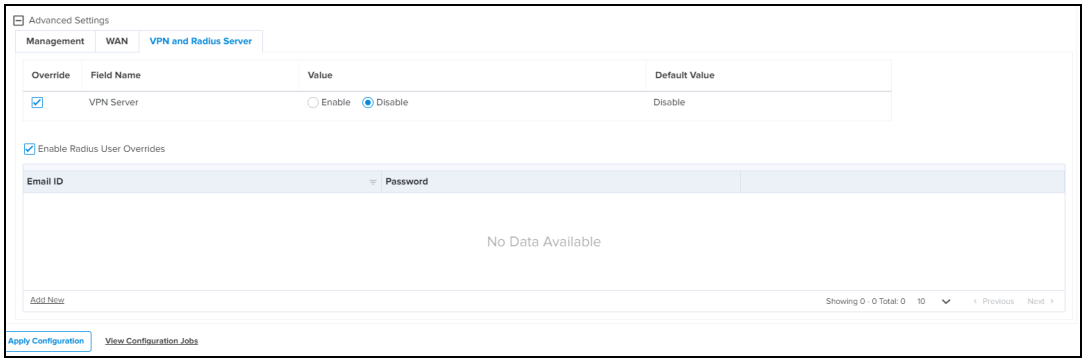


2. Select the fields to override.
3. Click **Apply Configuration**.

VPN and Radius Server

In the **VPN and Radius Server** tab you can override VPN and Radius Server settings.

1. Select VPN overrides field name.

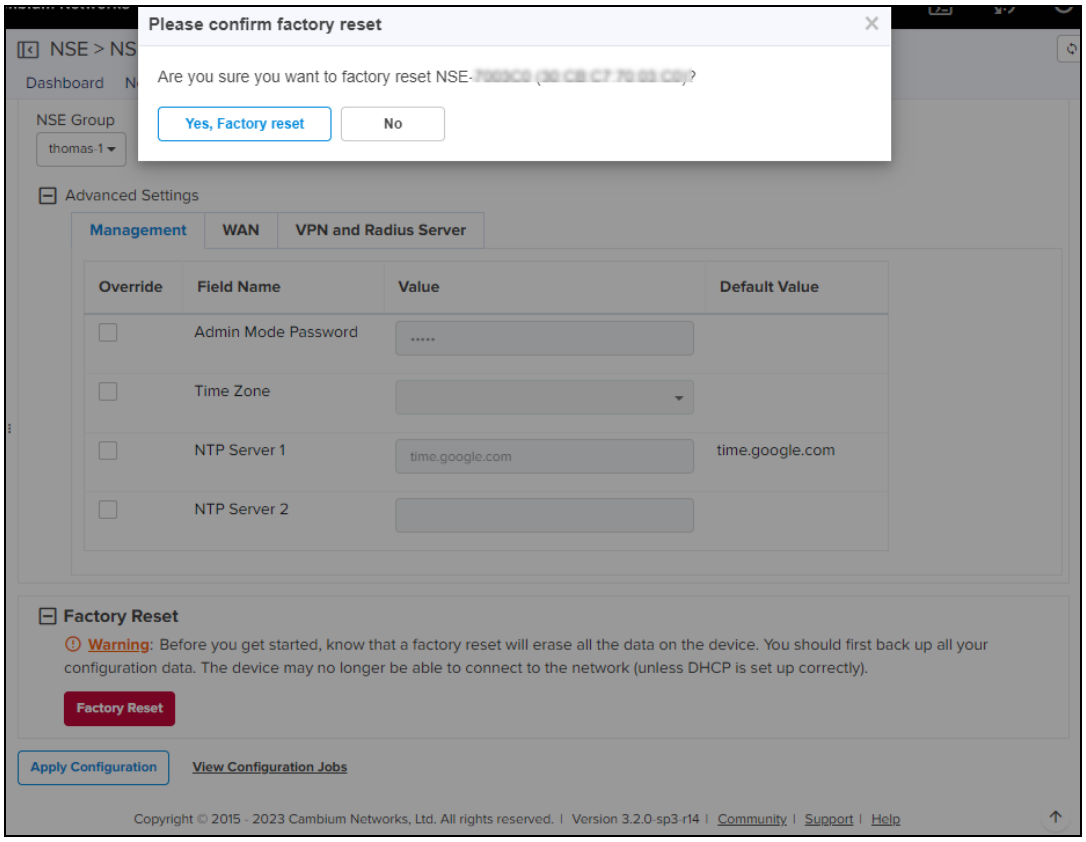


2. Select **Enable Radius User Overrides** option.
3. Click **Apply Configuration**.

Factory Reset

To erase all the configuration on the device and bring the device back to the default factory configuration, follow these steps:

1. .Navigate to the **NSE > Configuration** page.
2. Click **Factory Reset**.



3. In the pop-up window that appears, Click **Yes, Factory Reset**.

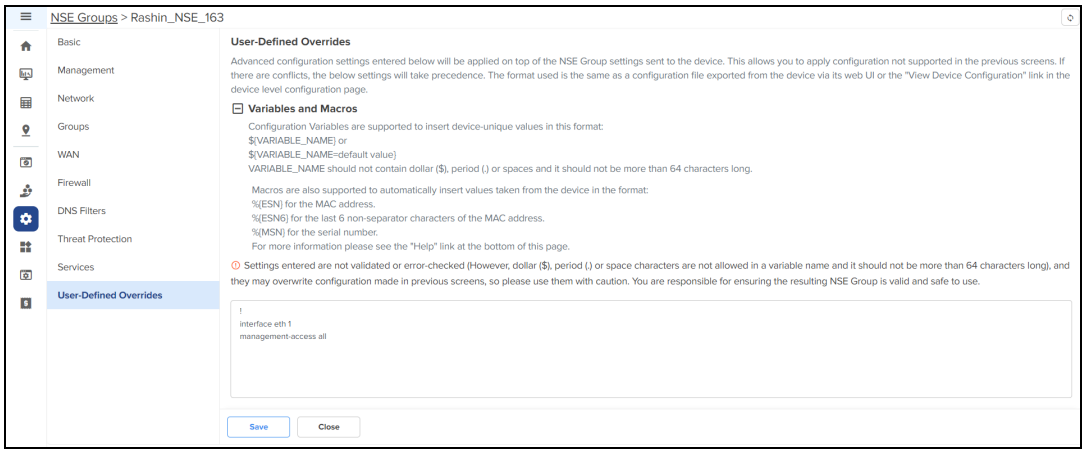
User-Defined Overrides

User-Defined Overrides are appended to the NSE groups before the configuration is applied to the device. This allows setting configuration parameters which are not supported by GUI.

To configure overrides based on your customized requirements by using variables and macros, follow these steps:.

1. Navigate to the **NSE > configuration** page.
2. Define your overrides in the text box.

Figure 126 The User-Defined Overrides page



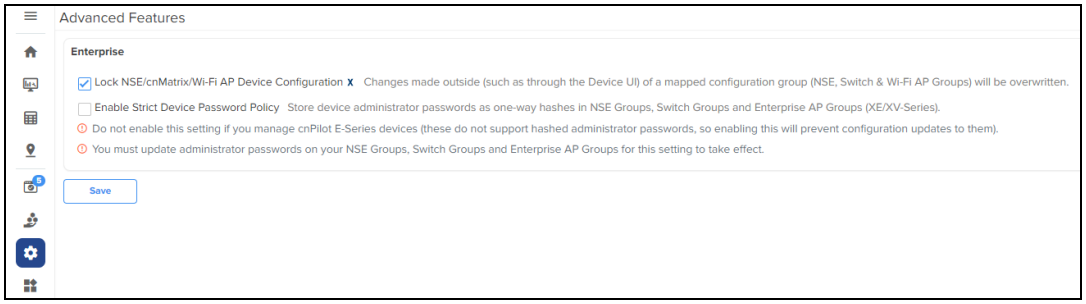
3. Click **Save**.

Configuration Lock

Configuration Lock forces the configuration on NSE and cnMaestro to be in sync always. If there is any configuration change done directly on the device, then cnMaestro tracks that device and triggers a configuration sync job to bring back the device to same configuration which is applied from the NSE Group.

To enable the configuration lock, follow these steps:

1. Navigate to the **Configuration > Advanced Features**.
2. Select the **Lock NSE/cnMatrix/Wi-Fi AP Device Configuration** check box.



3. Click **Save**.

Security

The **Security** page allows you to report the vulnerability and threats detected by the device.

Threats

1. Navigate to **NSE > Security > Threats**.
2. Select **Time Range** from the drop-down.
   - Last 24 hours
   - Last 7 Days
   - Last 30 Days

The threat page displays **Threat by Location, Total Threats,** and threat categories based on **Critical, Major, Minor,** and origin of the threat (country of origin). The bar graph on the left hand side displays the count based upon the threat **by Category**. The pie chart displays the percentage of threats with respect to other threats. The per day bar chart displays the threat count aggregated on per day basis.

Figure 127 The Threats page

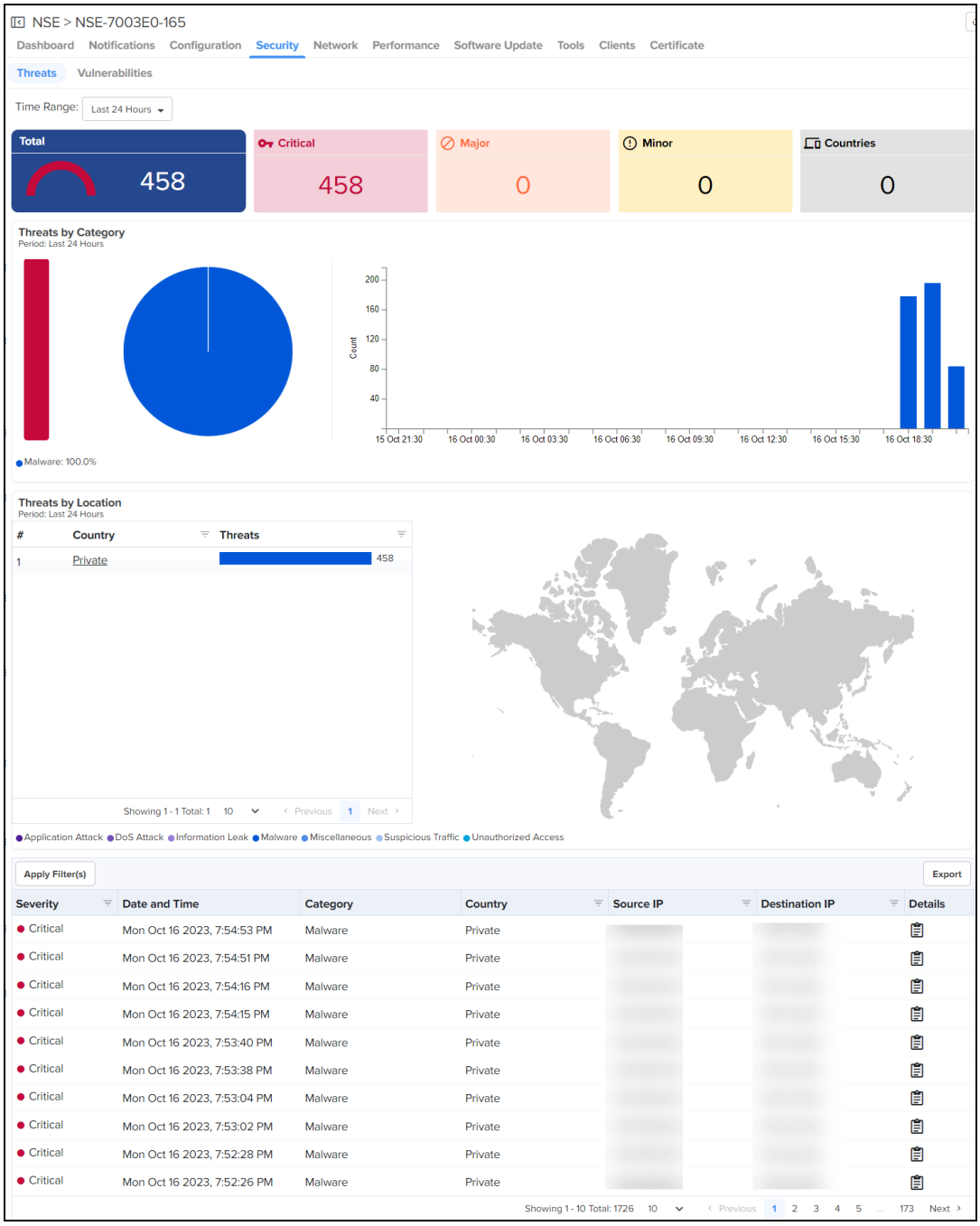


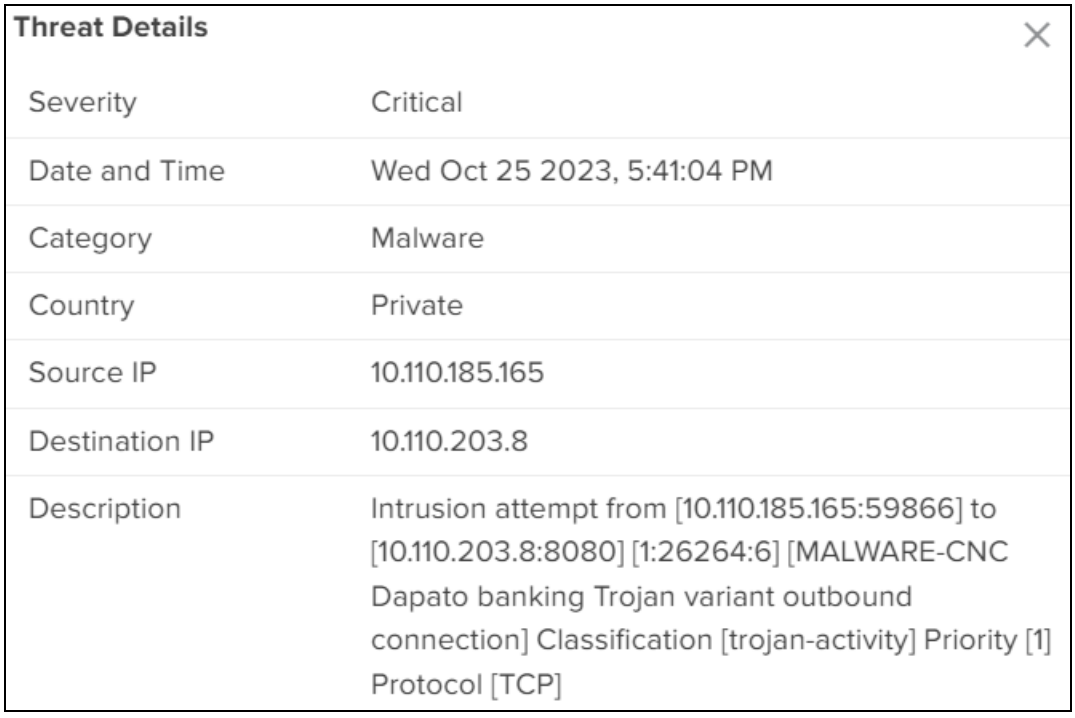
Table 42: Parameters on the Threats page

Parameter	Description
Severity	The severity of threat such as Critical, Major, and Minor.
Date and Time	The date and time of the threat occurrence.
Category	Displays any of the following categories of threat: • Application Attack

Table 42: Parameters on the Threats page

Parameter	Description
	• DoS Attack • Information Leak • Malware • Miscellaneous • Suspicious Traffic • Unauthorized Access
Country	The source country of the threat is displayed for threats that originate from WAN to LAN.
Source IP	Source IP address of the flow which is resulted in the threat.
Destination IP	Destination IP address of the flow which is resulted in the threat.
Details	Displays the above details in a single window in addition to a description of the threat. When you click the icon, the **Threat Details** window appears, as shown in Figure 128.

Figure 128 The Threat Details window



Vulnerabilities

The Vulnerabilities page displays **Total Vulnerabilities, Unique Critical, Unique Major, Unique Minor,** and **Vulnerable Clients.**

Figure 129 The Vulnerabilities page

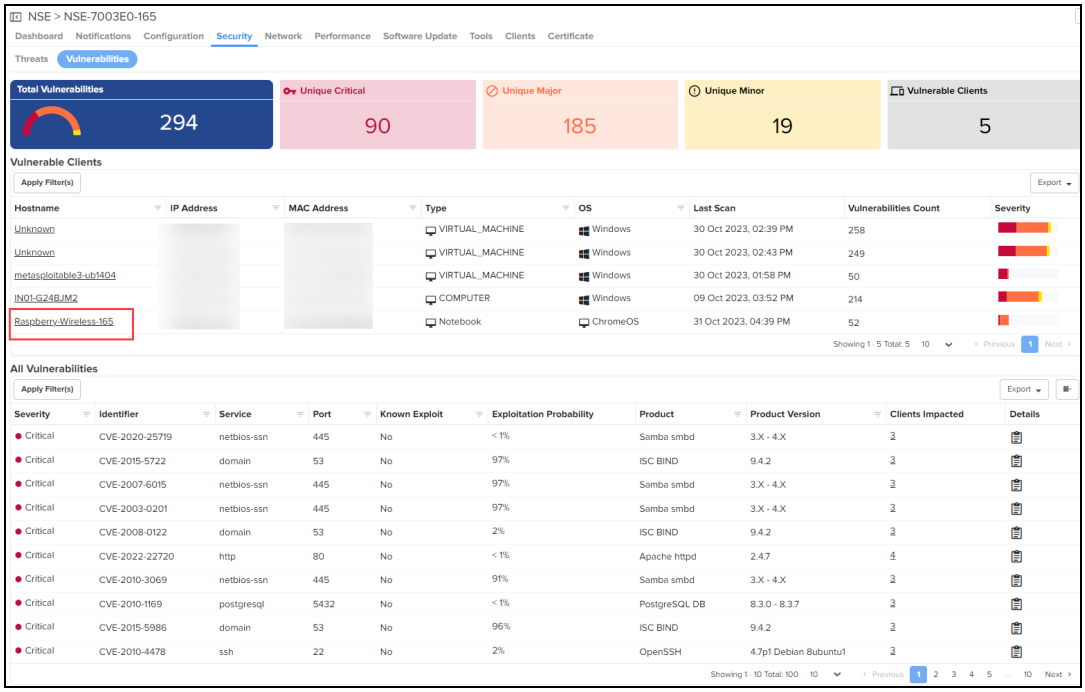


Table 43: Parameters on the Vulnerabilities page

Parameter	Description
Vulnerable Clients	
Hostname	Hostname of the client. When you click the hostname, you can view the vulnerabilities discovered by the NSE for the client, as shown in Figure 139.
IP Address	Source IPv4 address of the vulnerable client.
MAC Address	MAC address of the client.
Type	Type of client. For example, Computer, or Switch.
OS	Operating system running on the client. For example, Windows, or macOS.
Last Scan	Date and time of the last security scan performed on the client.
Vulnerabilities Count	Number of vulnerabilities found on the client during the security scan.
Severity	Level of severity assigned to each vulnerability, such as Critical, Major, or Minor.
All Vulnerabilities	
Severity	The severity level of the vulnerability: • Critical • Major

Table 43: Parameters on the Vulnerabilities page

Parameter	Description
	• Minor
Identifier	CVE ID number for the discovered vulnerability.
Service	Service of the vulnerability.
Port	Port number of the service.
Known Exploit	Indicates whether the vulnerability is exploited in the wild and is present in the Known Exploited Vulnerabilities (KEV) catalog. For information on KEV catalog, see Known Exploited Vulnerabilities Catalog.
Exploitation Probability	The probability (in percentage) that a vulnerability will be exploited in the next 30 days. A higher value indicates a higher probability of the vulnerability being exploited. For information on Exploit Prediction Scoring System (EPSS), see Exploit Prediction Scoring System.
Product	Name of the product.
Product Version	Version of the product.
Clients Impacted	Number of clients impacted by the vulnerability. When you click the number in the **Clients Impacted** column, the **Impacted Clients** window appears as shown in Figure 132.
Details	Displays the above details in a single window in addition to a short description of the vulnerability. A short description typically includes essential information, such as details on how an attacker can potentially exploit the vulnerability and which product versions are affected by it. When you click the Details icon, the **Vulnerability Details** window appears, as shown in Figure 130. When you click the CVE Identifier link, you can access detailed information about the specific vulnerability in the National Vulnerability Database (NVD) page, as shown in Figure 131.

Figure 130 The Vulnerability Details window

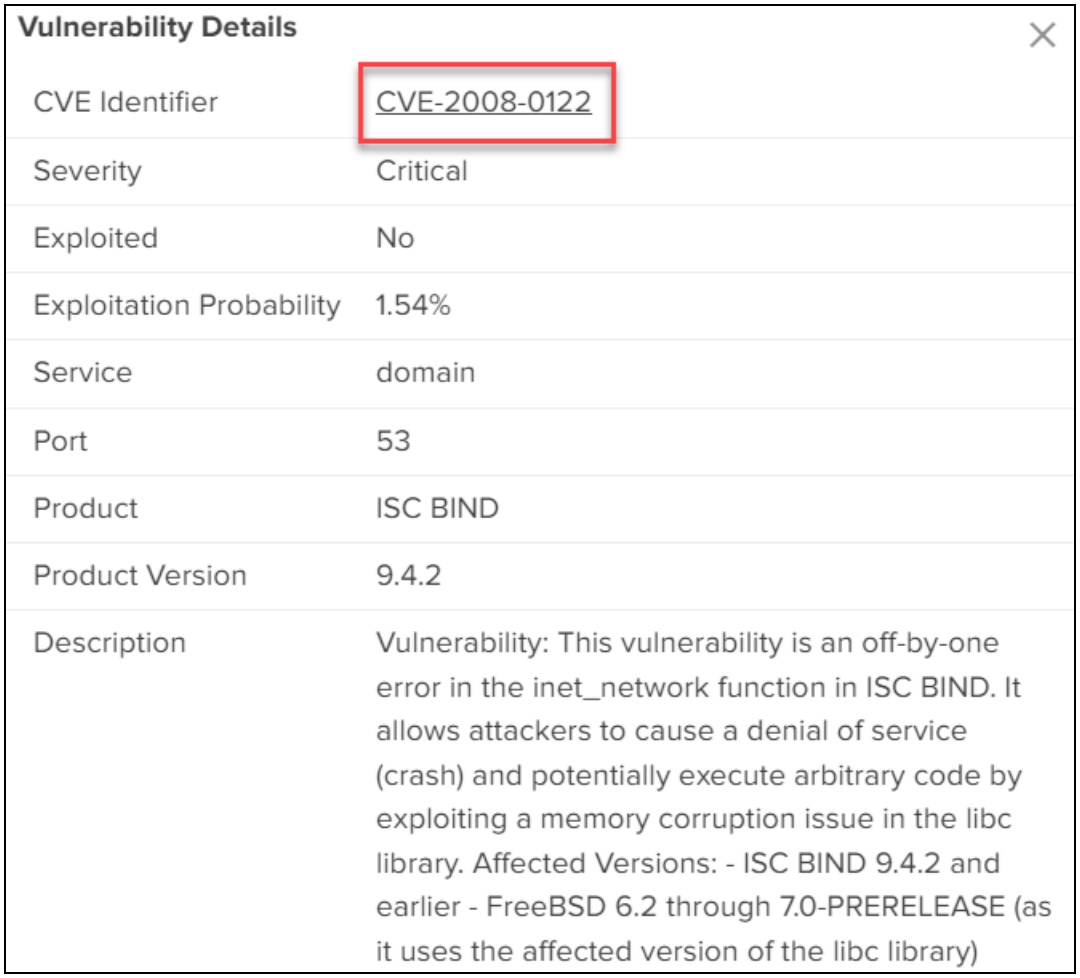
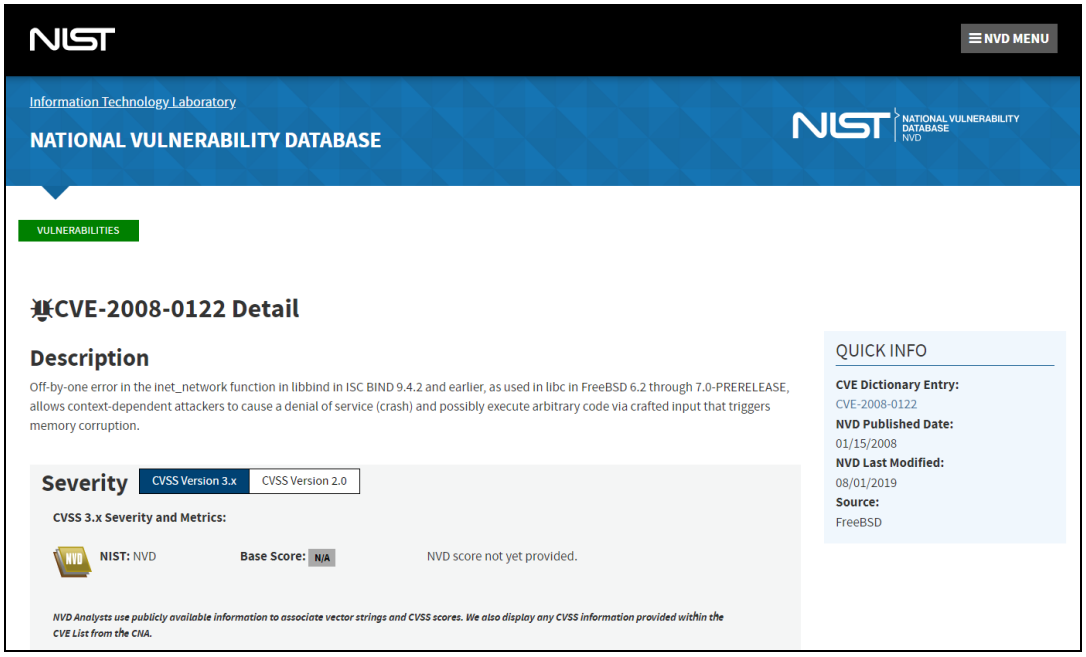


Figure 131 The NVD page

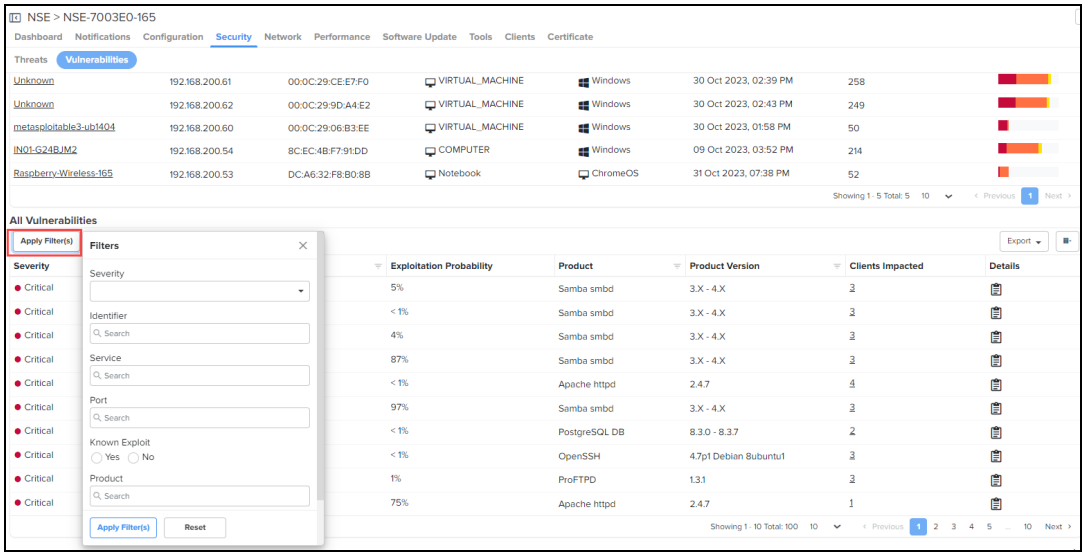


Click the MAC address from the **Impacted Clients** window as shown in Figure 132 to view the Clients Dashboard.

Figure 132 The Impacted Clients window

You can refine your search results using **Apply Filter(s)** option as shown in Figure 133.

Figure 133 Apply Filter(s) option



Network

Network page displays information about onboard DHCP servers, Route table, and WAN statistics.

LAN

LAN page displays **Subnet** and **DHCP Leases**. You can **Apply Filters** for the table header to search for a specific parameter in the table.

Figure 134 The LAN page

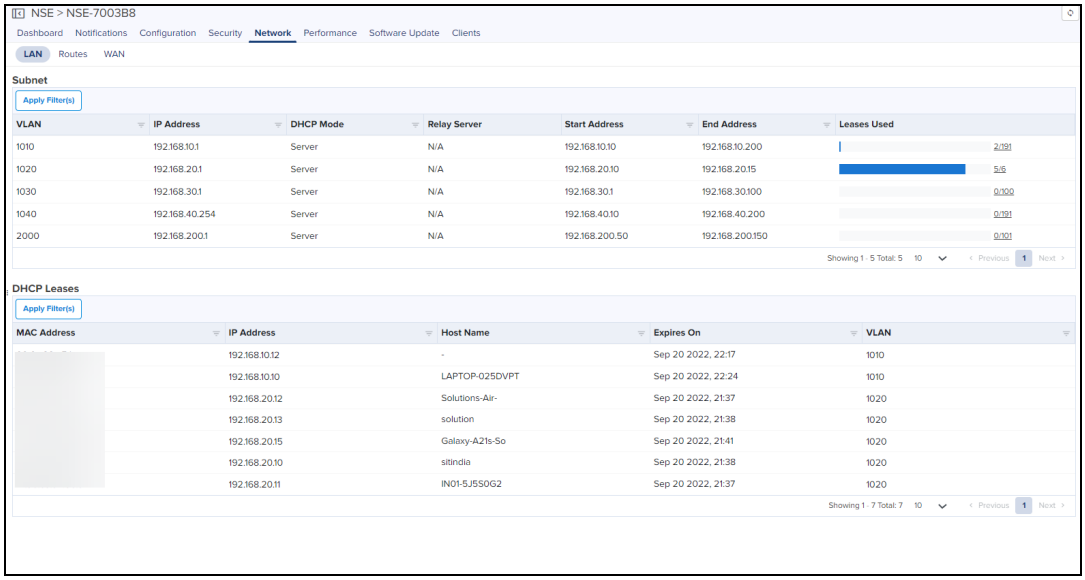


Table 44: Parameters displayed in LAN

Parameter	Description
Subnet	
VLAN	VLAN ID.
IP Address	Static IP address of the VLAN interface.
DHCP Mode	Status of the DHCP server mode enabled or disabled.
Relay Server	Status of the relay server mode enabled or disabled.
Start Address	DHCP pool start IP address.
End Address	DHCP pool end IP address.
Lease Used	Active IP address issued by the DHCP server.
DHCP Leases	
MAC Address	MAC address of the client.
IP Address	The leased IP address to the client.
Host Name	The hostname of the client.
Expires On	The duration for the leased IP.
VLAN	The VLAN ID assigned to the client.

Routes

Routes page displays layer 3 routing table of the device. You can **Apply Filters** for the table header to search for a specific parameter in the table.

Figure 135 The Routes page

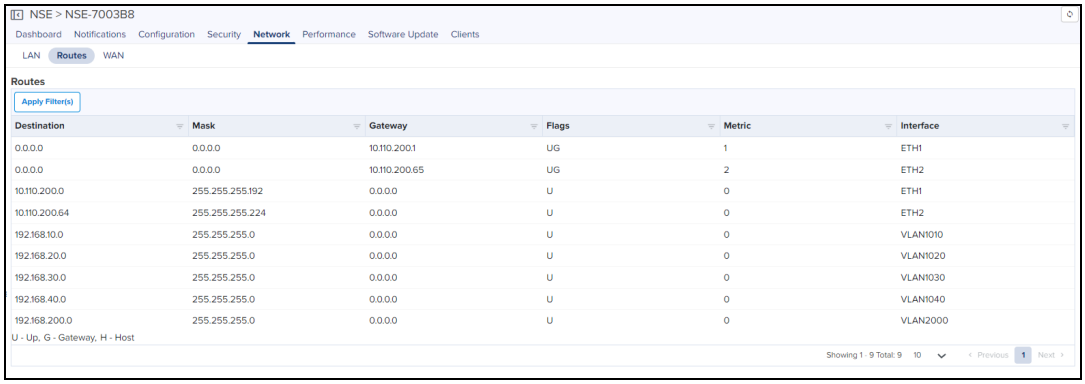


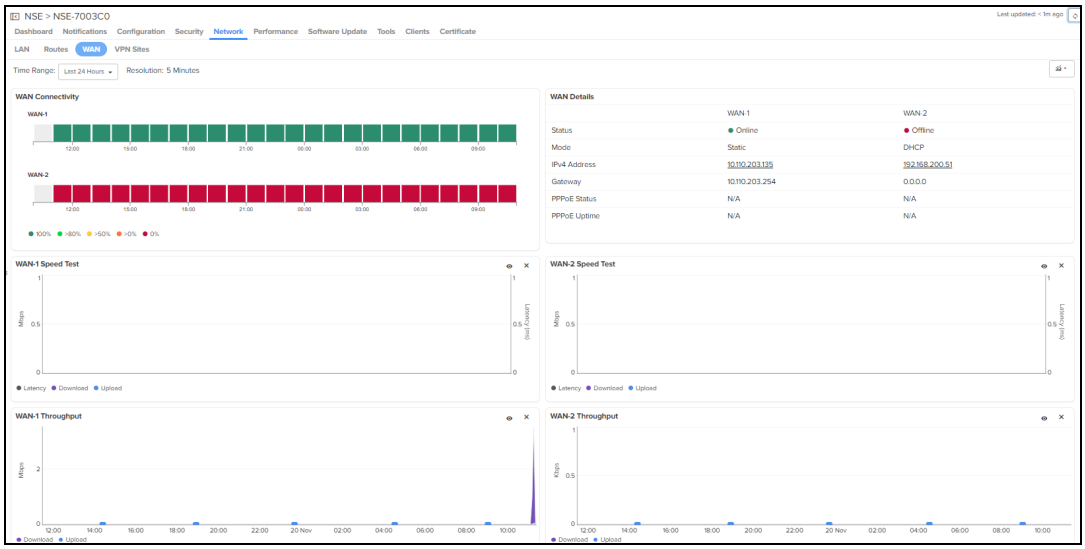
Table 45: Parameters on the Routes page

Parameter	Description
Routes	
Destination	Destination address of the routes.
Mask	Subnet mask of the specific route.
Gateway	Default gateway of the routes.
Flags	Flags of the routes.
Metric	Metric of the routes.
Interface	Iinterface of the routes.

WAN

WAN page displays **WAN Connectivity, WAN Details,** graphical representation of **Speed Test, Throughput** in **WAN-1** and **WAN-2** in selected **Time Range** (Last 24 hours or Last 7 Days).

Figure 136 The WAN page



- **WAN connectivity**: Provides the status of the periodic health check of WAN links.

- **WAN speed test**: Provides the status of the MAX uplink and downlink bandwidth of the WAN link.
- **WAN throughput**: Provides the usage of WAN uplink and downlink over a period of time.

WAN Details

Table 46: Parameters displayed on the WAN Details section

Parameter	Description
WAN Details	
Status	Status (online or offline) based upon the periodic WAN link health check.
Refresh time	Last update of date and time.
IP mode	Mode as DHCP or Static.
IPv4 Address	IPv4 Address of the WAN.
Gateway	Default gateway of the WAN interface.

VPN Sites

The VPN Sites page displays the network traffic and connection details as shown in Figure 137.

Figure 137 The VPN Sites page

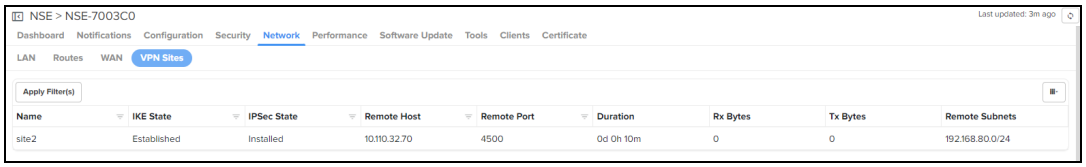


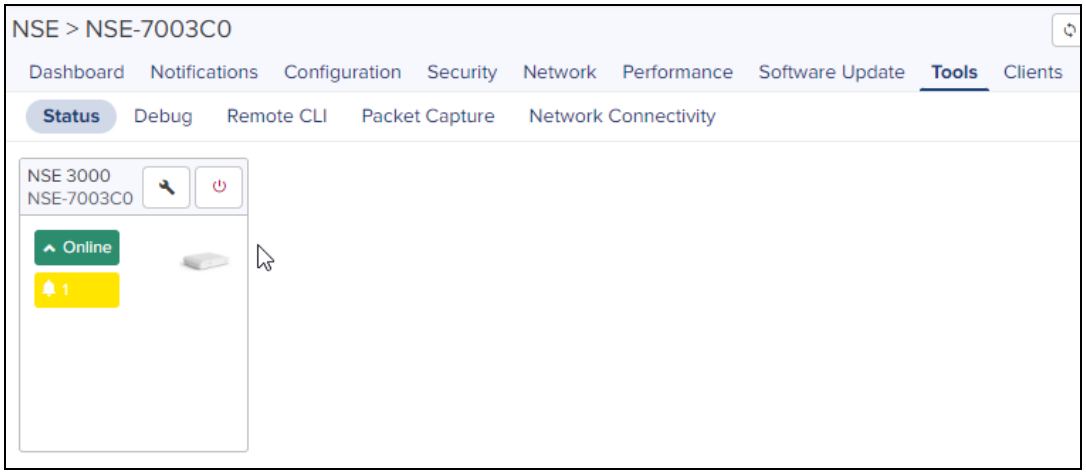
Table 47: Parameters displayed on the VPN Sites page

Parameter	Description
VPN Sites	
Name	Name of the VPN site.
IKE State	Current state of IKE protocol.
IPSec State	Current state of IPSec protocol.
Remote Host	IP address of the remote VPN endpoint.
Remote Port	Port number of the remote VPN endpoint.
Duration	Duration of the VPN connection.
Rx Bytes	Number of bytes received by the local VPN endpoint from the remote VPN endpoint.
Tx Bytes	Number of bytes transmitted by the local VPN endpoint to the remote VPN endpoint.
Remote Subnets	IP address ranges assigned to the remote VPN endpoint's network.

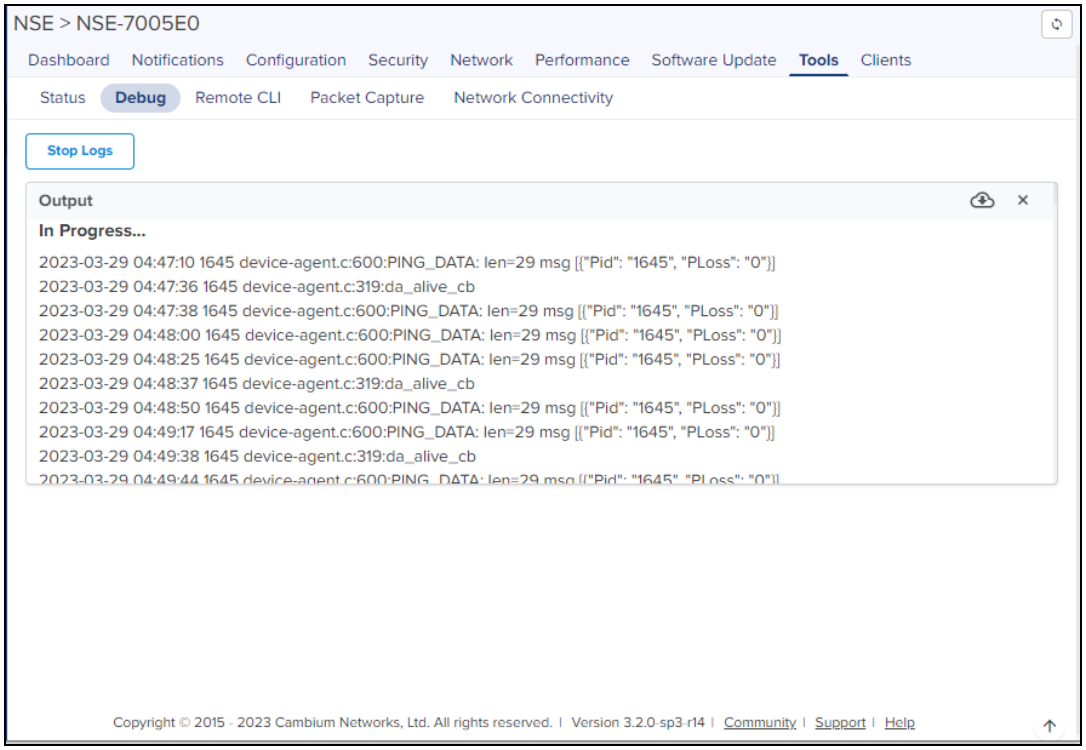
Debug Tools

You can capture logs, run remote CLI commands to see stats in real time, run traceroute, ping to check the reachability, and run live packet capture on the NSE devices on the selected interface.

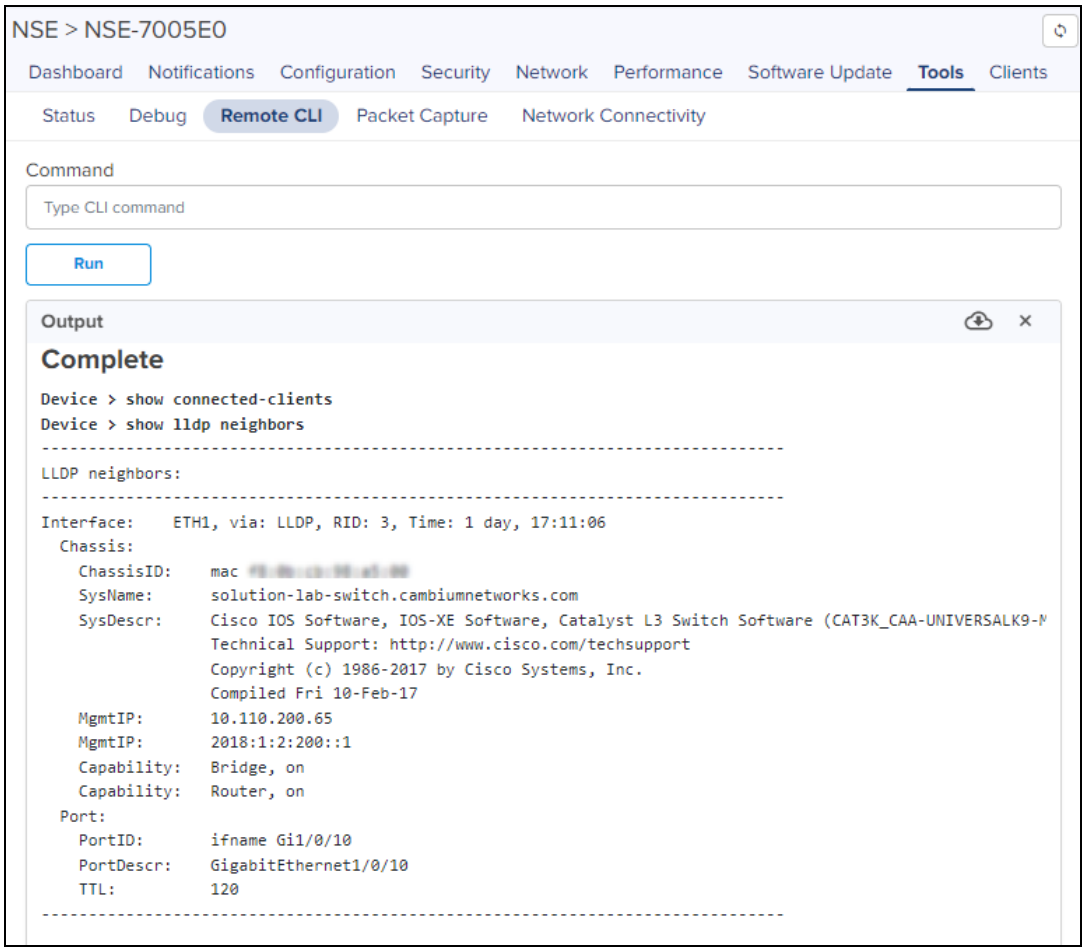
To display the NSE device status, navigate to **NSE > Tools > Status** page.



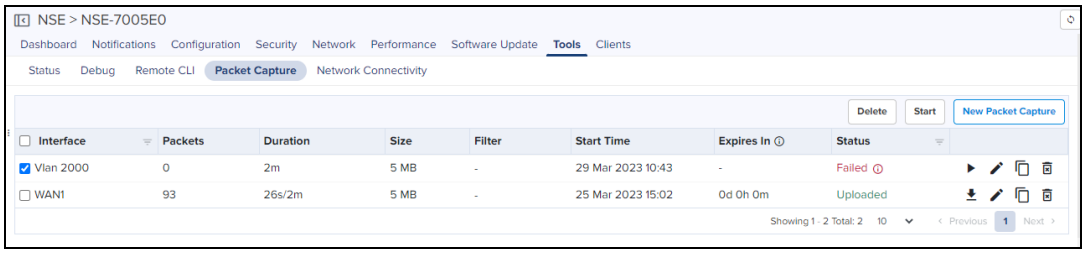
To access the logs, navigate to **NSE > Tools > Debug** tab and click **Start Logs**:



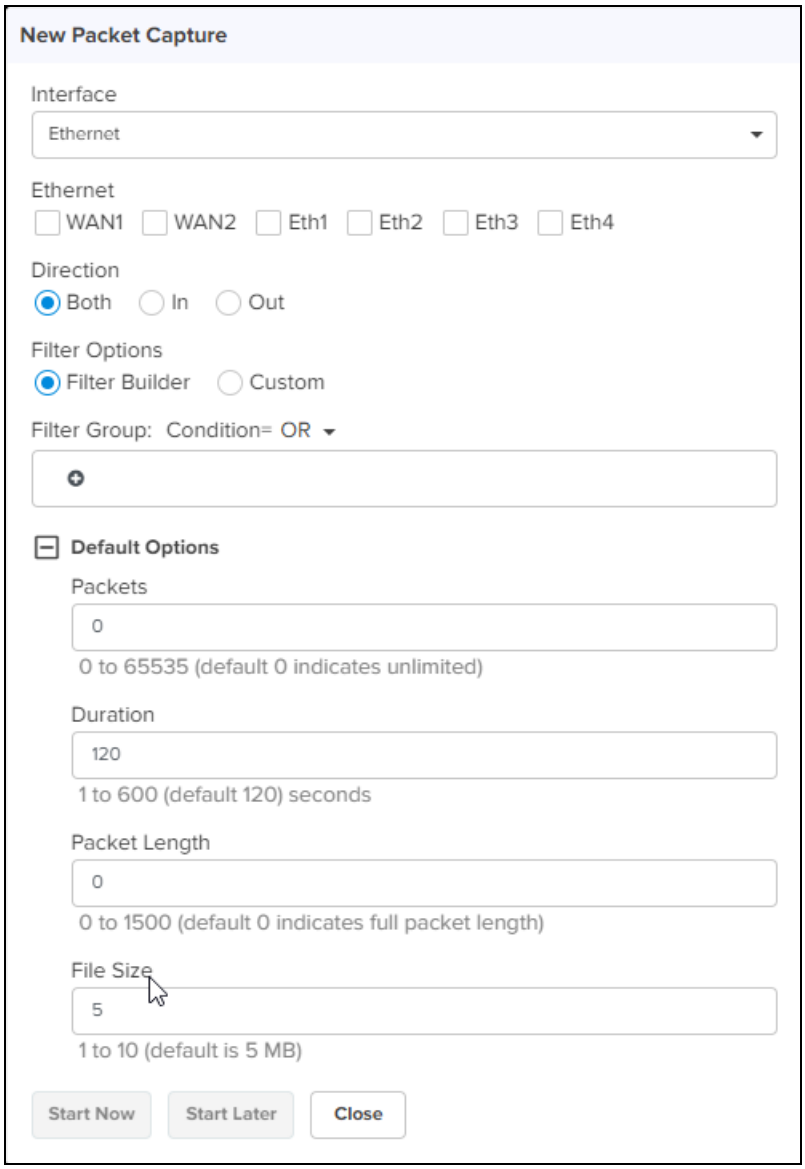
To run CLI commands, navigate to **NSE > Tools > Remote CLI** page, enter the **Command** and then click **Run**:



To do packet capture on the NSE device, navigate to **NSE > Tools > Packet Capture** page and follow these steps:

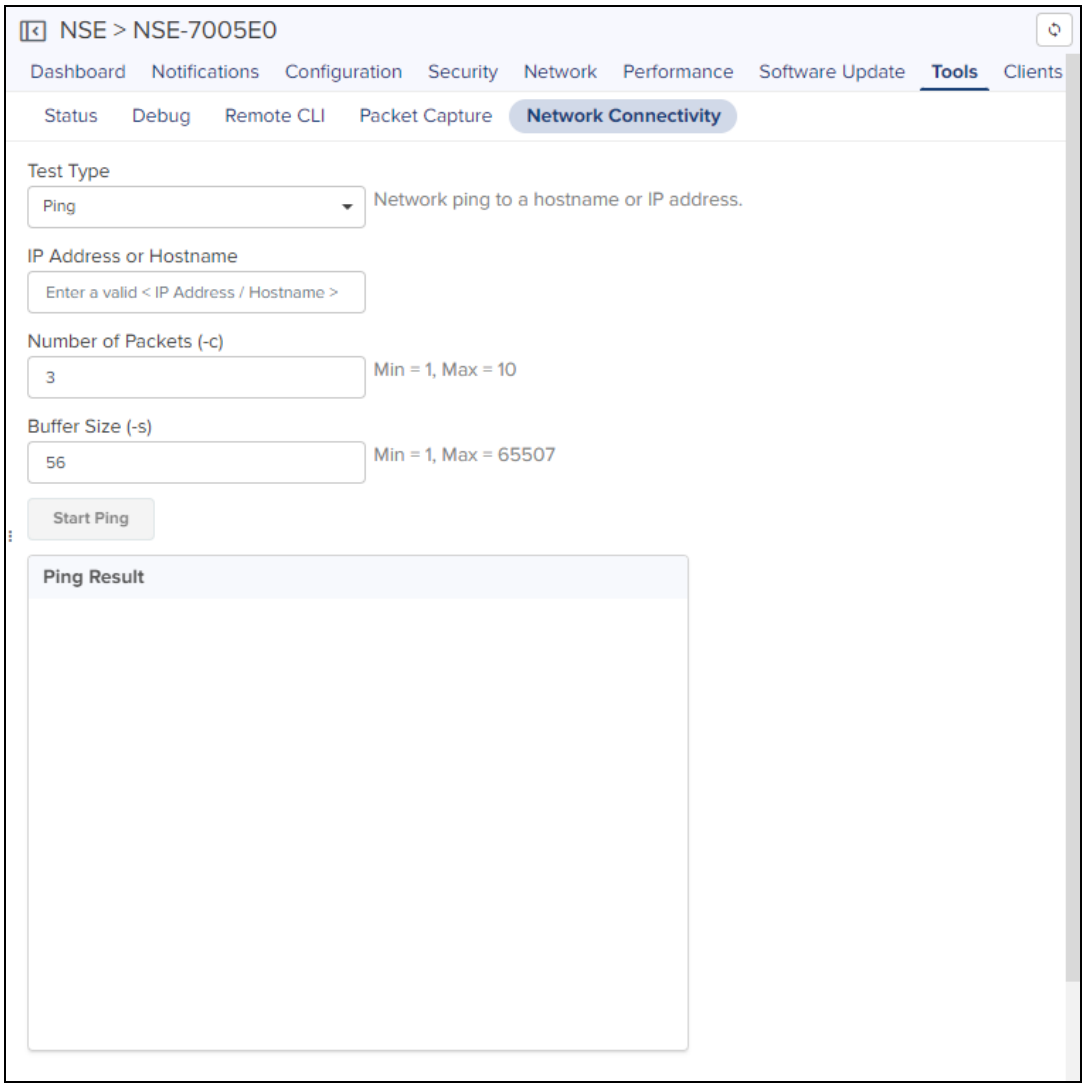


1. Click **New Packet Capture** and complete the details.



2. Click either **Start Now** or **Start Later** and then click **Close**.
3. If you had clicked **Start Later**, you can start the packet capture by clicking the right pointed triangle in the right most column of the interface details list.

To check the network connectivity, navigate to **NSE > Tools > Network Connectivity** page, complete the details, and then click **Start Ping**:

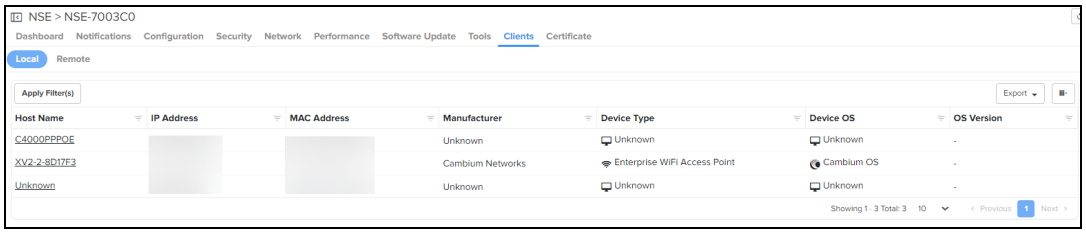


Clients

Clients page displays the Local and Remote clients (VPN clients).

Local

The Local page displays the total client count which are connected to the NSE on the LAN side. Using device finger printing NSE provides **Device Type, Device OS, and OS Version.**



Click **Host Name**. It navigates to detailed Client Dashboard as shown in Figure 138.

Remote

The **Remote** page displays client count (vpn client) connected on the WAN side.

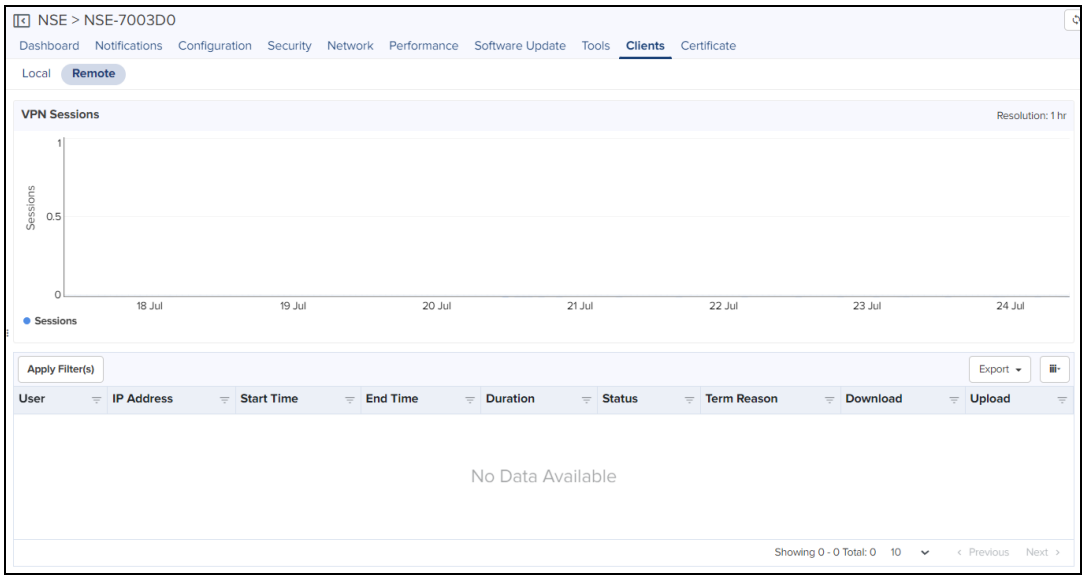


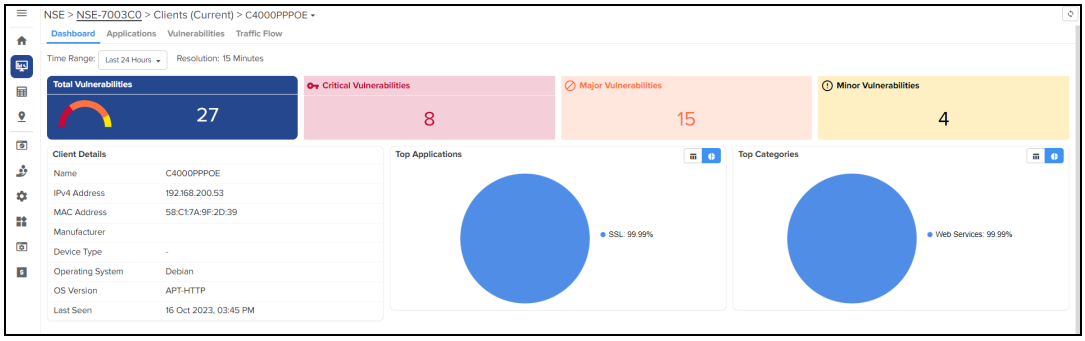
Table 48: Parameters displayed in VPN sessions

Parameter	Description
VPN Sessions	
User	VPN user name.
IP Address	IP Address assigned to the VPN client.
Start Time	VPN session start time.
End Time	VPN session end time.
Duration	Total session duration.
Status	Session status as active or inactive.
Term Reason	Terminated reason of the session disconnected or timeout.
Download	Total download by the VPN user.
Upload	Total upload by the VPN user.

Client Dashboard

Dashboard provides overview of the wired and wireless clients usage. Click the piechart to view specific application usage.

Figure 138 Client Dashboard

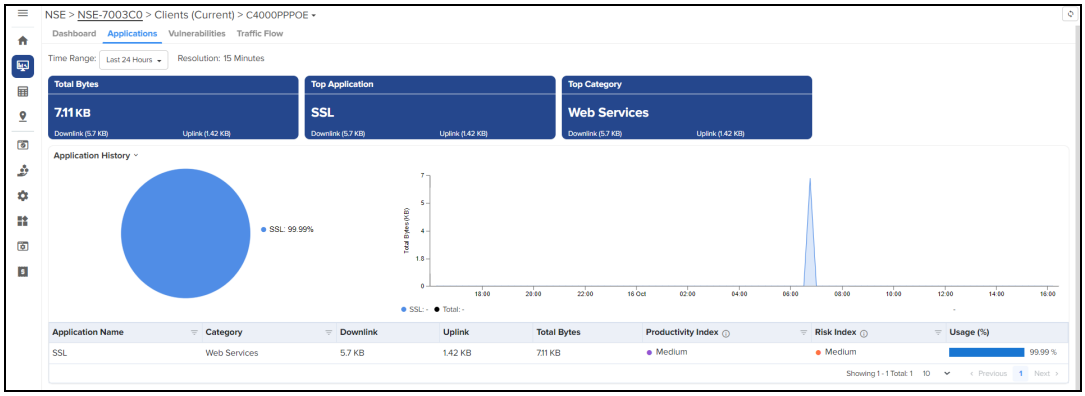


The following parameters are displayed for NSE Clients:

- Total Vulnerabilities
- Critical Vulnerabilities
- Major Vulnerabilities
- Minor Vulnerabilities
- Client Details
- Top Applications
- Top Categories

Applications

The Applications tab displays **Application History, Top Application**, **Top Category**, and **Total Bytes.**



The Application data can be presented most for 24 hours or 7 days.

- **Top Application**: Represent the most used application by the client.
- **Total Bytes**: Represents the sum of Uplink and Downlink traffic across all applications used by the client.
- **Top Category**: Category of the top application used by the client.

Table 49: Parameters on the Applications page

Field	Description
Application Name	Name of the application.
Category	Category of the application.
Downlink	Total number of downlink bytes during the period selected.

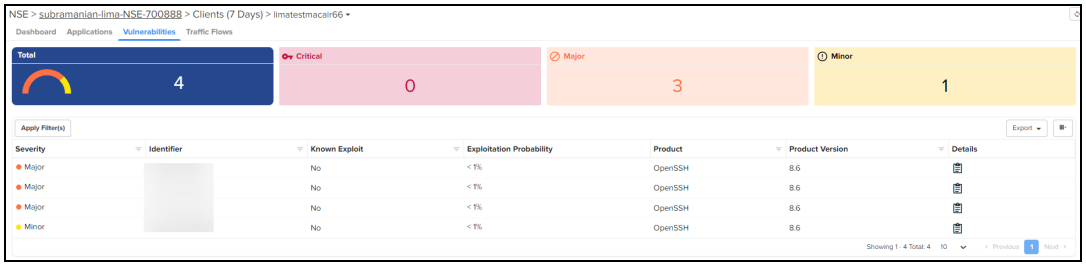
Table 49: Parameters on the Applications page

Field	Description
Uplink	Total number of uplink bytes during the period selected.
Total Bytes	Total amount of application data (uplink plus downlink).
Productivity Index	The estimate of the typical productivity of the application. A higher value means better productivity.
Risk Index	The estimate of the typical security risk of the application. A higher value means greater risk.
Usage	The percentage of usage by this application in comparison to all applications.

Vulnerabilities

The **Vulnerabilities** page displays the vulnerabilities discovered for the client by the NSE. Vulnerabilities are categorized as Minor, Major, and Critical.

Figure 139 Vulnerabilities dashboard



Traffic Flows

Traffic flows can be referred to as a current snapshot of existing flows. The flow direction can be either LAN to WAN or WAN to LAN.

The **Traffic Flows** page displays the active connections or flows of a client, as shown in Figure 140.

Figure 140 The Traffic Flows page

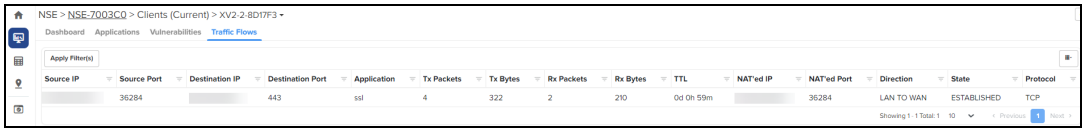


Table 50: Parameters on the Traffic Flows page

Parameter	Description
Source IP	Source IP address of the device or endpoint, based on the flow direction. If the flow direction is from LAN to WAN, the source IP address is the source IP address of the device. If the flow direction is from WAN to LAN, the source IP address is the source IP address of the endpoint to which the device has connection to.
Source Port	Source port number.
Destination IP	Destination IP address of the device or endpoint, based on the flow direction. If the flow direction is from LAN to WAN, the destination IP address is the destination IP address of the endpoint. If the flow direction is from WAN to LAN, the destination IP address is the destination IP address of the device.
Destination Port	Destination port number.
Application	Name of the application.
Tx Packets	Transmitted packets.
Tx Bytes	Transmitted bytes.
Rx Packets	Received packets.
Rx Bytes	Received bytes.
TTL	Time to live. Time period during which a session or connection is active.
NAT'ed IP	IP address after the Network Address Translation (NAT) process.
NAT'ed Port	Port number after the NAT process.

Table 50: Parameters on the Traffic Flows page

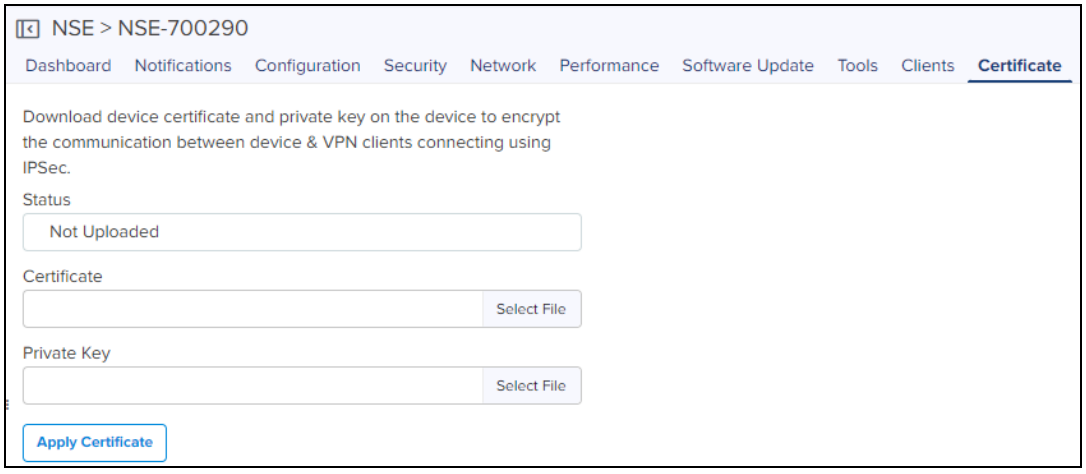
Parameter	Description
Direction	Direction of the communication, indication whether it is incoming or outgoing. Outgoing: LAN to WAN Incoming: WAN to LAN
State	Current state of a connection. The following connection states are valid only if the protocol is TCP. • SYN_SENT • SYN_RECV • ESTABLISHED • FIN_WAIT • CLOSE_WAIT • LAST_ACK • TIME_WAIT • CLOSE
Protocol	Name of the protocol, such as TCP, UDP, ICMP, or any.

Certificate

To secure the communication between an NSE device and the VPN clients, you can encrypt the communication. To apply the encryption certificate, navigate to **NSE > Certificate**, upload the certificate and the key files, and then click **Apply Certificate**.

Note: Only certificates with "**.der**" and "**.pem**" file extensions are accepted.

Figure 141 The Certificate page



Wireless LAN Dashboards

Wi-Fi Monitoring

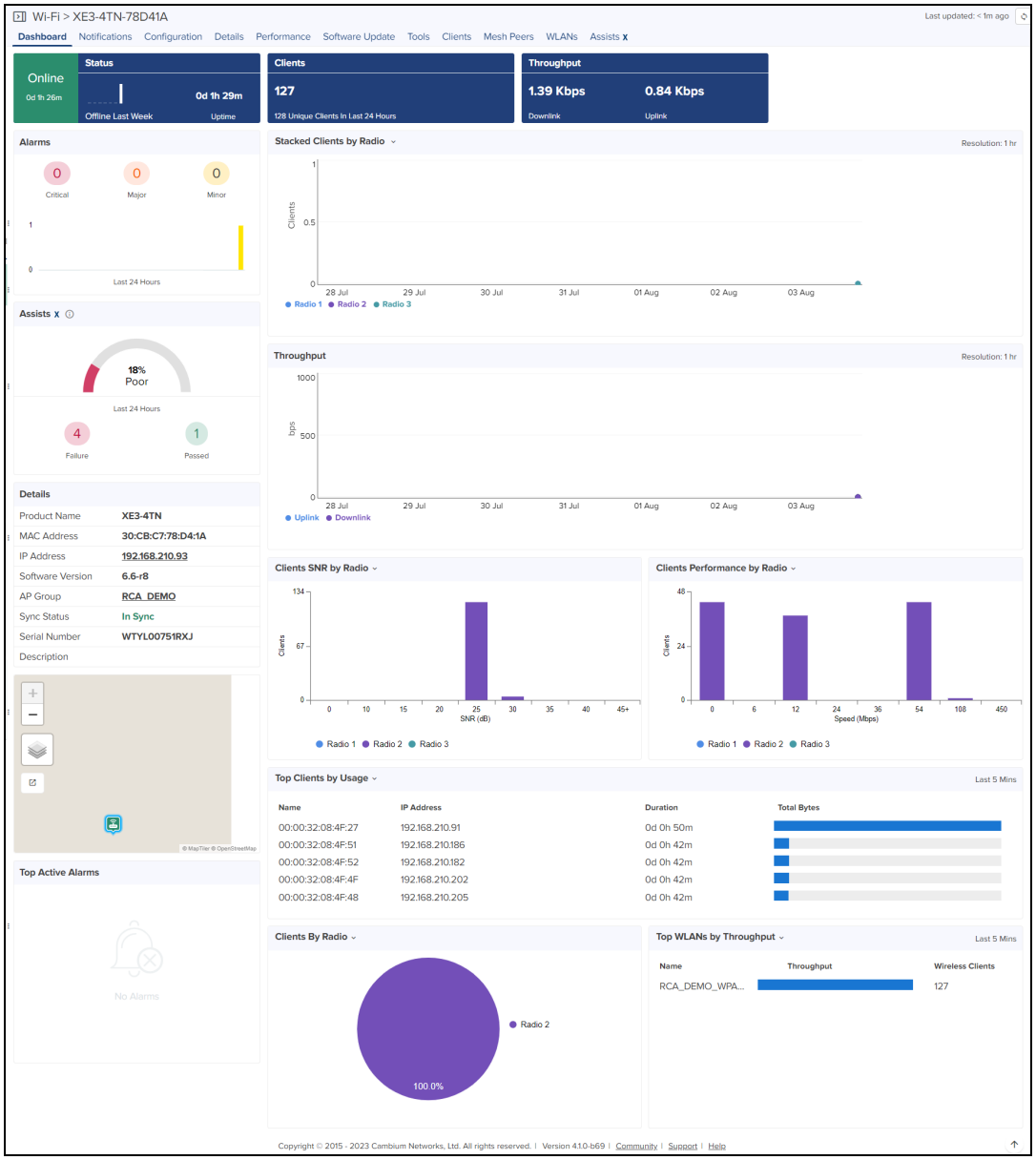
The Wi-Fi Monitoring pages include the following:

- Dashboard
- Clients
- Details
- Mesh Peers
- Wireless LAN Dashboards

Dashboard

The cnPilot Dashboard displays **Stacked Clients by Radio, Stacked Clients by Band, Clients by Radio, Clients by Band, Details, Status, Throughput, Top Active Alarms, Top Clients by Usage, Top Clients by Session, Top WLANs by Clients,** and **Top WLANs by Throughput**.

Figure 142 Device > Dashboard



Clients

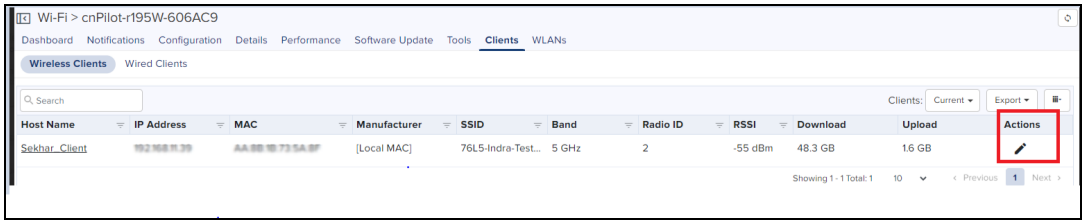
The Clients tab displays the details of all the Wireless and Wired clients.

The following parameters are displayed for Wireless clients for cnPilot Home (R-Series):

- Actions
    - SSID
- Band
- Download
- Host Name
    - Edit Name
- IP Address
- MAC
- Managed Account

- Manufacturer
- RSSI
- Upload

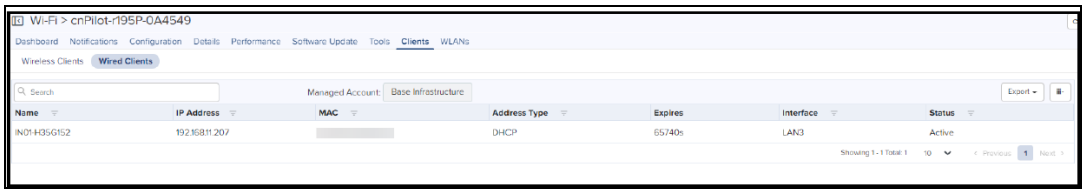
Figure 143 cnPilot Home: Device > Clients > Wireless Clients



The following parameters are displayed for Wired Clients for cnPilot Home (R-Series):

	NOTE: The historical clients are available for 24 Hours and 7 Days for cnMaestro X users.

Figure 144 cnPilot Home (R-Series): Device > Wired Clients



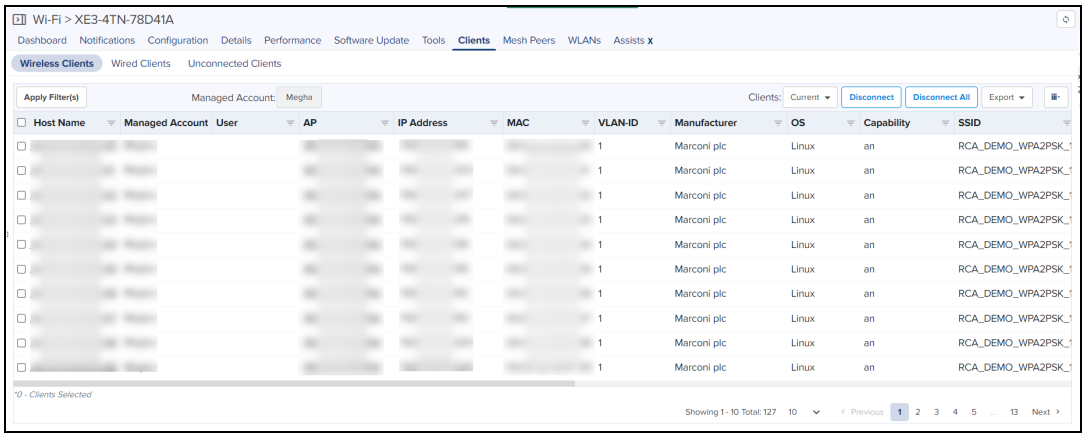
- Actions
    - Edit Name
- Address Type
- Expires
- Interface
- IP Address
- MAC Address
- Name
- Status

The following parameters are displayed for cnPilot E-Series Wireless Clients:

- Actions
- AP
- Auth Status
- Authentication Type
- Band
- Capability
- Client Type
- Download
- Download Quota
- Download Quota Balance

- Guest Access Type
- Host Name
- IP Address
- Last Duration
- Last seen
- MAC
- Managed Account
- Manufacturer
- OS
- Portal Mode
- Radio
- Radio ID
- Radio Mode
- RSSI
- Session Expiry
- SNR
- SSID
- Total Quota
- Total Quota Balance
- Upload
- Upload Quota
- Upload Quota Balance
- User
- VLAN-ID

Figure 145 Enterprise Wi-Fi: Device Dashboard > Wireless Clients



The following parameters are displayed for Wired clients for E-Series:

- Auth Status
- Client Type
- Download
- Download Quota
- Download Quota Balance

- Guest Access Type
- Host Name
- IP Address
- Last Duration
- MAC
- Manufacturer
- OS
- Portal Mode
- Total Quota
- Total Quota Balance
- Upload
- Upload Quota
- Upload Quota Balance
- VLAN-ID

NOTE:

The historical clients are available for 24 Hours and 7 Days for cnMaestro X users in System/ Network/ Site and Device level.

Figure 146 Enterprise Wi-Fi: Device Wired Clients

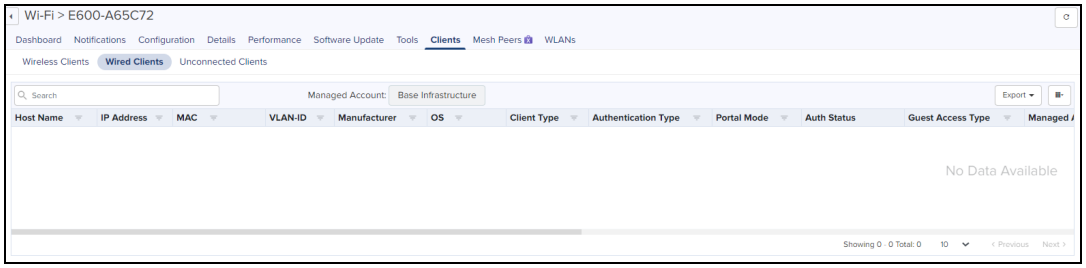
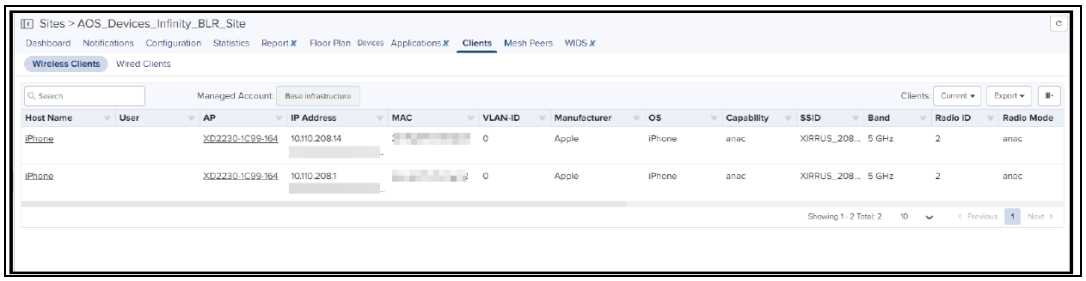


Figure 147 Enterprise Wi-Fi (Xirrus-Series) Wireless Clients

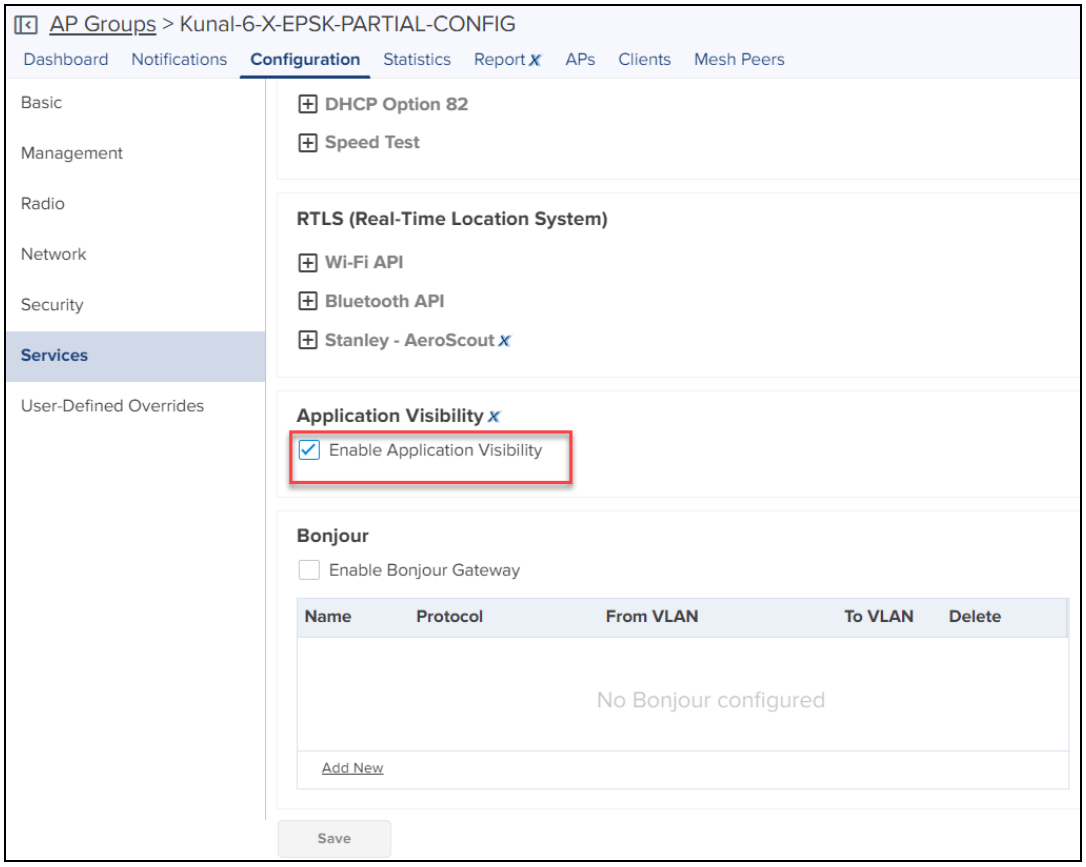


NOTE:

Wired clients are not supported for Xirrus-Series.

Client Dashboard

The user can view the applications used by client when the **Application Visibility** option is enabled as shown below.

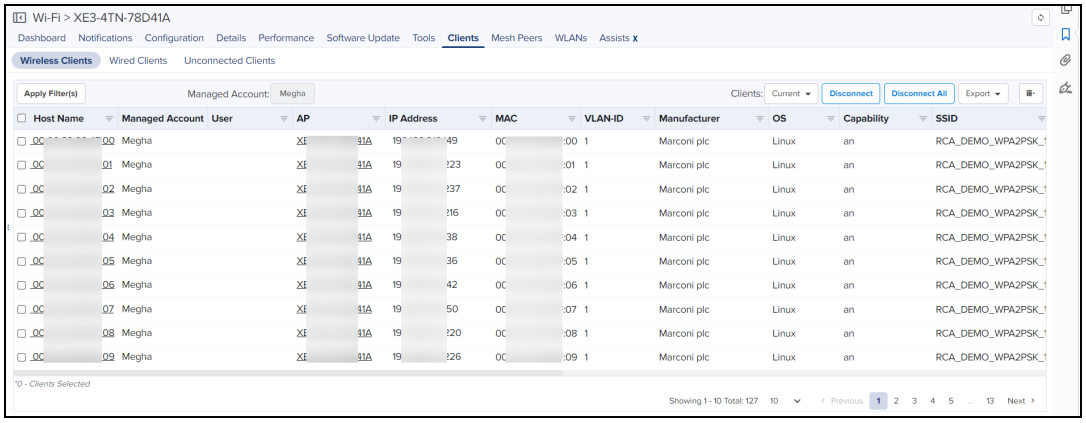


The Client Dashboard displays the details of the clients connected to the Wi-Fi device.

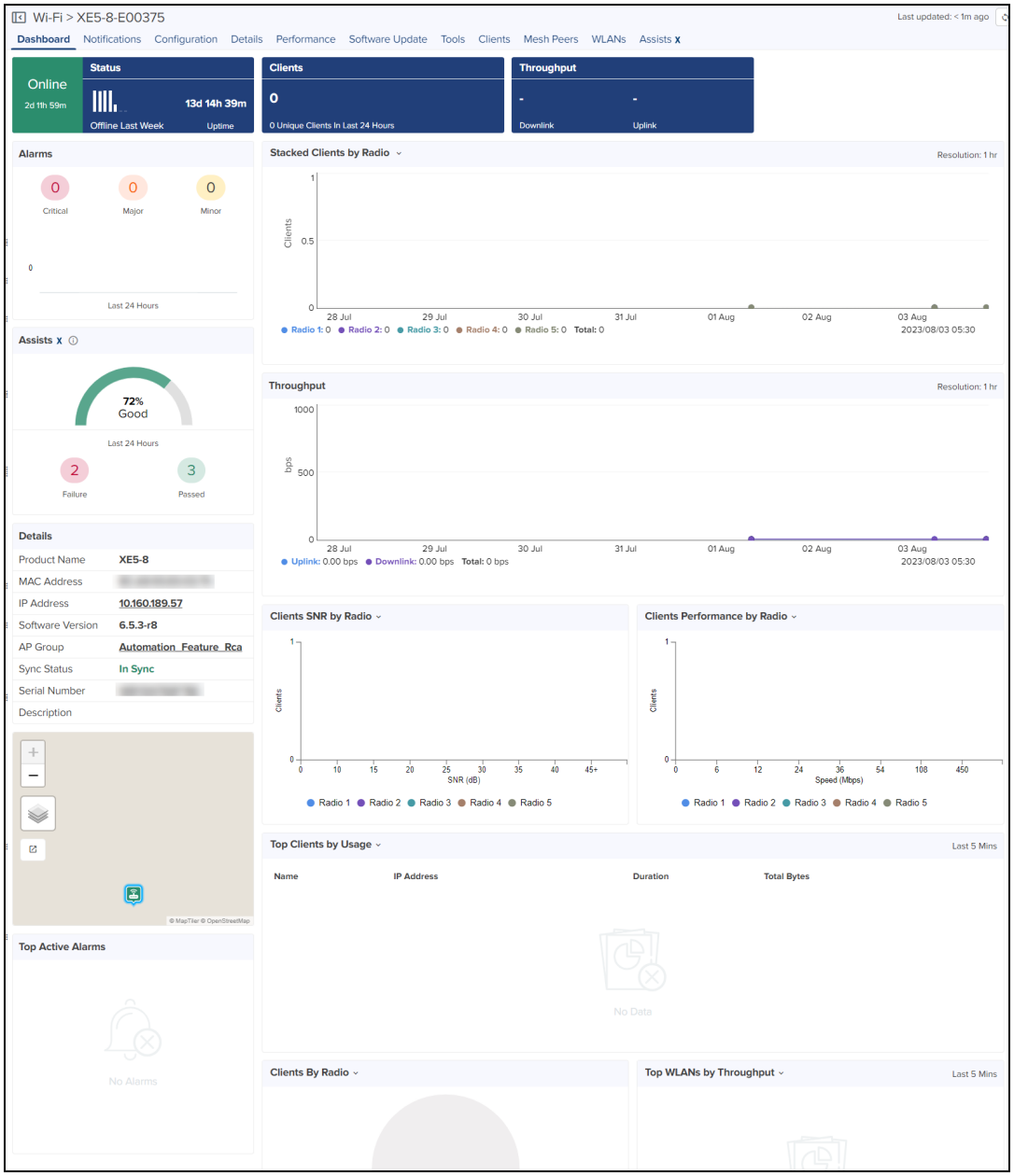
	NOTE: • Enable the **Application Visibility** feature to view **Application** page. It is supported only for XE and XV Series devices. • **Dashboard** is supported for all cnPilot devices. • The historical clients are available for 24 Hours and 7 Days for cnMaestro X users.

To view the **Dashboard**, navigate to **Clients** > **Wireless Clients** and click **Host Name**.

Figure 148 XE and XV Series: Device Dashboard Wireless Client



It navigates to detailed **Client Dashboard,** refer to [Client Dashboard](#).

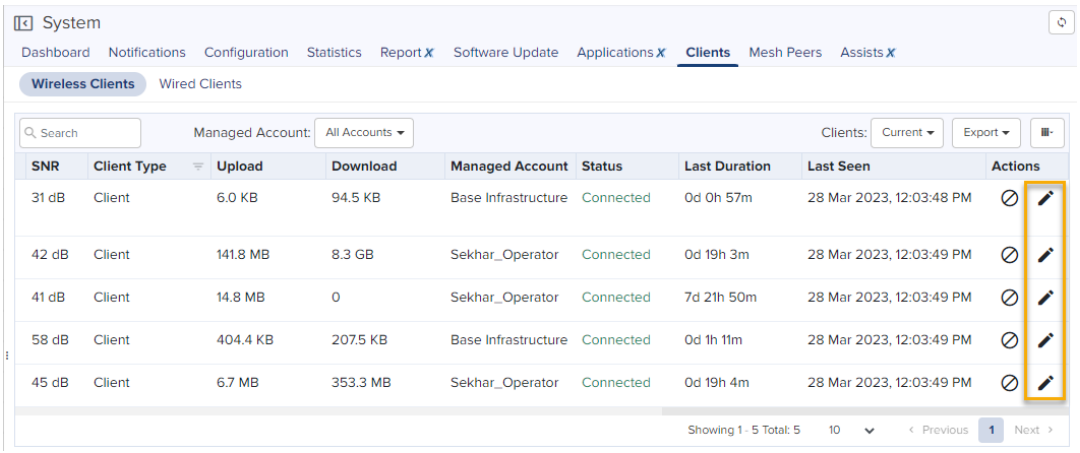


Click the piechart to view specific application usage.

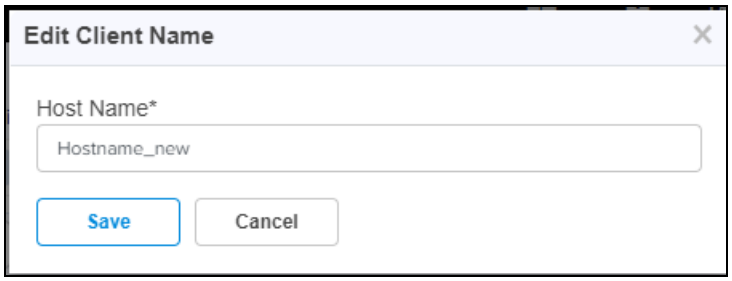
Renaming Client Host-names

You can assign friendly host-names for the clients. To edit the host-name of connected wired or wireless client, follow these steps:

1. Navigate to **Clients > Wireless Clients** or **Wired Clients** tab.



2. Scroll to the right most side of the clients list and click on the **Edit** icon under the **Actions** column.
3. In the **Edit Client Name** pop-up window, enter a friendly name for the client.

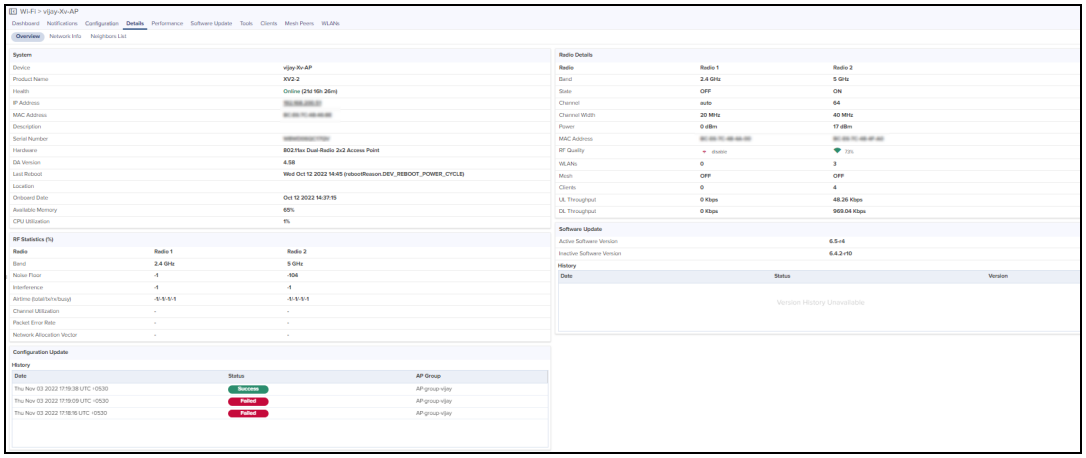


4. Click **Save**.

   The new host-name is displayed in all the places such as the Client Dashboards, Audit logs, and Reports.

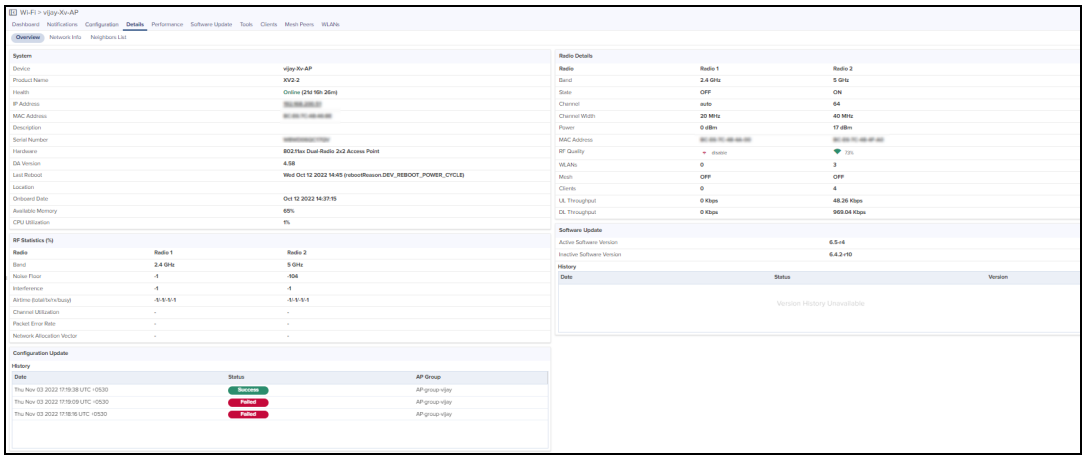
Details

Details page displays the Overview, Network Info, and Neighbors List.



Overview

Overview page provides the information such as System, RF Statistics(%), Configuration Update, Radio Details, Software Update, and History.

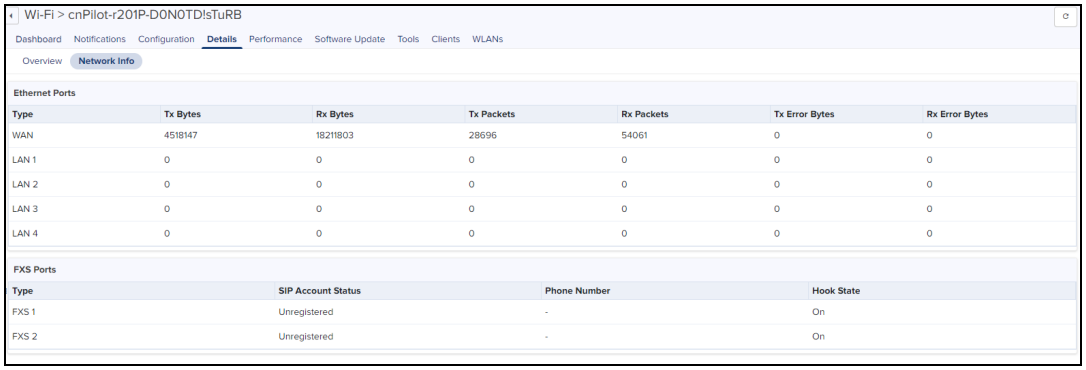


Network Info

The **Details > Network Info** section displays following parameters for cnPilot Home (R-Series) router:

- Ethernet Ports
  - Rx Bytes
  - Rx Error Bytes
  - Rx Packets
  - Tx Bytes
  - Tx Error Bytes
  - Tx Packets
  - Type
- FXS Ports
  - Hook State
  - Phone Number
  - SIP Account Status
  - Type

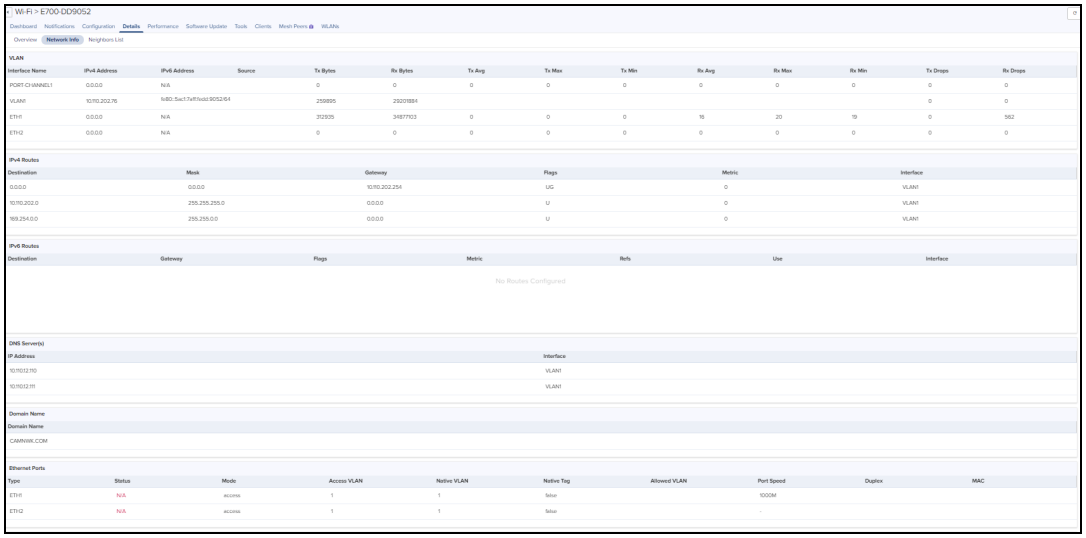
Figure 149 cnPilot Home: Device > Details > Network Info



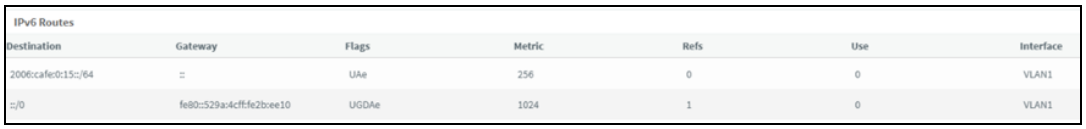
The following parameter details are displayed in E-Series:

- Ethernet Ports
- PPPoE
- Routes
- Tunnels
- VLAN Pool

Figure 150 Enterprise Wi-Fi: Device >Details > Network Info



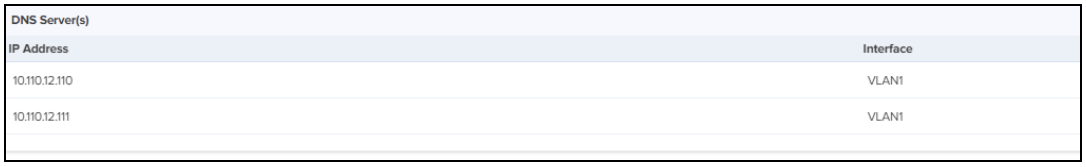
IPv6 Routes



IPv6 Routes

Destination	Gateway	Flags	Metric	Refs	Use	Interface
2006:cafe:0:15::/64	::	UAe	256	0	0	VLAN1
::/0	fe80::529a:4cff:fe2b:ee10	UGDAe	1024	1	0	VLAN1

DNS Servers



DNS Server(s)

IP Address	Interface
10.110.12.110	VLAN1
10.110.12.111	VLAN1

The following parameter details are displayed in E-Series:

- Port
- Rx Broadcasts
- Rx Frames
- Rx Frames Oversize
- Rx Frames Undersize
- Rx Frames with Error
- Rx Octets
- Tx Broadcasts
- Tx Frames
- Tx Octets

Figure 151 Enterprise Wi-Fi (Xirrus-Series): Device > Dashboard > Network Info

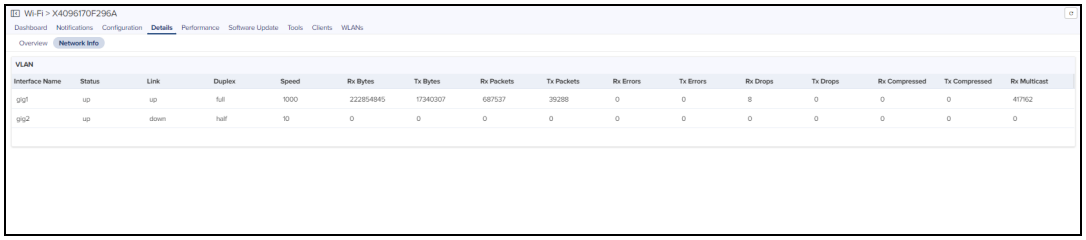
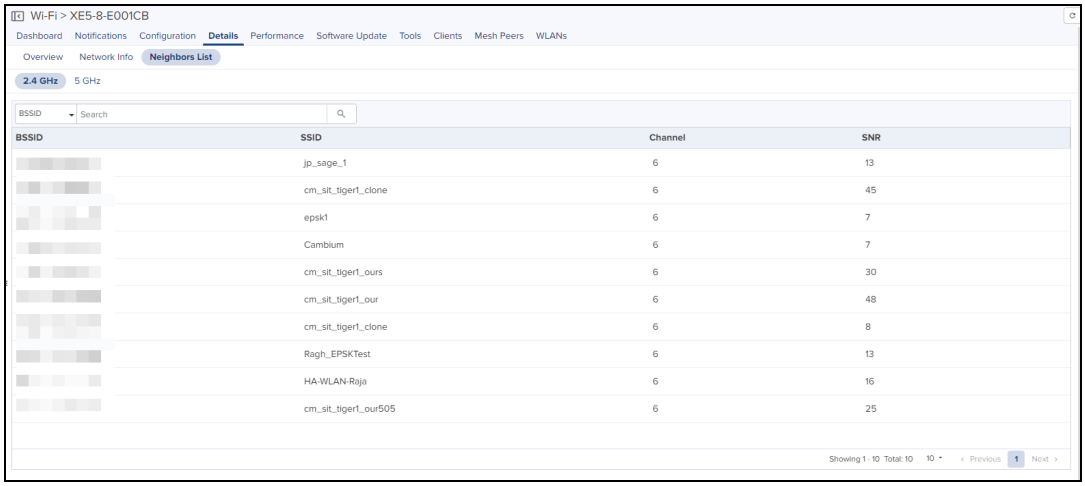


Figure 152 PTP 650/670/700: Device >Details > Network Info

Neighbors List

The **Neighbors List** displays the BSSID, SSID, Channel, and SNR details of neighboring 2.4 GHz and 5 GHz radios.

Figure 153 Neighbors List



PTP 820/850 Details

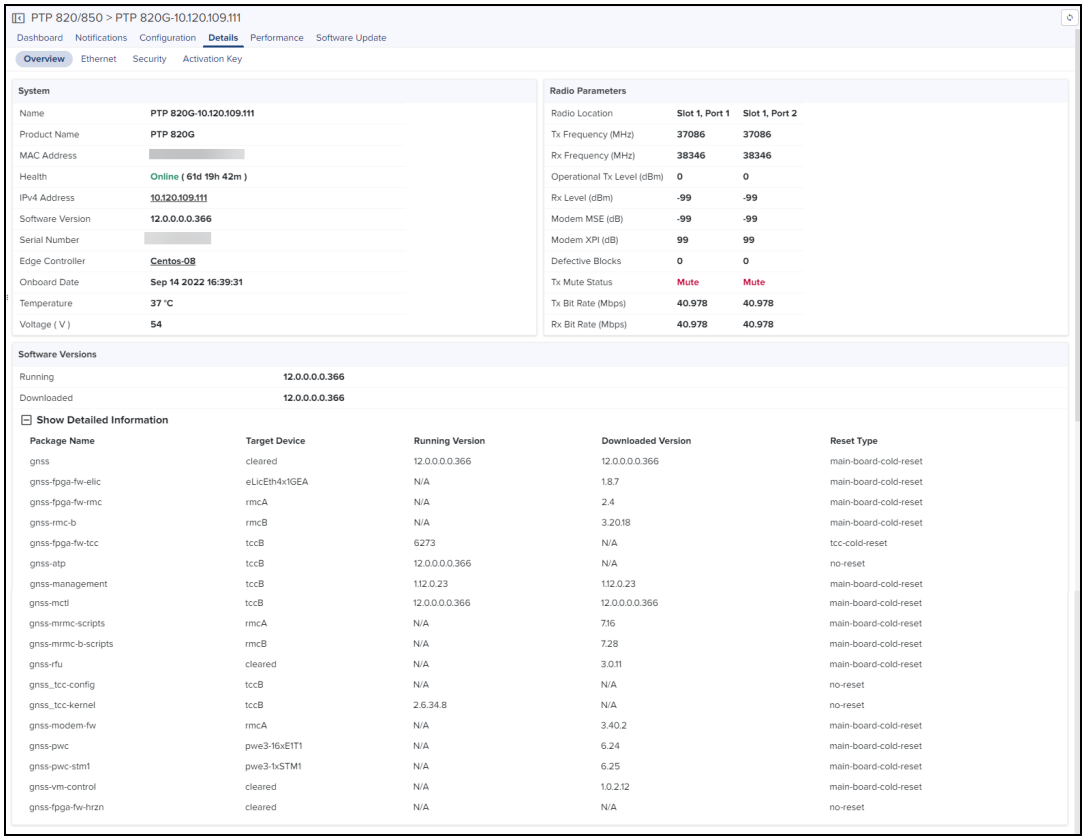
The **Details > Overview** section displays following tabs for PTP 820/850:

- Overview
- Ethernet
- Security
- Activation Key

Overview

Overview page provides the information such as System, Radio Parameters and Software Version.

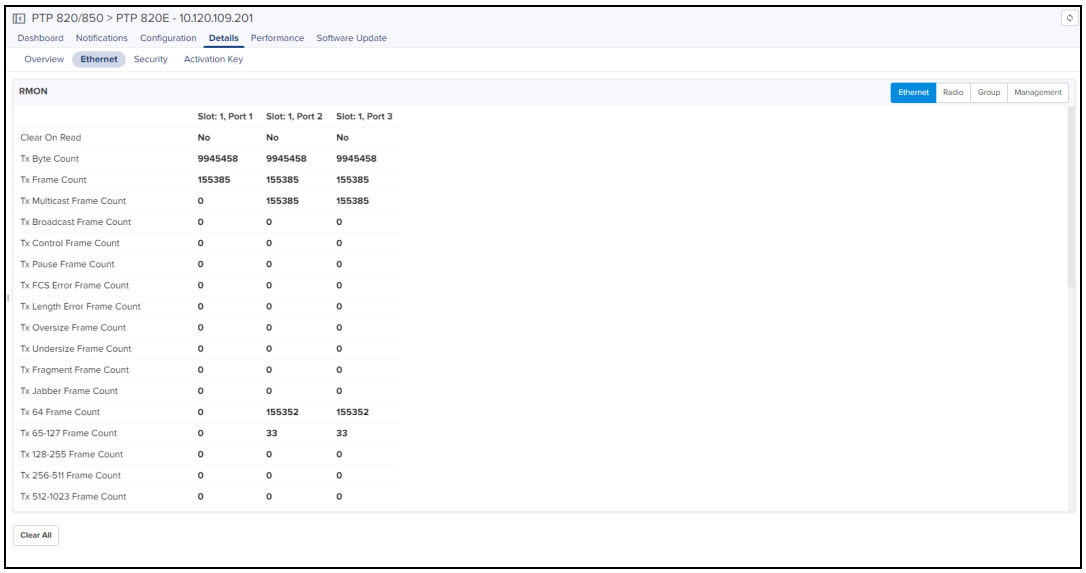
Figure 154 PTP 820/850 : Device > Details > Overview



Ethernet

Ethernet page provides the information RMON.

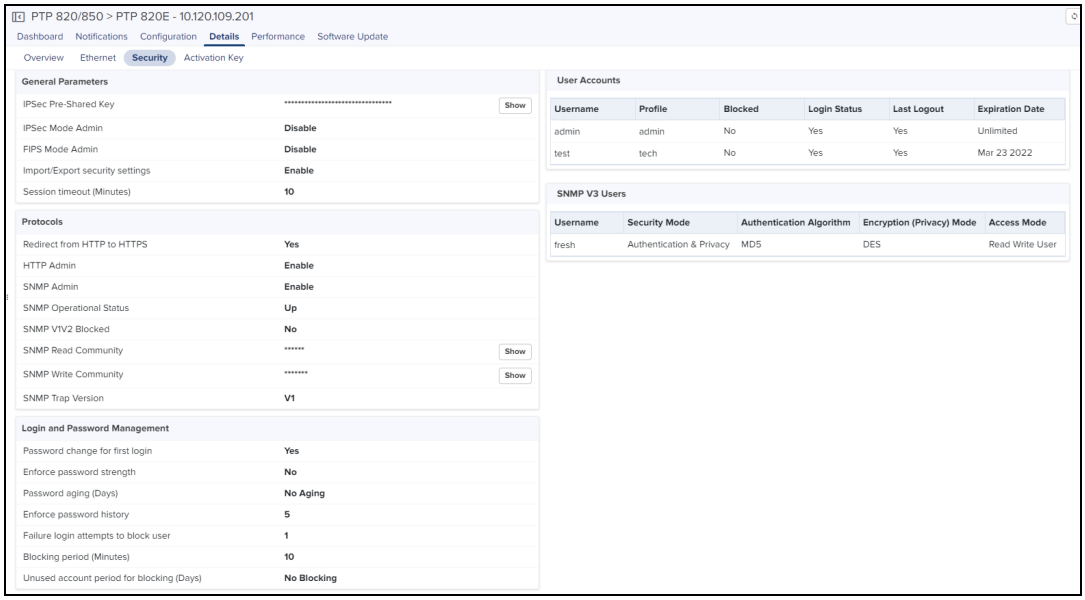
Figure 155 PTP 820/850 : Device > Details > Ethernet



Security

Security page provides the information of General Parameters, Protocols, Login and Password Management, User Account, and SNMP V3 Users.

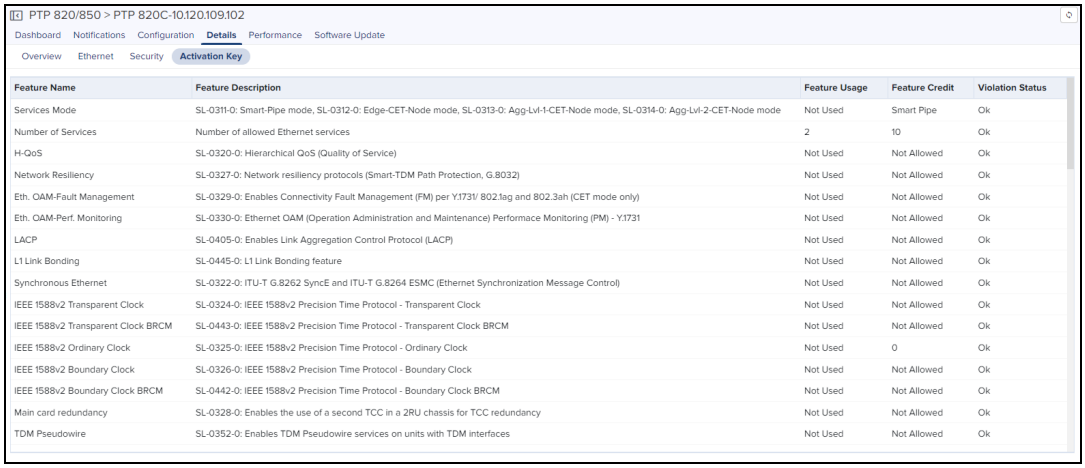
Figure 156 PTP 820/850 : Device > Details > Security



Activation Key

Activation Key provides the information of Feature Name, Feature Description, Feature Usage, Feature Credit, and Violation.

Figure 157 PTP 820/850 : Device > Details > Activation Key



cnWave 5G Fixed Details

cnWave 5G Fixed BTS

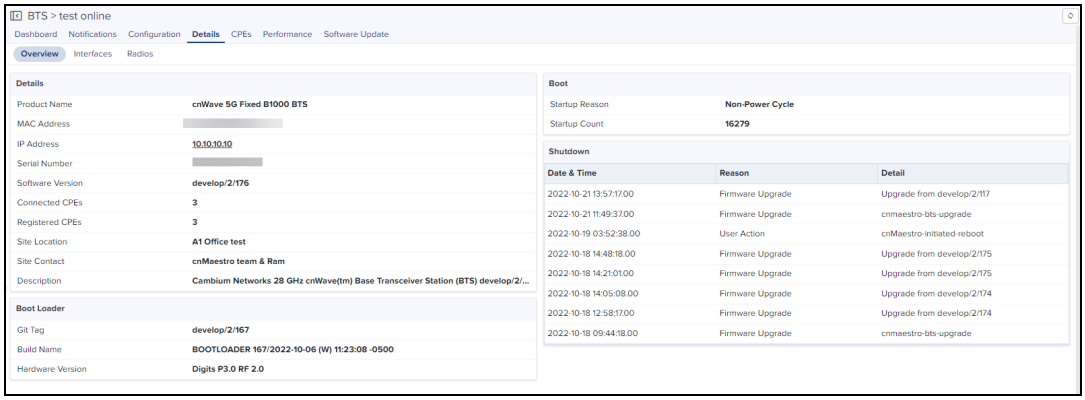
The **Details > Overview** section displays following tabs for cnWave 5G Fixed BTS device:

- Overview
- Interfaces
- Radios

Overview

Overview page provides the information such as Details, Boot Loader, Boot, and Shutdown.

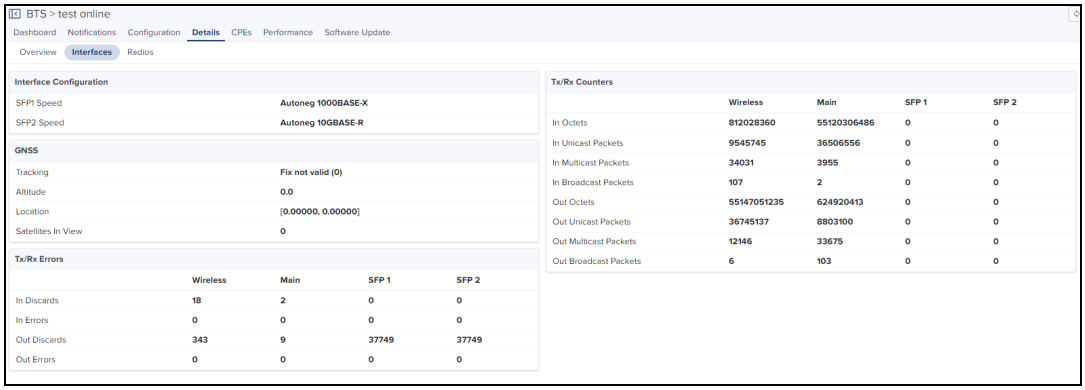
Figure 158 cnWave 5G Fixed: Device > Details > Overview



Interfaces

Interface page provides the information such as Interface Configuration, GNSS, Tx/Rx Errors, and Tx/Rx Counters.

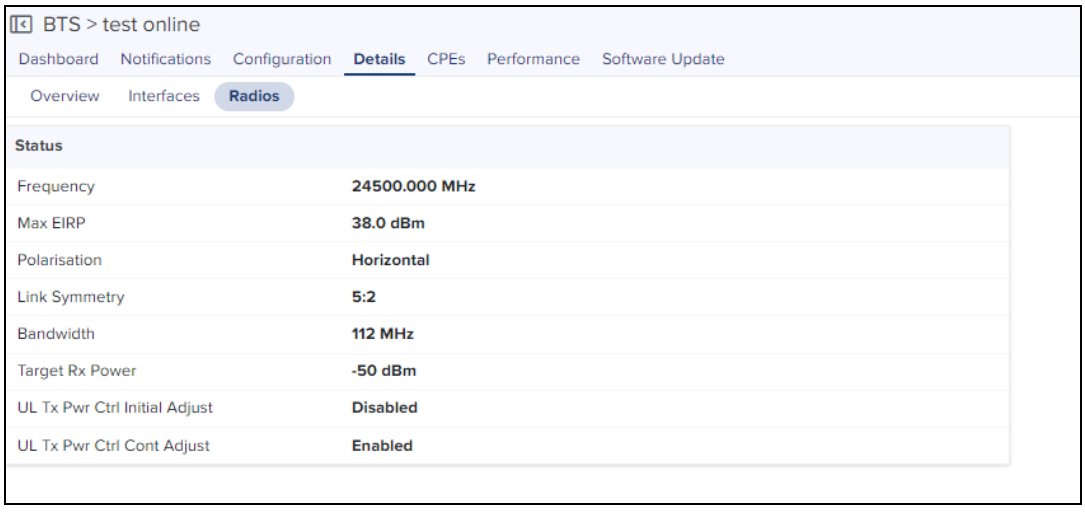
Figure 159 cnWave 5G Fixed BTS: Device > Details > Interfaces



Radios

Radios page provide the details of radios.

Figure 160 cnWave 5G Fixed BTS: Device > Details > Radios



cnWave 5G Fixed CPE

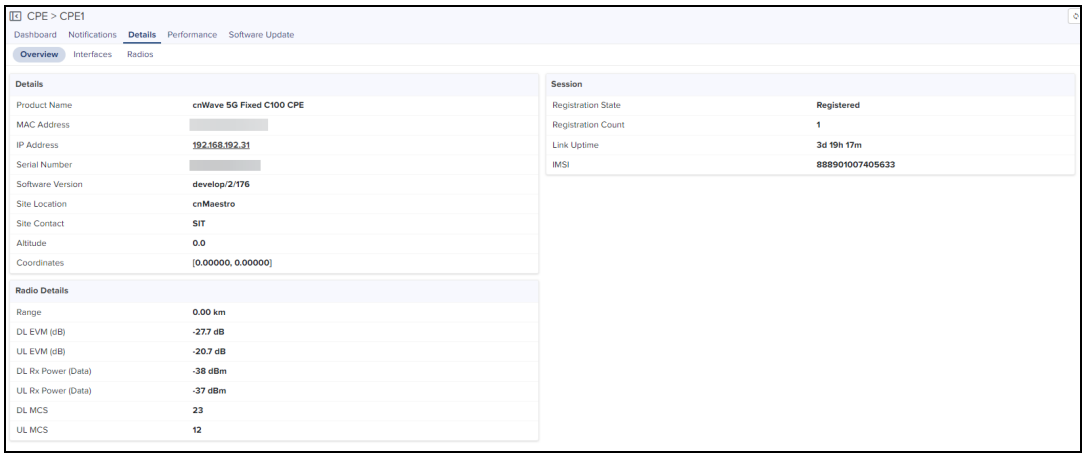
The **Details** section displays following pages for cnWave 5G Fixed CPE device:

- Overview
- Interfaces
- Radios

Overview

Overview page provides the information such as Details, Radio Details, and Sessions.

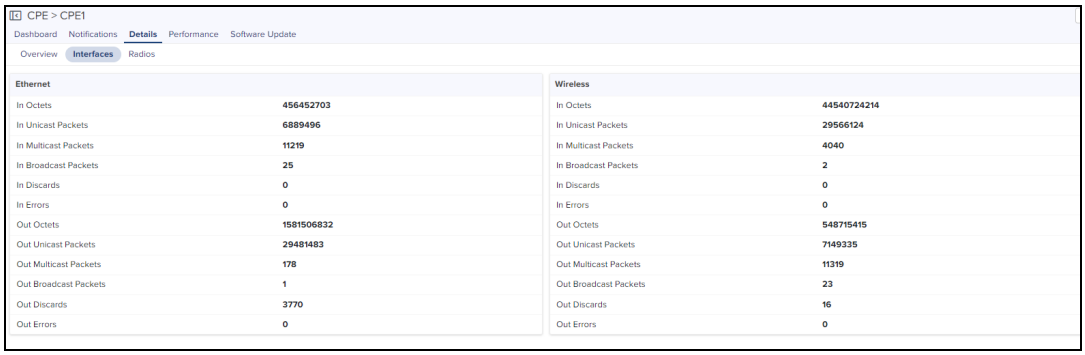
Figure 161 cnWave 5G Fixed CPE: Device > Details > Overview



Interfaces

Interface page provides the information such as Ethernet and Wireless.

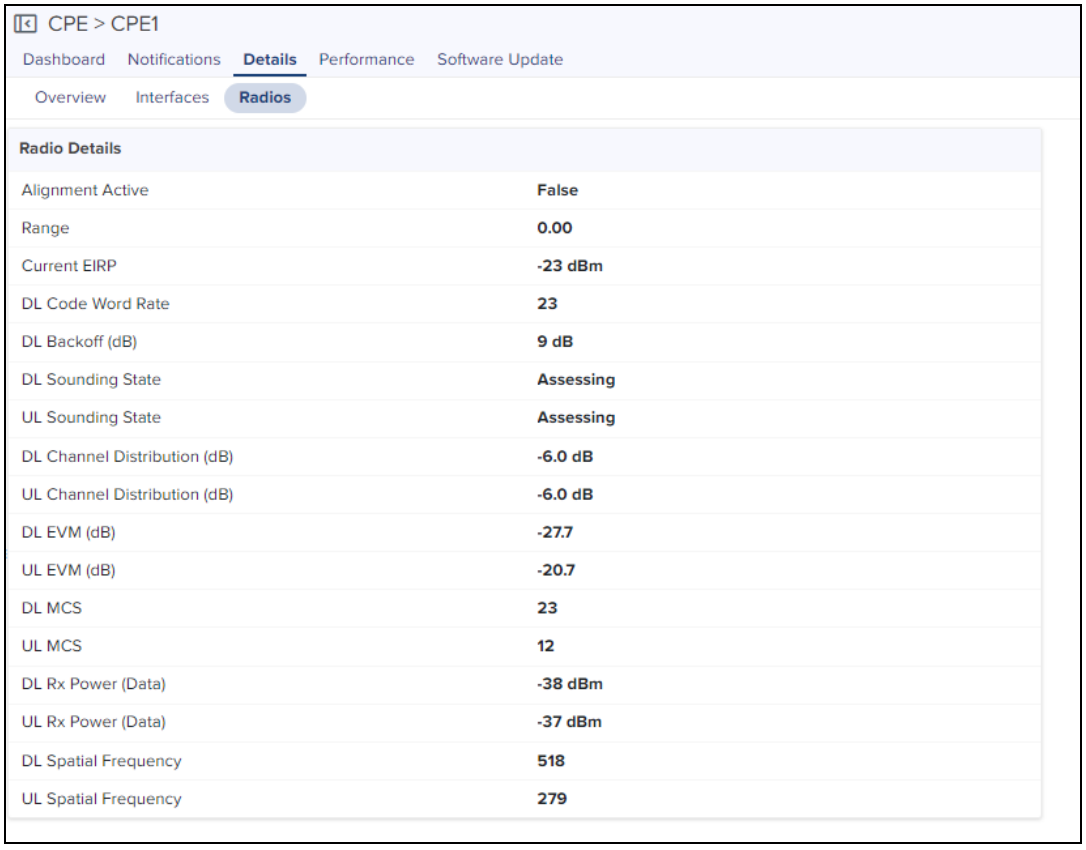
Figure 162 cnWave 5G Fixed CPE: Device > Details > Interfaces



Radios

Radios page provide the details of radio details.

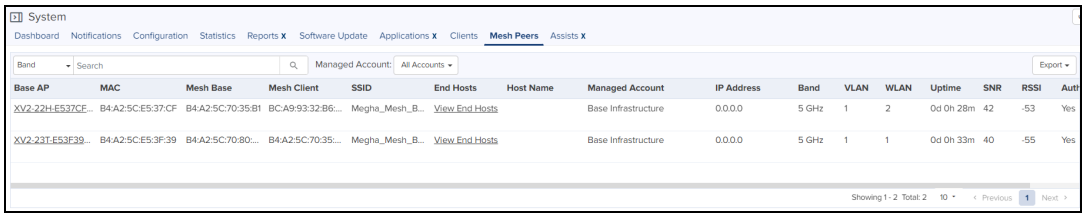
Figure 163 cnWave 5G Fixed CPE: Device > Details > Radios



Mesh Peers

The Mesh Peers tab displays information related to mesh such as SNR, RSSI, and Band. This provides insight to the performance between the Mesh Client and Mesh Base.

Figure 164 Device > Mesh Peers



Roaming History for Mesh Peers

To view the **Information** and **Roaming History,** perform the following**:**

In **the Mesh Peers** tab, click the **Host Name.**

A detailed Information and Roaming History window pops up.

Figure 165 Mesh Peers > Host Name > Information

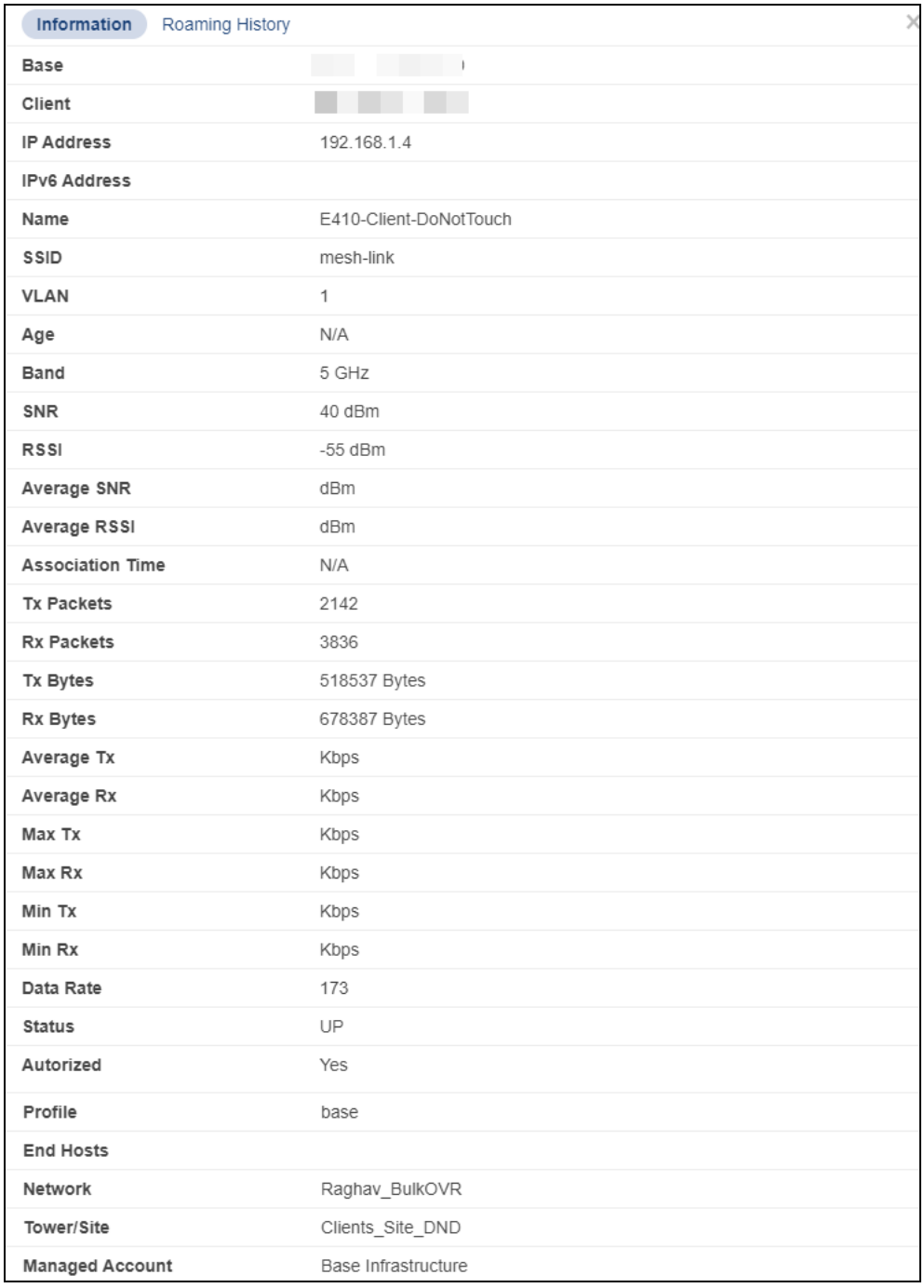
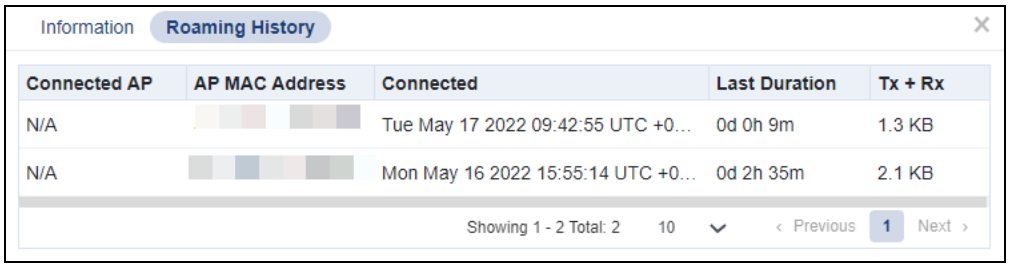
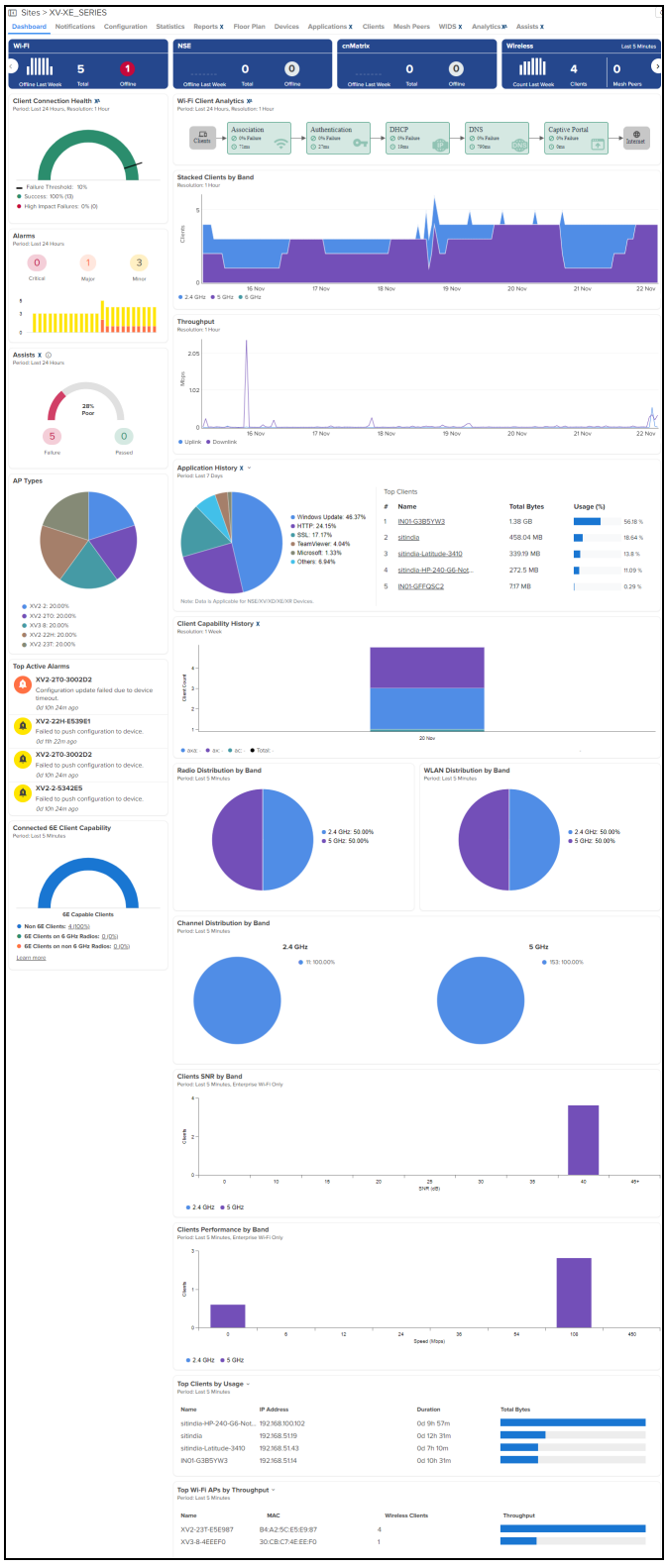


Figure 166 Mesh Peers > Host Name > Roaming History



Site Dashboard

The Site Dashboard provides the overview of site related parameters and devices.

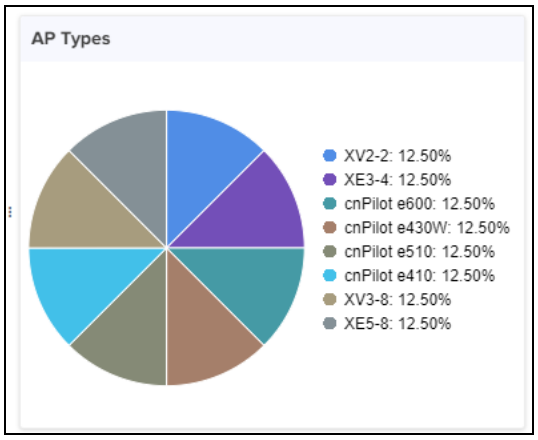


The Site Dashboard displays the following graphics:

- AP Types
- Channel Distribution by Band

- Clients by Performance by Band (Enterprise Wi-Fi)
- Clients by SNR by Band (Enterprise Wi-Fi)
- Connected 6E Client Capability
- Radio Distribution by Band
- Stacked Clients by Band
- Throughput
- Throughput Graph
- Top Wi-Fi APs by Throughput
- Wi-Fi Devices Availability (Total and Offline)
- Wireless Clients Graph
- WLAN Distribution by Band

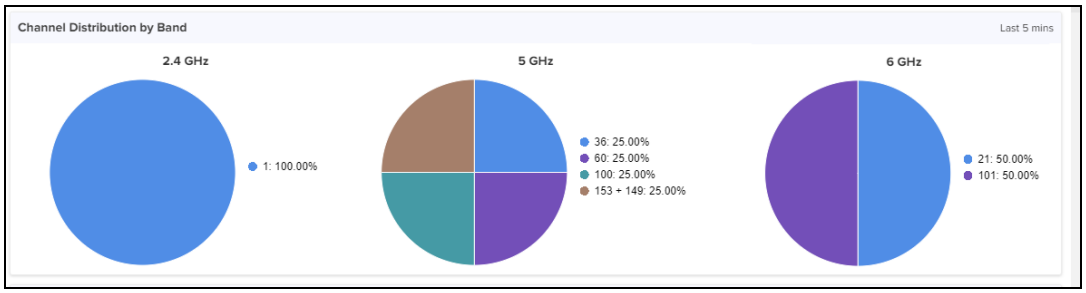
AP Types



Stacked Clients by Band

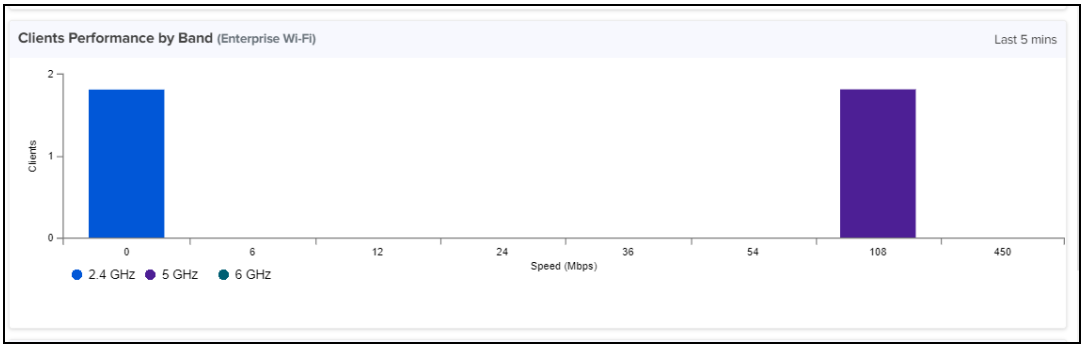
Channel Distribution by Band

Channel distribution displays usage of channels in 2.4 GHz, 5 GHz and 6 GHz. This helps in planning and implementing WLANs within a high-density environment. It displays the usage details for last 5 minutes.

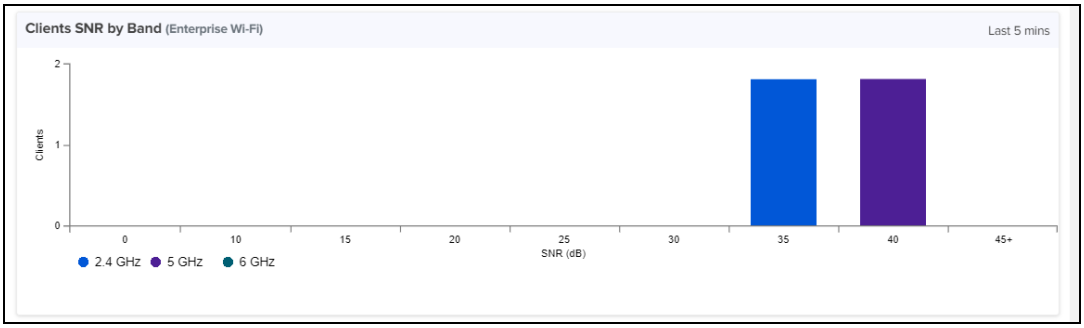


Clients Performance by Band (Enterprise Wi-Fi)

Clients performance details is displayed for last 5 minutes.



Clients SNR by Band (Enterprise Wi-Fi)



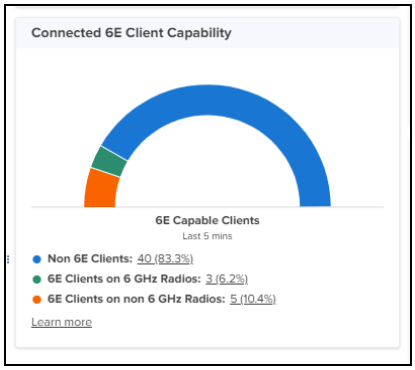
Connected 6E Client Capability

The Connected 6E Client Capability widget presents a point-in-time view of Wi-Fi 6E Clients associating to non-6E radios. These Clients may experience better service if SDR radios are upgraded from 5 GHz to 6 GHz. A high percentage of 6E Capable Clients connecting to non-6E radios is a signal to upgrade radios to 6 GHz. The Connected 6E Client Capability widget is represented using different colors and corresponding percentage values as described below:

- Non 6E Clients: represents non 6E clients connected across the devices at the Site level.
- 6E Clients on 6 GHz Radios: represents 6E clients connected across the devices at the Site level.
- 6E Clients on non 6 GHz Radios: represents 6E clients connected across the devices on non 6 GHz radios at the Site level.

	NOTE: For best results, deploy a few radios in 6G mode in high traffic areas.

Figure 167 Connected 6E Client Capability



Clicking next to clients number navigates to **Wireless Clients** page.

Client Capability History

The Client Capability History graphic displays the highest detected Wi-Fi protocol for Clients active at a Site on weekly basis. Wi-Fi 6E devices are grouped into a single 6E category. A large number of 6E Capable Clients are a signal to expand infrastructure to include 6 GHz radios. If the period of evaluation extends more than a few weeks, the bar chart converts to a line chart.

Figure 168 Clients History in line chart

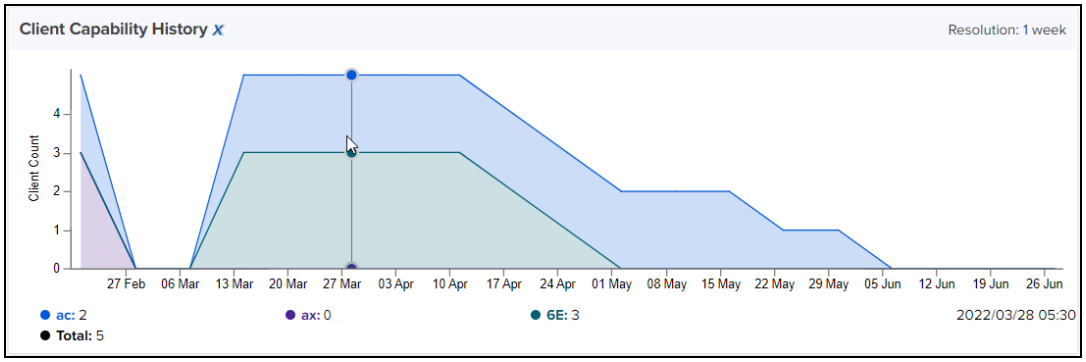
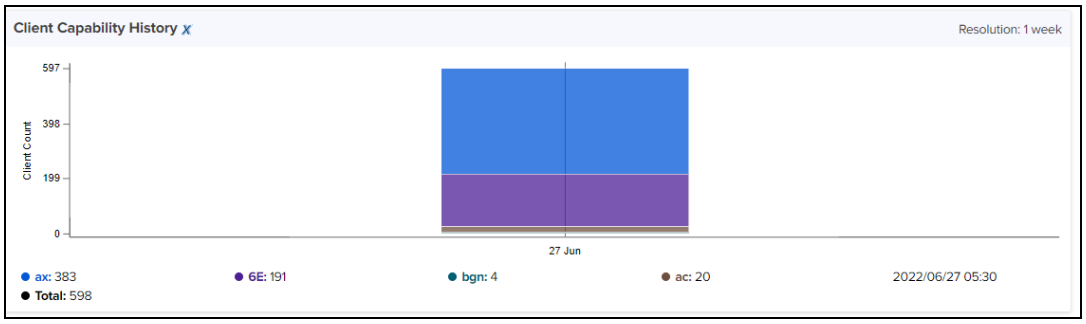
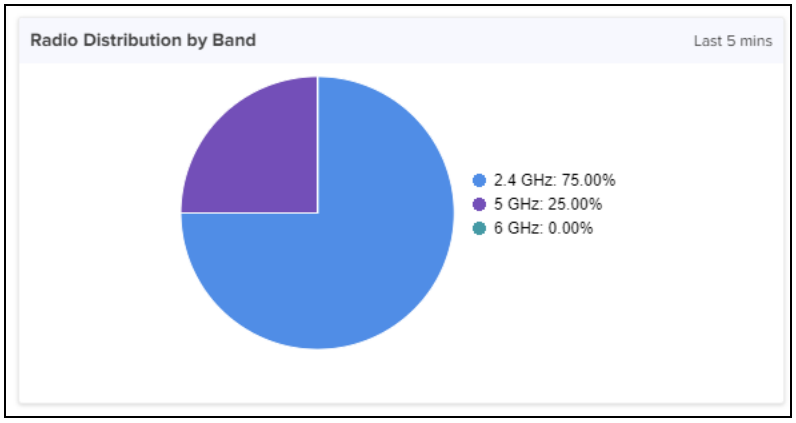


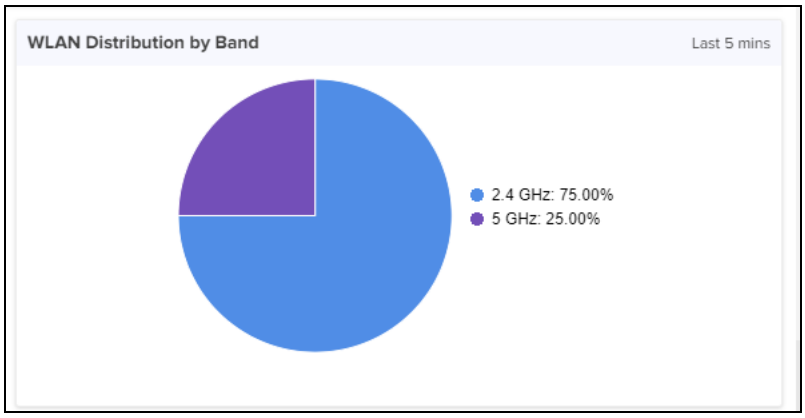
Figure 169 Clients History in bar chart



Radio Distribution by Band

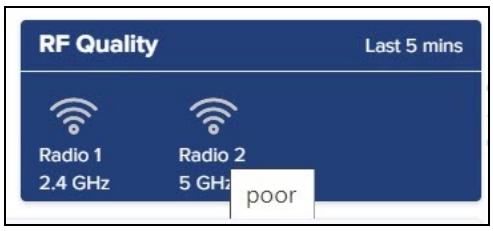


WLAN Distribution by Band



RF Quality

Provides an indication of the current RF Quality across the Site.

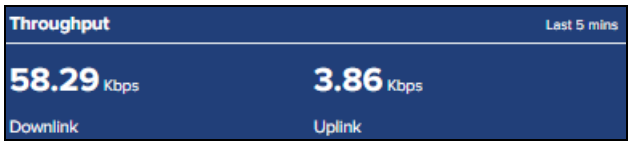


Radio RF Quality Index is an indication of wireless clients and or MESH clients' RF link as seen by the access point radio (AP). It is the average of all the wireless clients and or mesh clients SNR.

- If aggregated SNR is more than 45: RF Quality Index is marked as Excellent
- If aggregated SNR is more than or equal to 35 and below 45: RF Quality Index is marked as Good
- If aggregated SNR is more than or equal to 25 and below 35: RF Quality Index is marked as Average
- If aggregated SNR is less than 25: RF Quality Index is marked as poor

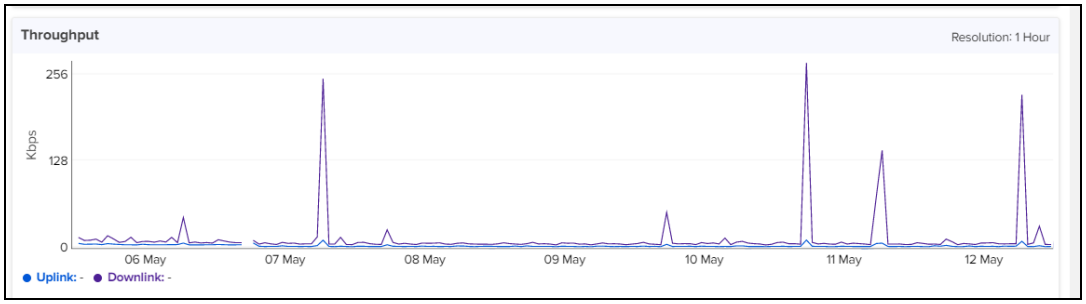
Throughput

Displays aggregated throughput for all the clients.

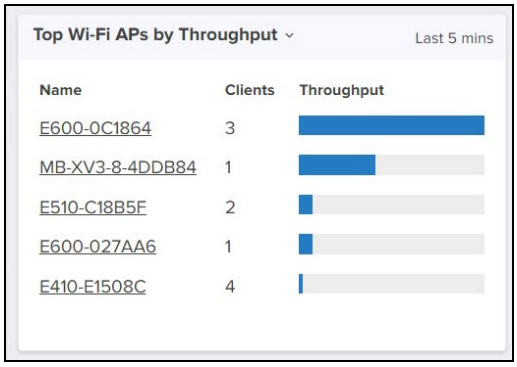


Throughput Graph

Throughput graph displays client traffic for the last week.

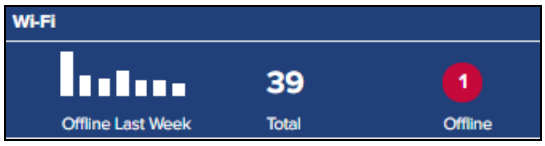


Top Wi-Fi APs by Throughput



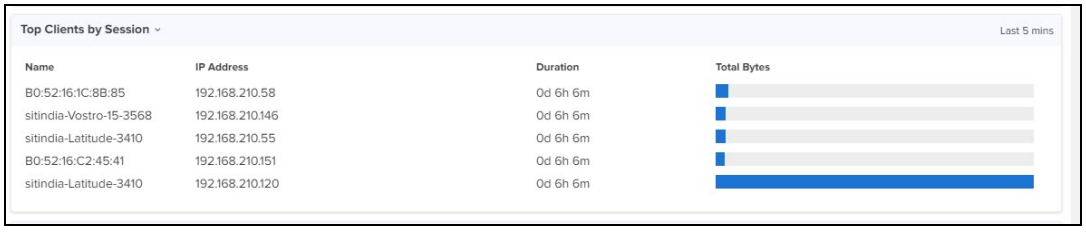
Wi-Fi Devices Availability (Total and Offline)

Displays total number of Access Points in the Site and the devices that are Offline.



Top Clients by Session

Displays the top clients by session and the respective details.

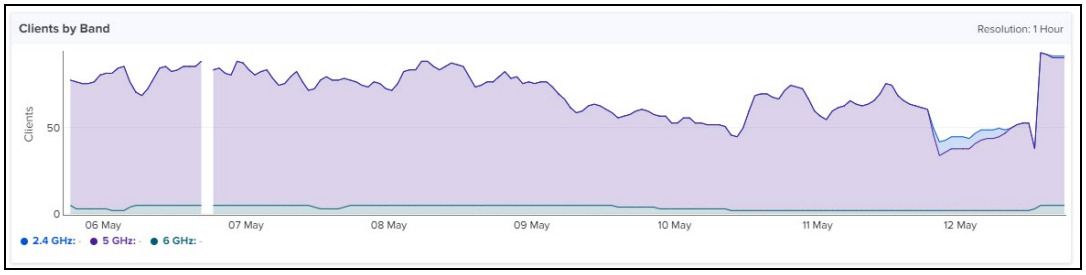


Top Clients by Usage

Displays the top clients by usage and the respective details.

Wireless Clients Graph

Wireless clients graph displays clients that are connected in Radio 1 (2.4 GHz),Radio 2 (5 GHz), and Radio 3 (6 GHz).



Floor Plan

A Floor Plan is used to view APs, device status, connected clients, and transmit power. This is done by creating the floor plan and adding devices. You can upload a floor plan for each floor based on the selected environment type.

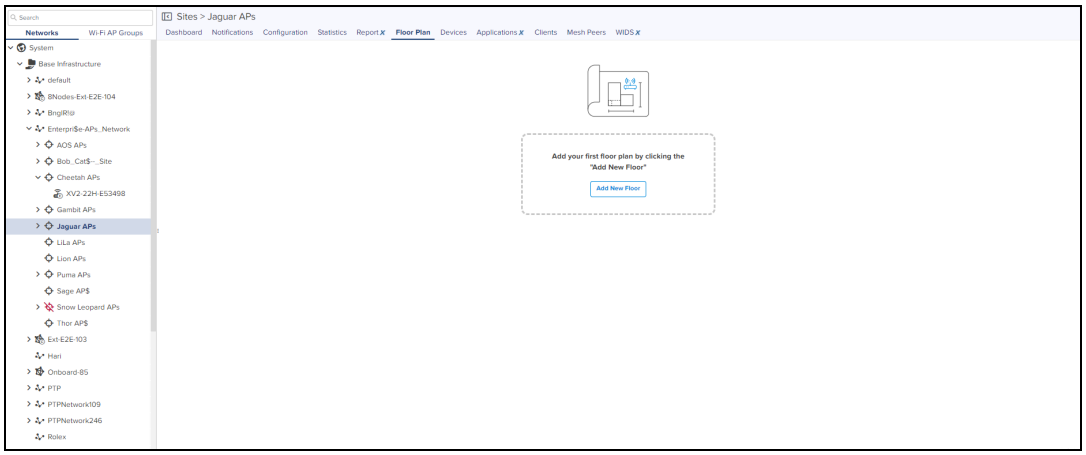
To create a floor plan, perform the following steps:

1. Navigate to **System > Network > Enterprise Site > Floor Plan.**

Floor Plan can be uploaded when a **Site** is created.

2. Click **Add New Floor**.

   The **Add New Floor** window appears.



3. Enter the parameters for a new floor plan.

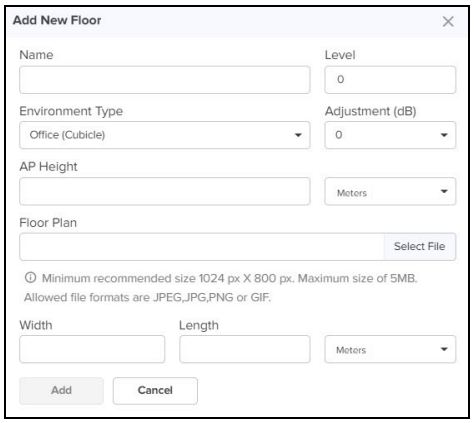


Table 51: Fields in Floor Plan

Field	Description
Name	Name of the floor.
Level	Level of the floor.
Environment Type	Floor type such as the following: • Apartment • Hospital • Hotel • Office (Cubicle) • Office (Walled) • Outdoors • School • University • Warehouse
Adjustment	Device adjustment in dB.
Height	Height of the ceiling in meters or feet.
Width	Width of the floor in meters or feet.
Length	Length of the floor in meters or feet.

NOTE:

Environment Type, Adjustment, and Height are currently unused by cnMaestro. They will become important when RF Heat Maps are added in a later release.

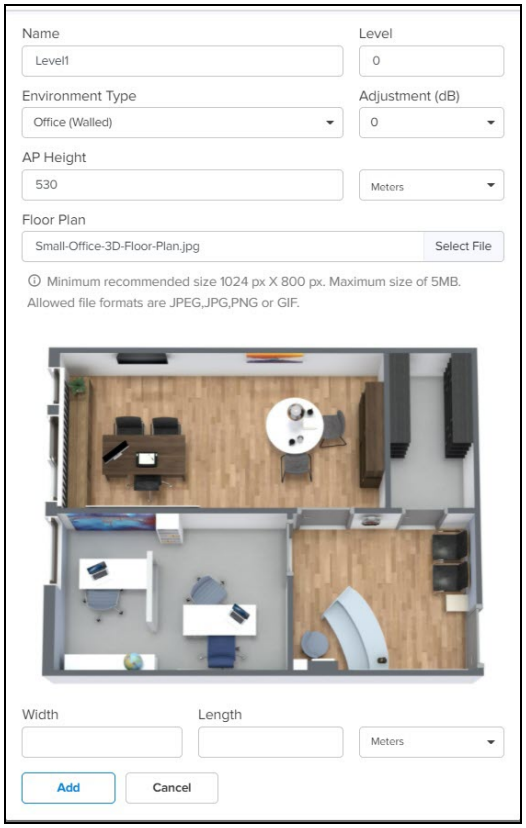
4. Click **Select File** and browse the required floor plan for uploading.

NOTE:

- The minimum size of a floor plan is 1024 X 800 pixels.
- The maximum supported file size is 5 MB.
- The supported file formats are JPEG, JPG, PNG, and GIF.

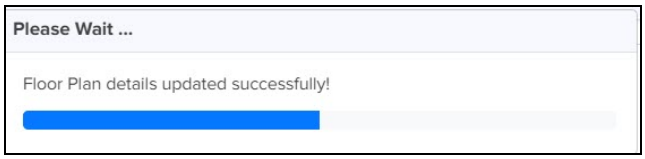
A preview of the uploaded floor plan is shown below:

Figure 170 Preview of Floor Plan



5. Click **Add**.

   A successful message is displayed, as shown below:



   The **Zoom** control lets you to zoom in and out of the floor plan.

	NOTE: • Only cnMaestro X users can upload more than one floor plan. • You cannot duplicate the floor level for other floor plans. • If the devices are in a default location and upgraded to 3.1.1, the devices are moved to the **Unmapped Devices** option.

The right pane of the Floor Plan window provides details of uploaded floor plans, such as Floor View, Map Opacity, Radio Details, Filters, and the devices in the floor plan.

Figure 171 Configure Floor Plan

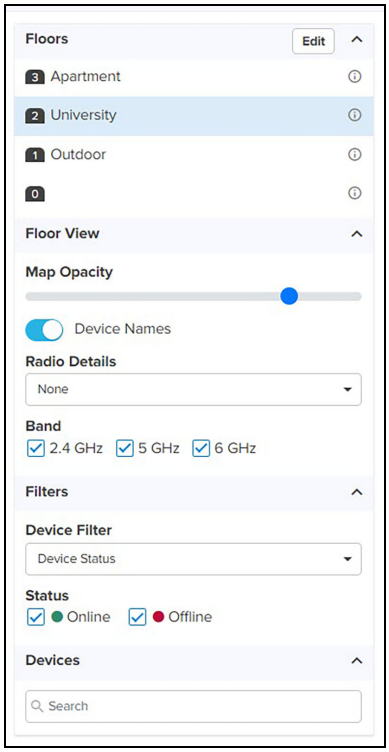


Table 52: Fields to configure floor plan page

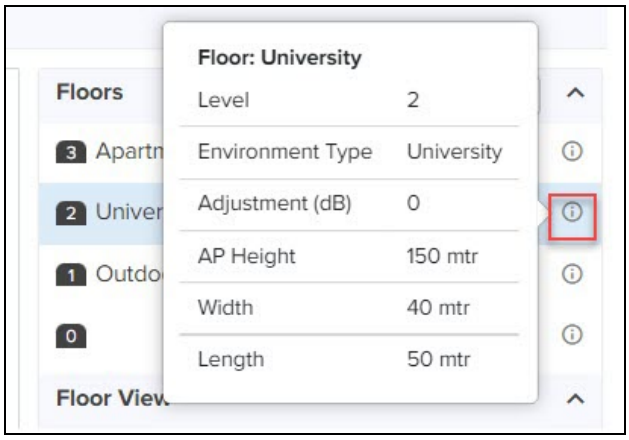
Field	Description
Floors	Indicates the floor level. The following actions are available: 1. Click **Add** to add new floor level. Drag and drop the selected devices from the right pane to the required floor level. If multiple floor levels are available, then select required floor level from the drop-down. 2. Select the floor level and click **Edit(**) icon to edit the uploaded floor level. 3. Click the **Delete** ( ) icon to delete a uploaded floor level. 4. Click on the info icon, next to floor level uploaded, to view the floor details.  5. In the **Devices on this floor** drop-down, you can view the following options: • Unmapped Devices: Devices not mapped to the floor plan. • Devices on this floor: Devices available on the floor plan. • Devices on other floors: Displays devices on the other floors. 6. Click **Remove** ( ) icon to remove device from the floor level.
Floor View	Configure device presentation. The following options are available: • Map Opacity: Increase or decrease the opacity for the better visibility of uploaded floor plan. • Device Names: Toggle to view device names on the floor plan. • Radio Details: View the radio details such as Client Count, Channel, and Power. • Band: Select the desired band 2.4 GHz, 5 GHz, and 6 GHz (radio frequency).
Filter	Filter devices by Device Status, Channel, and Power.
Devices	View and edit the device details. The following actions are available: 1. Select the device on the floor plan or type the device name in the search field. 2. Select the eye icon ( ) to **Show** or **Hide** the device on the floor plan. 3. Click on the device name to view device details, as shown below:

Table 52: Fields to configure floor plan page

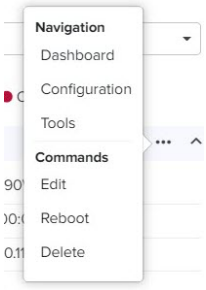
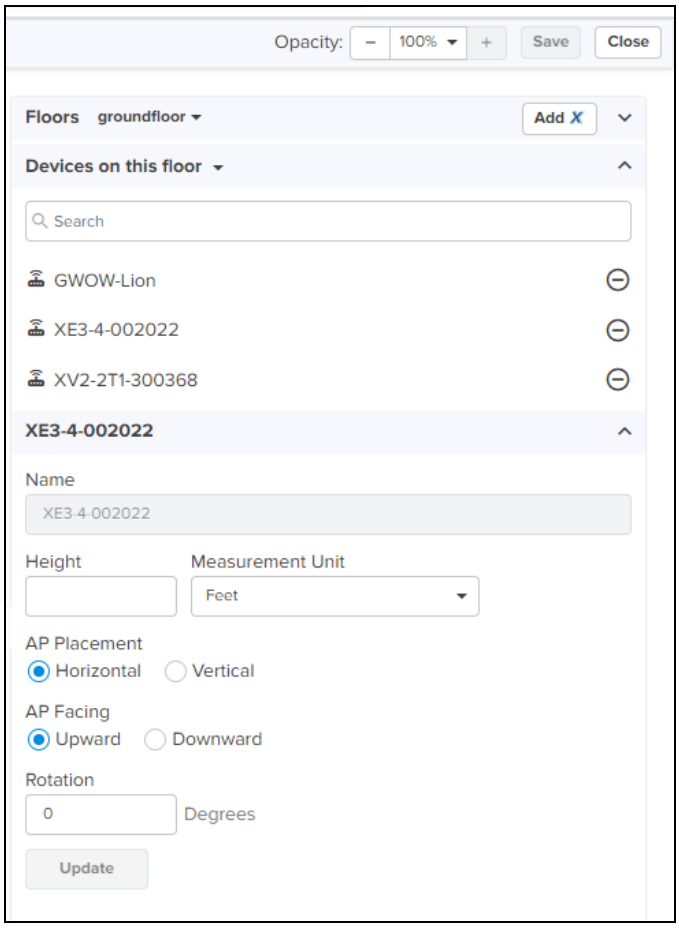
Field	Description
	 4. Click ellipsis (...) icon next to the device name, to navigate to the device homepage.  5. Click **Edit** on the top right corner and select the device in the current floor.

Table 52: Fields to configure floor plan page

Field	Description
	 Edit the **AP Placement**, **AP Facing** and **Rotation** options. 6. Click **Update** and **Save.** 7. Click **Remove** (⊖) icon to remove device from the floor plan. 8. Click **Save**.

Fiber OLT and ONU

The Fiber Optical Line Terminal (OLT) from Cambium Networks is a Passive Optical Network (PON) device that connects to a core switch using either an Ethernet cable or a fiber cable. It supports Gigabit Passive Optical Network (GPON), 10 Gigabit Symmetrical PON (XGS-PON), and combo-PON (GPON co-existing with XGS-PON) Optical Defined Networking (ODN) access. The Fiber OLT is available in 8 and 16 ports, including All-in-One (AIO) PON interfaces, allowing simultaneous support for multiple PON technologies. It is used for network development with GPON and User Network Interface (UNI) ports. The high-performance access design of the Fiber OLT focuses on Software-Defined Networking (SDN) deployments, providing open interfaces to all control management functions for seamless integration with SDN environments.

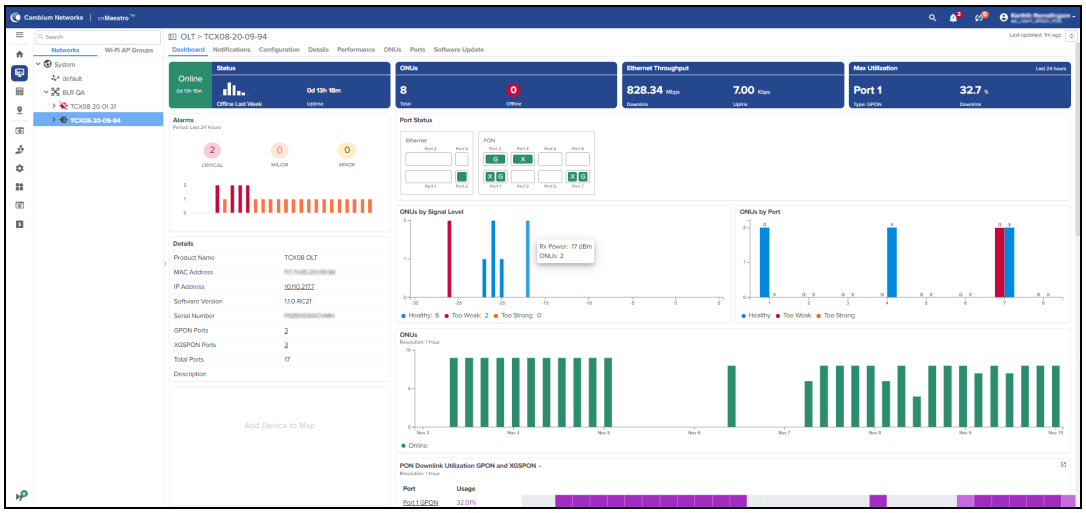
cnMaestro provides management, configuration, and monitoring services for Fiber OLT. It includes the following pages for Fiber OLT and ONU, providing comprehensive tools for efficient management and optimization:

- Dashboard
- Notifications
- Configuration
- Details
- Performance
- ONU
- Ports
- Software Update

Dashboard

Displays the monitoring information of the OLT.

Figure 172 Fiber OLT dashboard



Dashboard has the following elements:

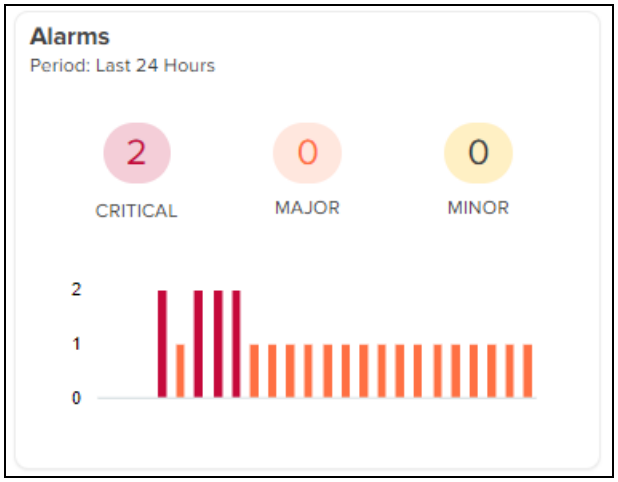
- Alarms
- Port Status
- ONU by Signal Level
- ONU by Signal Level per Port
- ONUs
- PON Downlink Utilization
- PON Downlink throughput
- PON Uplink throughput

- Ethernet Downlink throughput
- Ethernet Uplink throughput

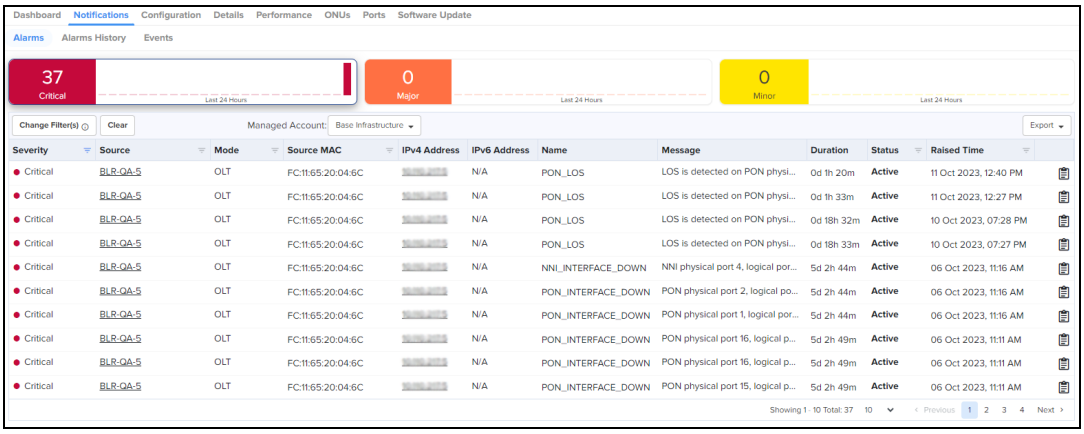
Alarms

Displays the critical, major, and minor alarms. Figure 173 shows the status of the alarms.

Figure 173 Alarms



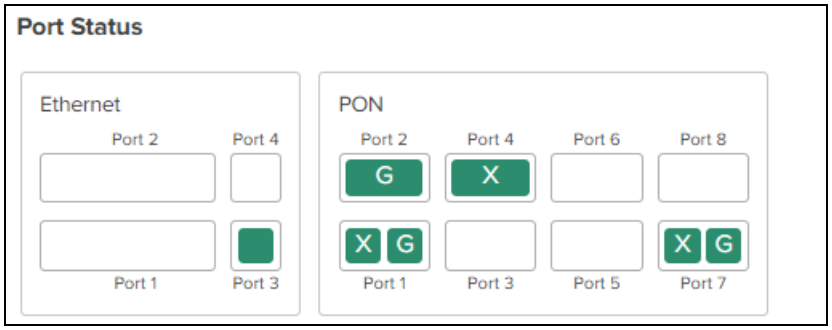
To view the detailed information, click on the respective alarm count.



Port Status

Displays the connection status for Network-to-Network Interface (NNI) or Ethernet (uplink) ports and PON ports (downlink). Small Form-Factor Pluggable (SFP) devices are connected to the Ethernet ports, and ONUs are connected to the PON ports. The uplink NNI has four ports. Port 1 and port 2 support 100 Gbps speed. Port 3 and port 4 support 10 Gbps speed. There are 16 downlink PON ports, with each port supporting both GPON and XGS-PON.

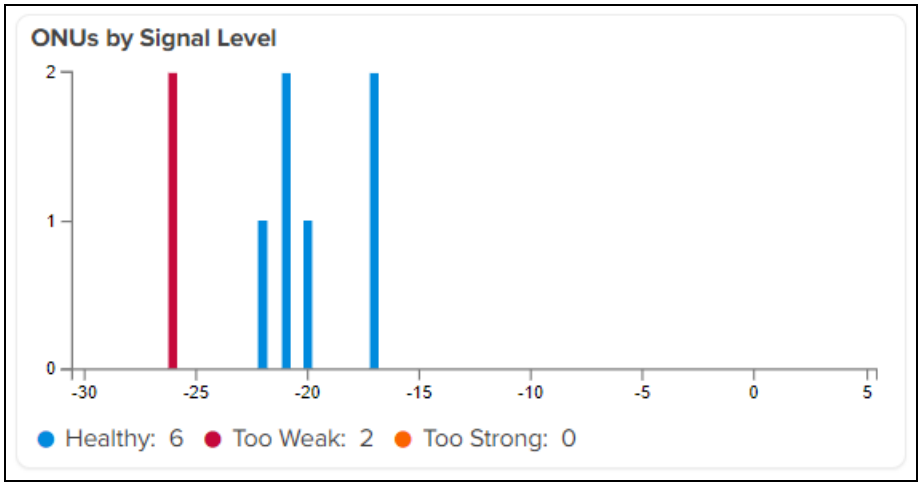
Figure 174 Port status



ONU by Signal Level

Displays the signal level received by the ONU.

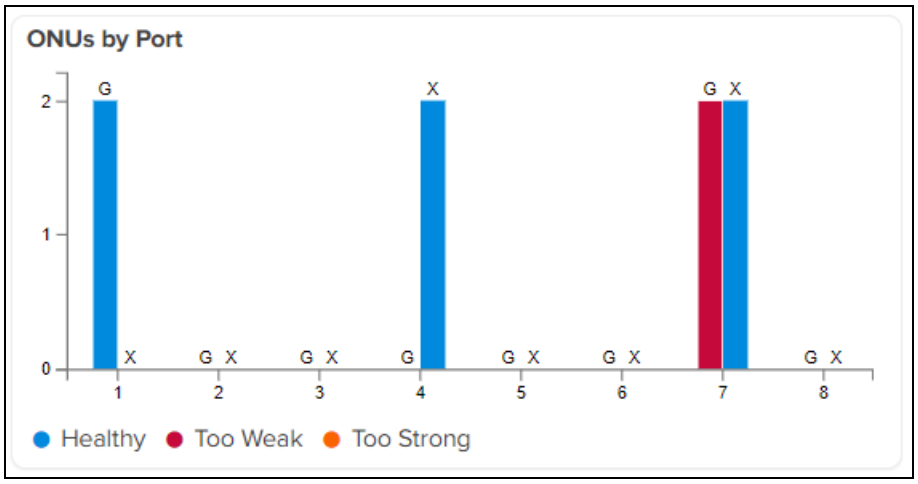
Figure 175 ONU by signal level graph



ONU by Signal Level per Port

Displays the number of ONU connected and their corresponding power levels.

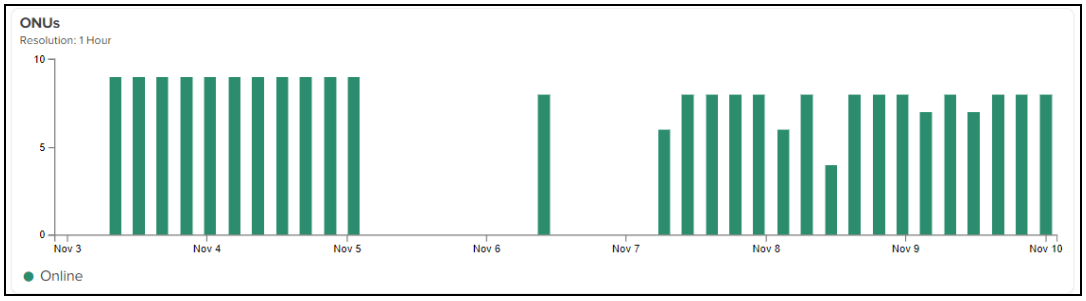
Figure 176 ONU by signal level per port



ONUs

Displays the number of ONUs connected to the OLT.

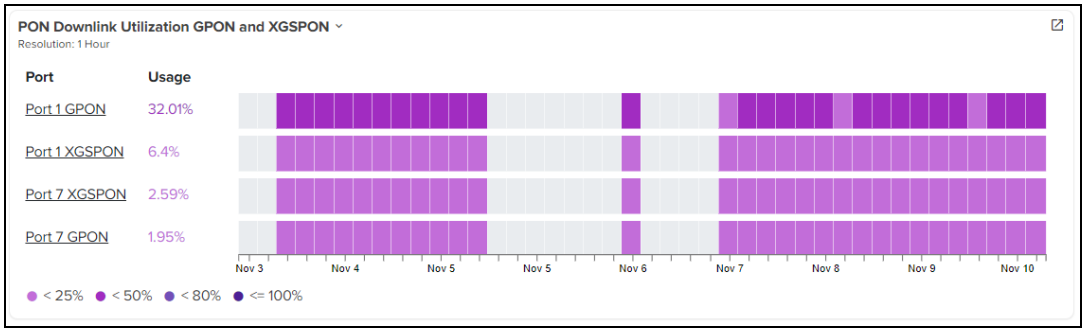
Figure 177 ONU



PON Downlink Utilization

Displays the utilization of GPON and XGS-PON.

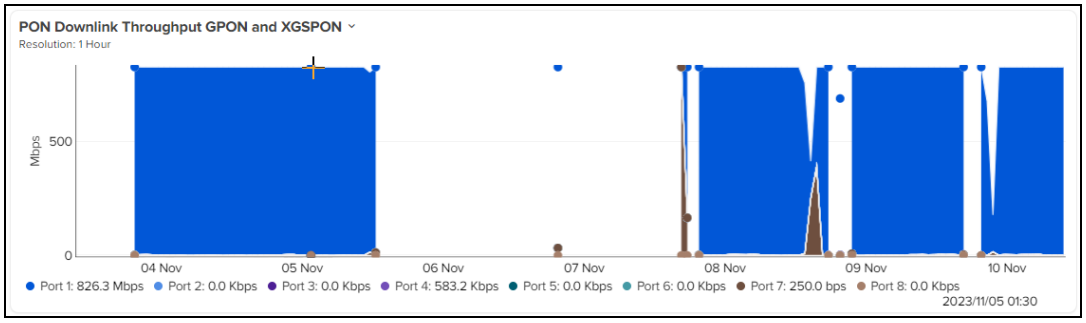
Figure 178 PON Downlink Utilization



PON Downlink Throughput

PON Downlink throughput displays the downlink throughput information of GPON and XGS-PON.

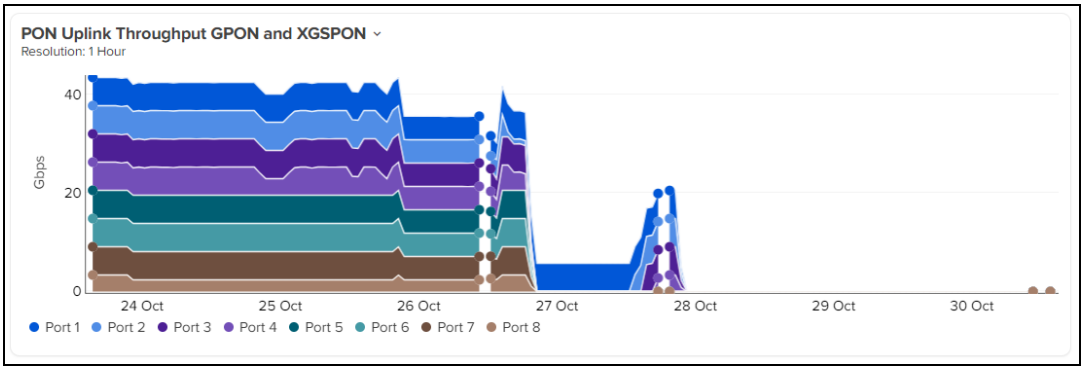
Figure 179 PON Downlink Throughput



PON Uplink Throughput

Displays the uplink throughput information of GPON and XGS-PON.

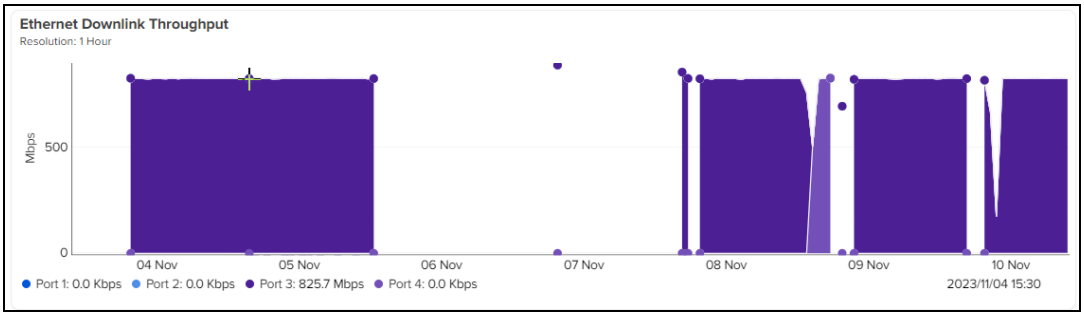
Figure 180 PON Uplink Throughput



Ethernet Downlink Throughput

Displays the Ethernet Downlink information of GPON and XGS-PON.

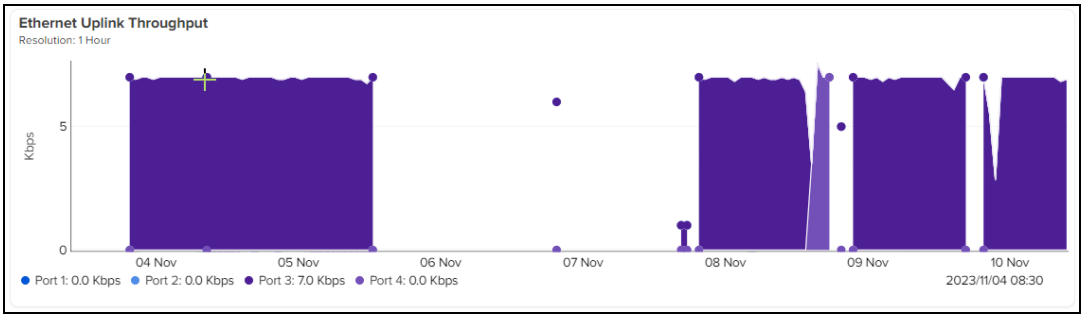
Figure 181 Ethernet Downlink throughput



Ethernet Uplink Throughput

Displays the Ethernet Uplink information of GPON and XGS-PON.

Figure 182 Ethernet Uplink Throughput



Notifications

Displays the alarm information of the OLT.

Figure 183 Notifications

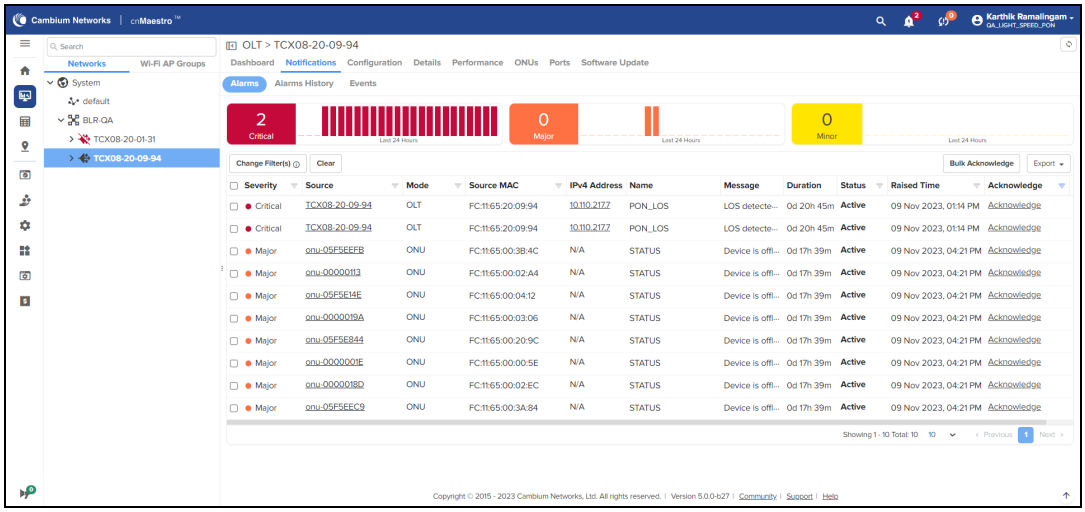


Table 53: Parameters on the Notifications page

Parameter	Description
Severity	Severity level of the alarm. This parameter supports the following severity levels: • Critical • Major • Minor
Source	Name of the OLT.
Mode	Type of the device. The following device types are supported: • OLT • ONU
Source MAC	MAC address of the OLT.
IPv4 address	IPv4 address of the OLT.
Name	Name of the ONU.
Message	A brief description of the alarm message.
Duration	Duration of the alarm.
Status	Status of the alarm. The following status values are supported: • Active • Inactive
Raised Time	Time when the alarm was raised.

Configuration

Users can configure the OLT using the Configuration tab.

Figure 184 Configuration

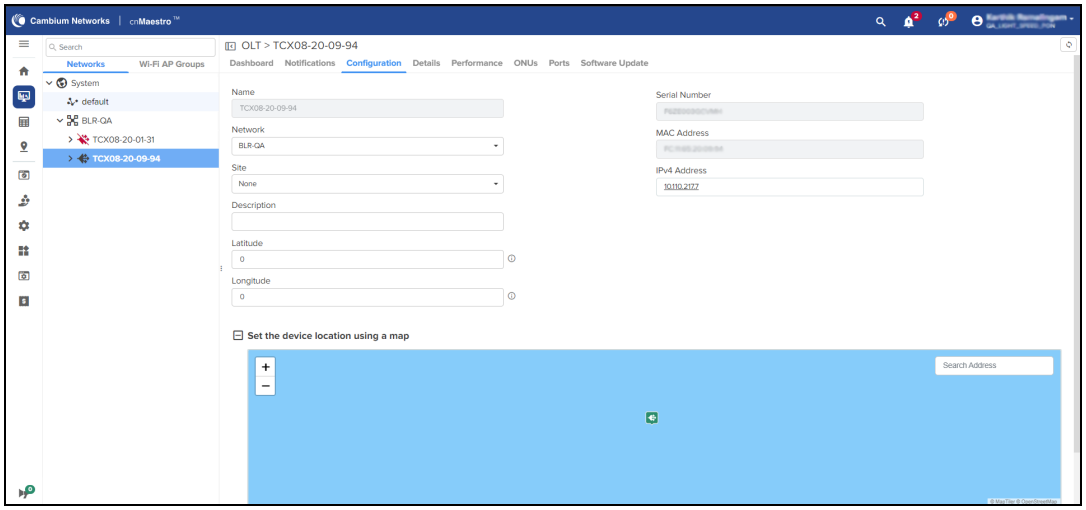


Table 54: Parameters on the Configuration page

Parameter	Description
Managed Account	Name of the site where OLT is configured.
Name	Name of the OLT.
Network	Name of the network where OLT is configured.
Site	Name of the site.
Description	A brief description of the OLT.
Latitude	Latitude of the OLT.
Longitude	Longitude of the OLT.
Serial Number	Serial Number (MSN) of the OLT.
MAC Address	MAC Address of the OLT.
IPv4 Address	IPv4 Address of the OLT.

Details

The Details page displays general configuration and runtime information of the OLT.

Figure 185 Details

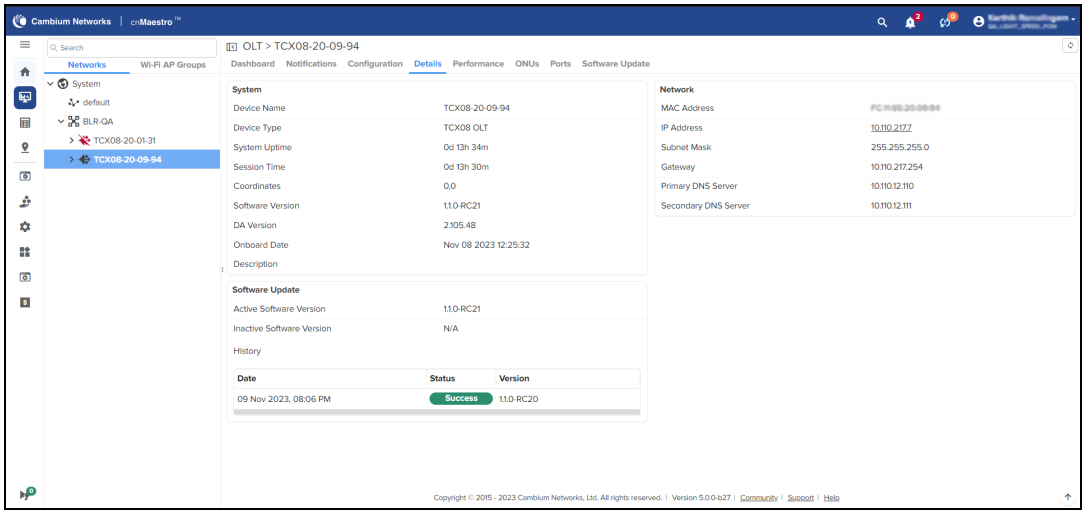


Table 55: Parameters on the Details page

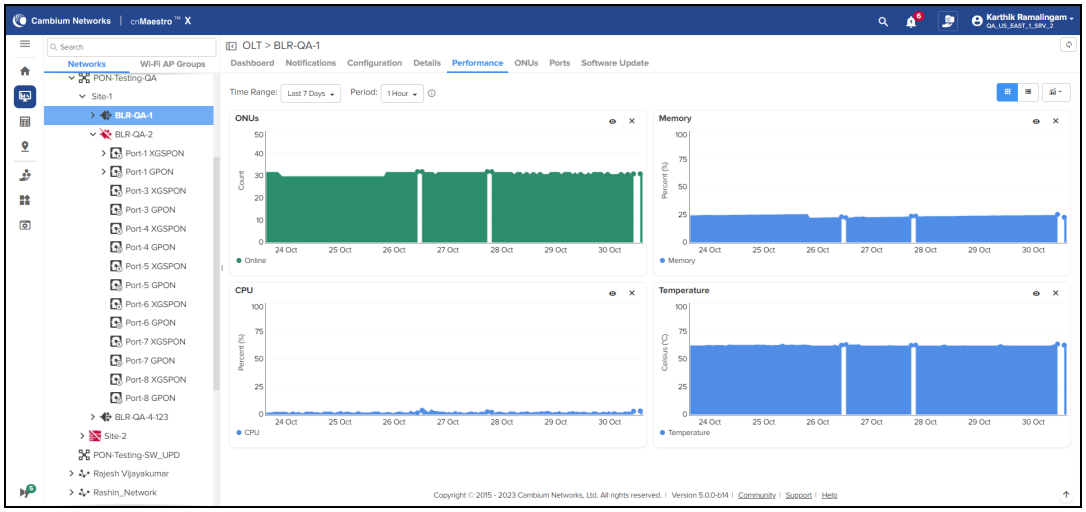
Parameter	Description
System	
Device Name	Name of the device.
Device Type	Type of the device. This parameter supports the following device types: • OLT • ONU
System Uptime	Date and time configured for the device.
Session Time	Duration of the session.
Coordinates	Latitude and longitude.
Software Version	The current software version used.
DA Version	Version of the device agent (DA).
Onboard Date	Onboard date of the device.
Description	A brief user-defined description of the onboarded device.
Software Update	
Active Software Version	Version of the active software.
Inactive Software Version	Version of the inactive software.
History	History of software version updates.
Network	
MAC Address	MAC Address of the device.

Parameter	Description
IP Address	IP Address of the device.
Subnet Mask	Subnet Mask of the device.
Gateway	Gateway address of the device.
Primary DNS Server	IP address of the primary DNS server.
Secondary DNS Server	IP address of the secondary DNS server.

Performance

Displays the performance graphs for ONU, CPU, memory, and temperature of the OLT and ONU.

Figure 186 Performance



ONU

Displays the number of ONUs connected to the OLT and their information.

Figure 187 ONU

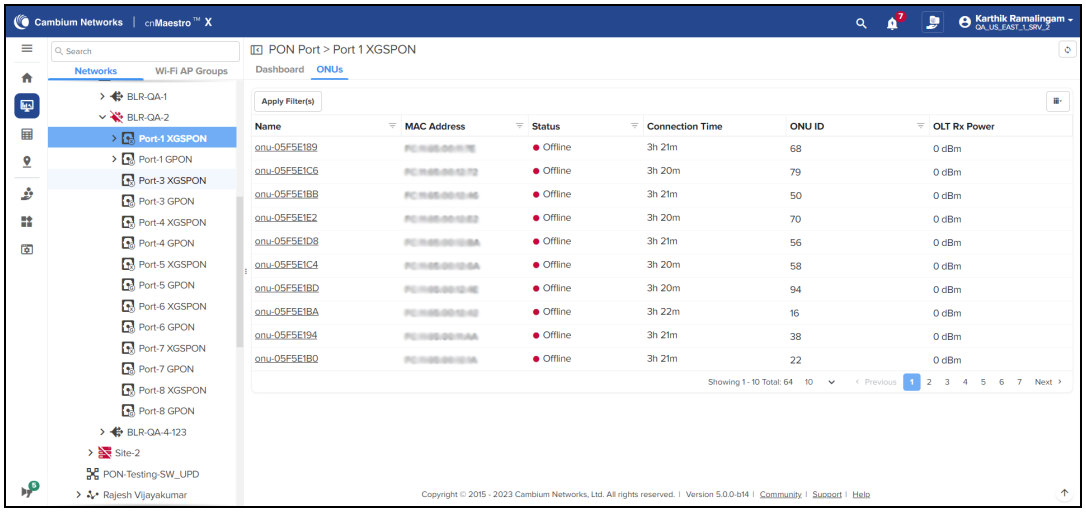


Table 56: Parameters on the ONU page

Parameter	Description
Name	Name of the OLT.
MAC Address	MAC address of the OLT.
Status	Status of the OLT.
OLT Port	Port number of the OLT to which ONU is connected.
Connection Time	Time during which ONU is connected to OLT.
ONU ID	ID of the ONU.
OLT Rx Power	Receive power of the OLT.

Ports

Displays the port details. Fiber OLT has 8 ports and 16 ports

Figure 188 Ports

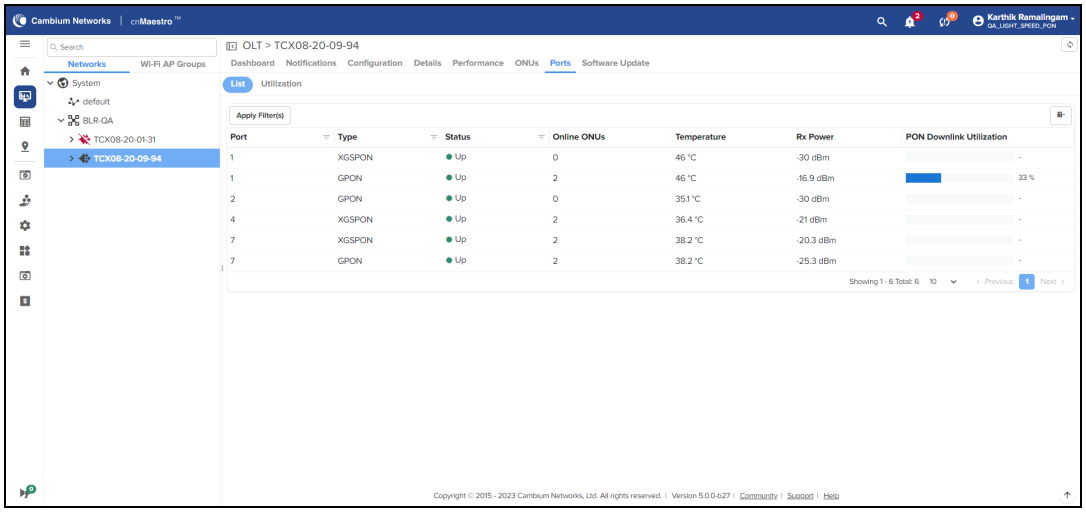
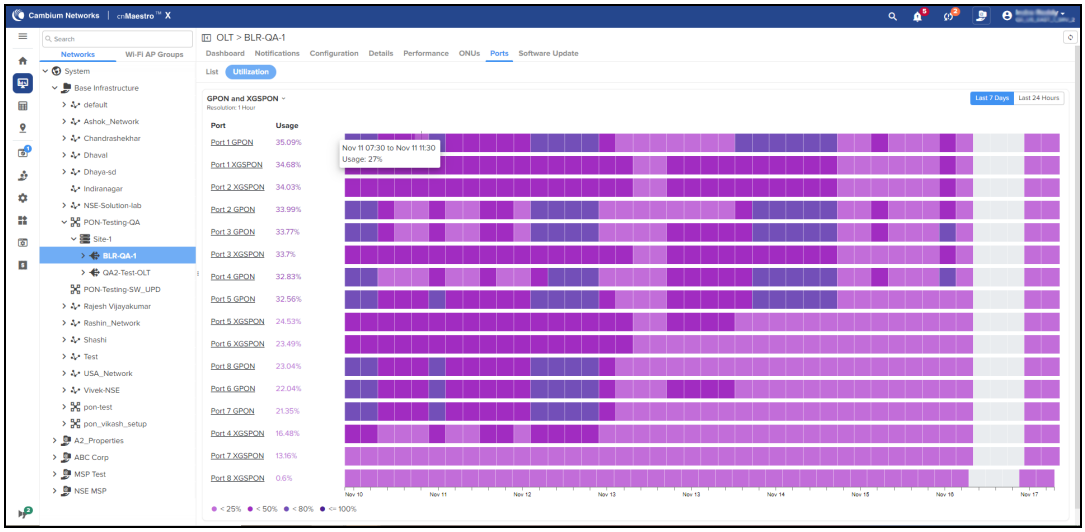


Figure 189 Ports utilization



To filter selected ports, perform the following steps:

1. Click **Apply Filter(s)**, type the port name.
2. Select the type of the OLT.
3. Select the status of the OLT and click **Apply Filter(s)**.

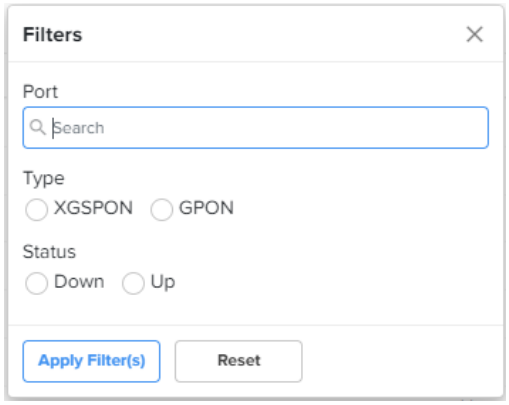


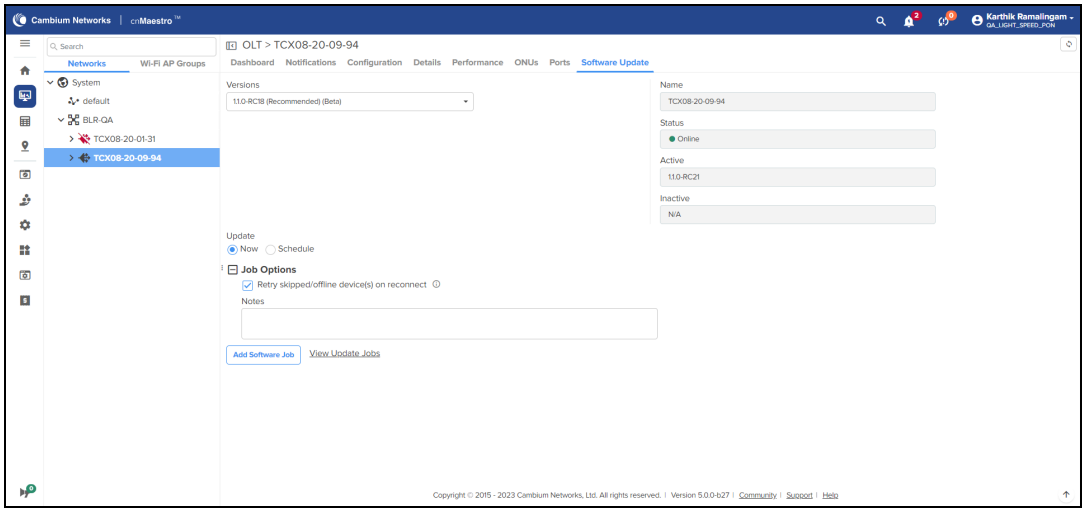
Table 57: Parameters on the Ports page

Parameter	Description
Port	Port number of the OLT.
Type	Type of the PON.
Status	Status of the ONU.
Online ONU	Number of ONUs online.
Temperature	Temperature of the ONU.
Rx Power	Receive power of the ONU.
PON Downlink Utilization	Utilization percentage of the PON Downlink.

Software Update

Users can upgrade the OLT firmware using the **Software Update** page. To upgrade the software, perform the following steps:

1. Download the latest firmware from Cambium Networks Support Site.
2. Select the status of the OLT and click **Apply Filter(s)**.
3. Click **Add Software Job** to upload the latest Firmware file.
4. Click **View Update Jobs** to view the history of the software updates.

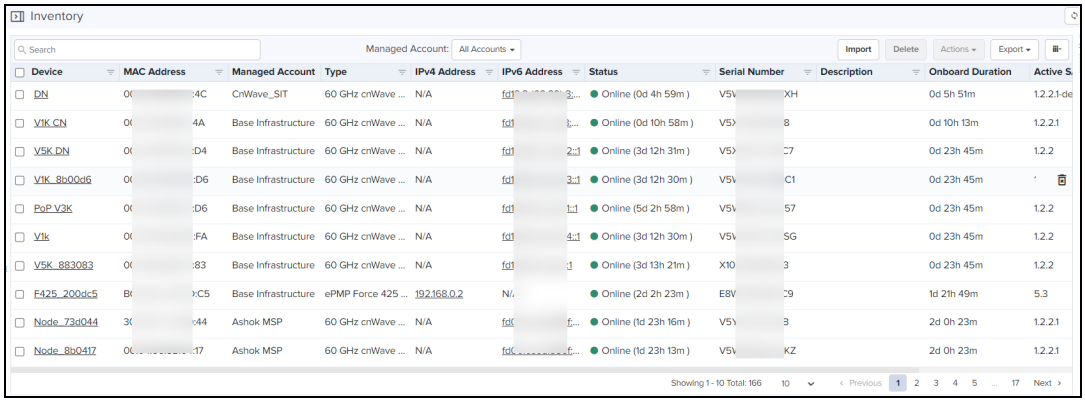


Inventory

The Inventory page displays a list of devices under the selected Node. It presents health and maintenance information in a tabular view that allows for sorting and filtering. When selected for a single device, it presents a detailed customized page of that device.

Navigate to the **Inventory** tab on the left pane.

Figure 190 Inventory



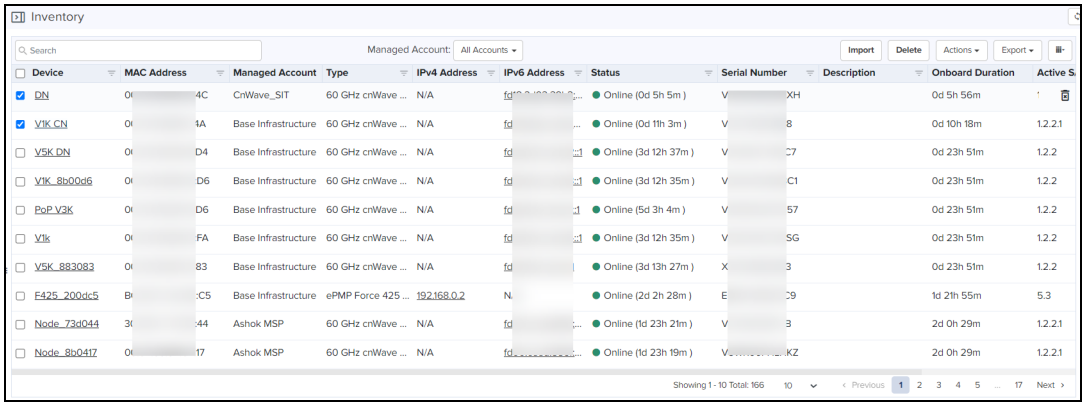
Inventory Export

The inventory table can be exported in either CSV or PDF format. The values exported will match those in the selected table columns. You can customize the health and maintenance views to add or delete columns.

Bulk Delete

The **Bulk Delete** option is available in the inventory page of System/Tower/Network/Site.

Figure 191 Bulk Delete



To delete devices using bulk delete, perform the following steps:

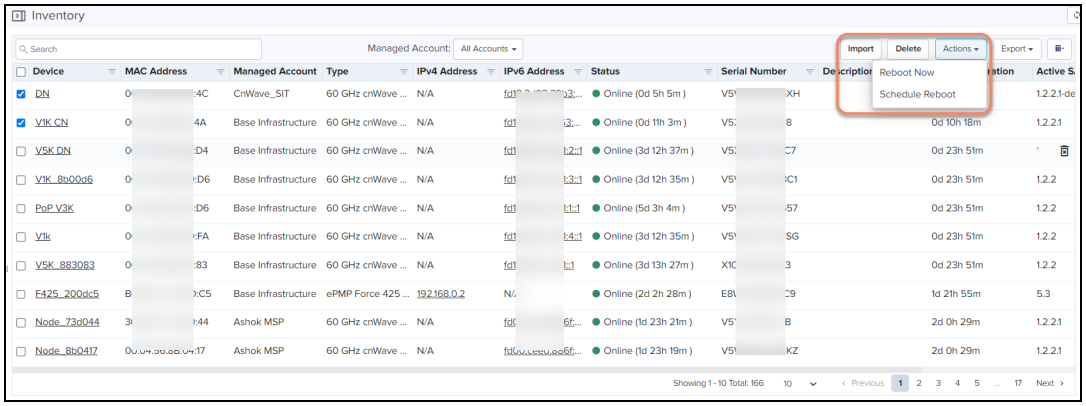
1. Navigate to **Inventory** page of System/Network/Tower/Site.
2. Select one or multiple devices.
3. Click **Bulk Delete**.

	NOTE: In Wi-Fi view, Bulk Delete can also delete devices waiting for Approval.

Bulk Reboot

The **Bulk Reboot** option is available on the inventory page of Tower/Network/Site. When the devices are rebooted using Bulk Reboot, all the Network/Tower/Site Dashboards, Graphs, Clients, Reports, and Mesh Peers will be updated accordingly.

Figure 192 Bulk Reboot



To reboot devices using bulk reboot, perform the following steps:

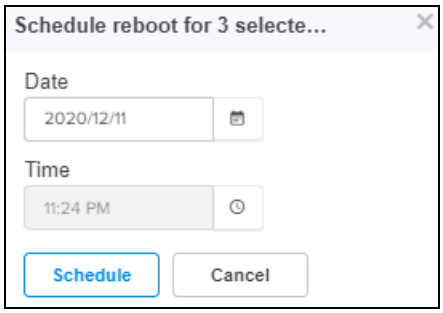
1. Navigate to **Inventory** page of Network/Tower/Site.
2. Select one or multiple devices.
3. Click **Actions** and choose **Reboot Now**.

Schedule Reboot

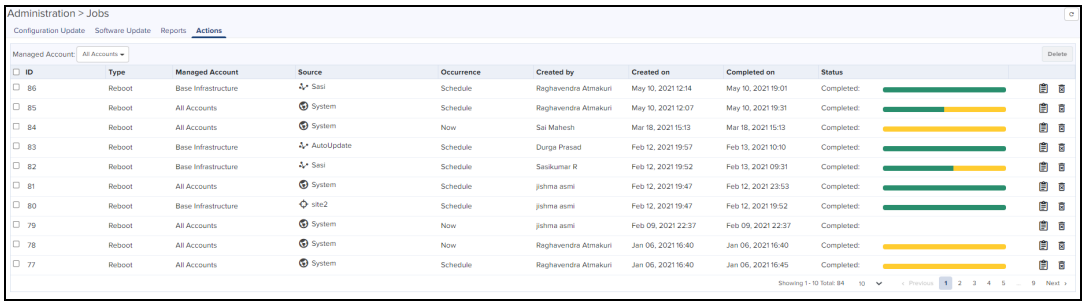
Schedule a reboot of the device(s) by selecting **Schedule Reboot** from **Actions** drop-down.

To reboot devices using schedule reboot, perform the following steps:

1. Navigate to **Inventory** page of Network/Tower/Site.
2. Select one or multiple devices.
3. Click **Actions** and choose **Schedule Reboot**.
4. Enter **Date** and **Time**.
5. Click **Schedule**.



After creating a scheduled reboot job, can view the status in the **Administration > Jobs > Actions**.



Import Device Configuration

Import device(s) configuration is available from the inventory page at System/Network/Managed Account/ePMP or PMP AP device levels.

	NOTE: The Import Device configuration is supported only for the Access and Backhaul account and is applicable only on ePMP/PMP AP and SM devices.

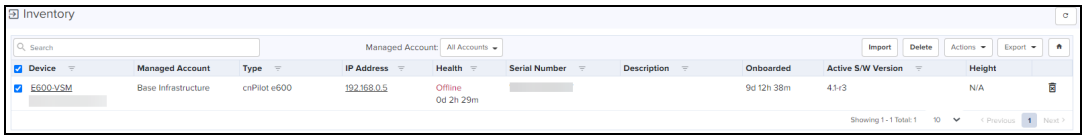
The following parameters are supported for ePMP/PMP AP in the CSV file:

- Azhimuth
- Beamwidth
- Elevation
- Height
- Latitude
- Longitude

The following parameters are supported for ePMP/PMP SM is in the CSV file:

- Latitude
- Longitude

Figure 193 Import Device Configuration

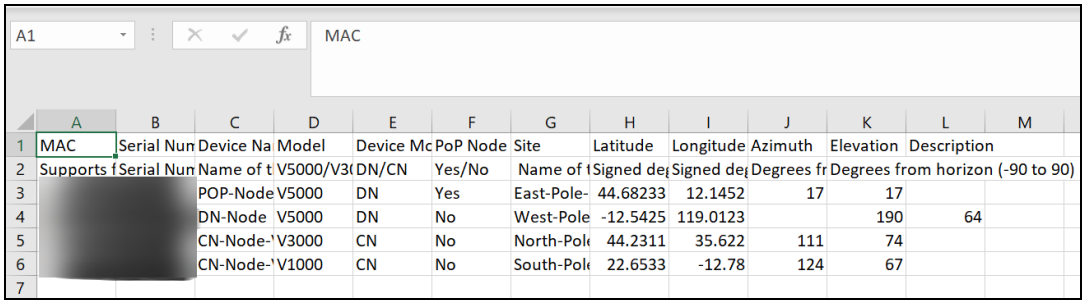


Sample Configuration File

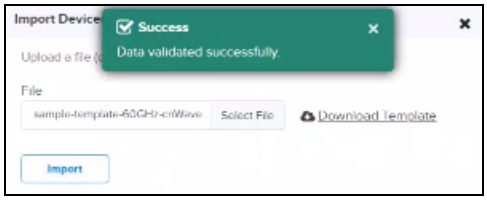
MAC	LATITUDE	LONGITUDE	AZIMUTH	ELEVATION	BEAM WIDTH	HEIGHT	HEIGHT UNIT
Supports formats with ':', '-', 'no space', upper and lower case.	Signed degrees format (DDD.ddd).	Signed degrees format (DDD.ddd).	Degrees from North (0 to 360)	Degrees from horizon (-90 to 90)	Degrees from 1 to 360	Min=0, Max=5	Meters/Feet
[redacted]	16	19	17	17	130	1500	Feet
[redacted]	-90	119.0123	190	64	120	1000	feet
[redacted]	79.0123	11	111	74	112	110	Meters
[redacted]	-44	-12.78	124	67	177	190	meters

Sample Configuration File (60 GHz cnWave)

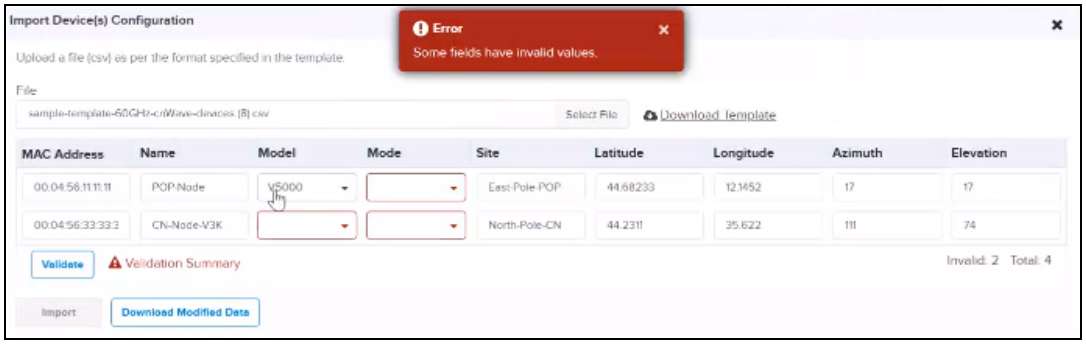
Figure 194 Sample Configuration file: 60 GHz cnWave



While importing the file, it automatically validates the data as shown below:



If any invalid fields are found, an error message pops up:



Uploading a Configuration File

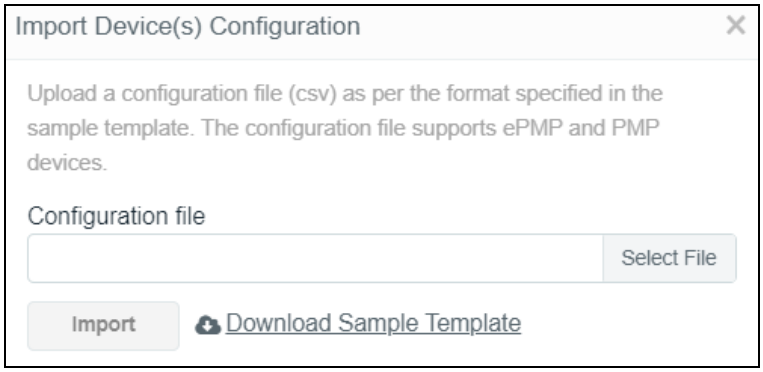
To upload a configuration file (CSV) using the format specified in the sample template, perform the following steps:

1. Click **Download Sample Template** or prepare a sheet in CSV file format with necessary column details.
2. Upload a configuration file (CSV) using the format specified in the sample template.

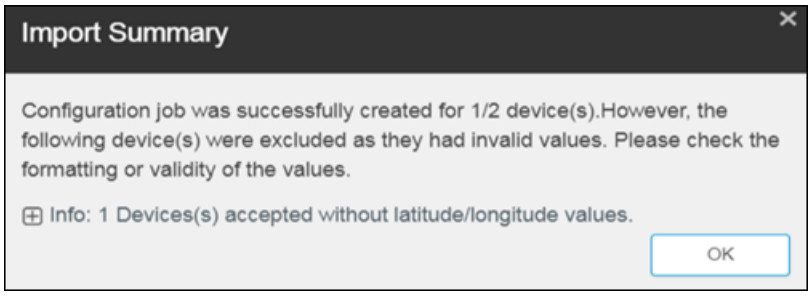
	NOTE: You must know the MAC address of the device to push the configuration.

3. Click **Import**.

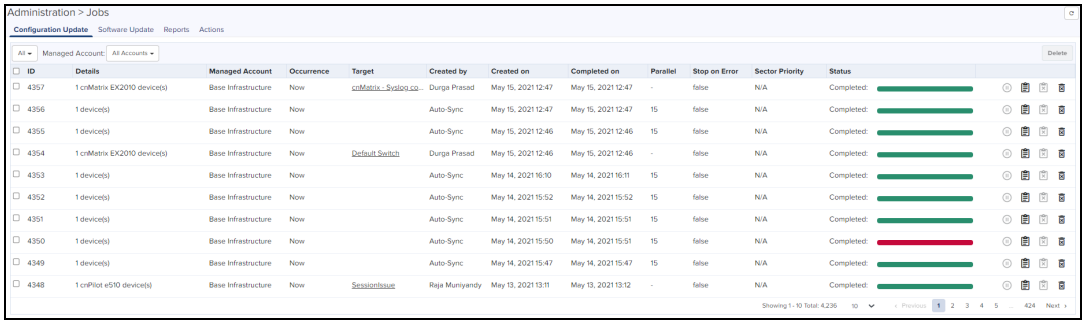
Figure 195 Uploading Configuration file



4. A configuration job will be created.



5. You can view the completed status of the configuration import in the configuration update page.



The following table provides details on different errors that might occur while importing a CSV file:

Table 58: Importing Error

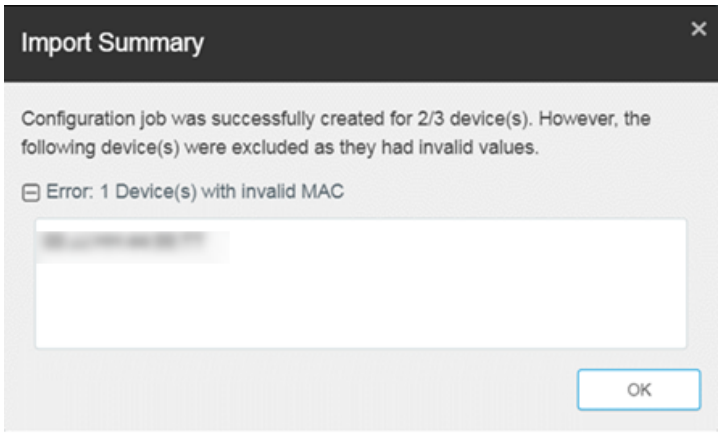
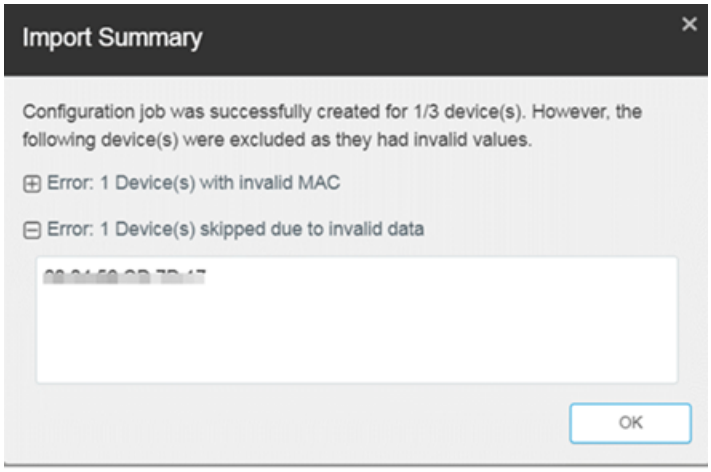
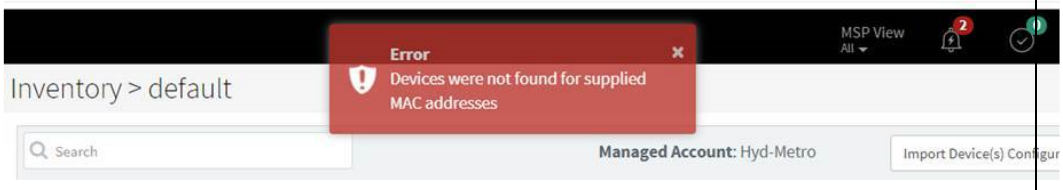
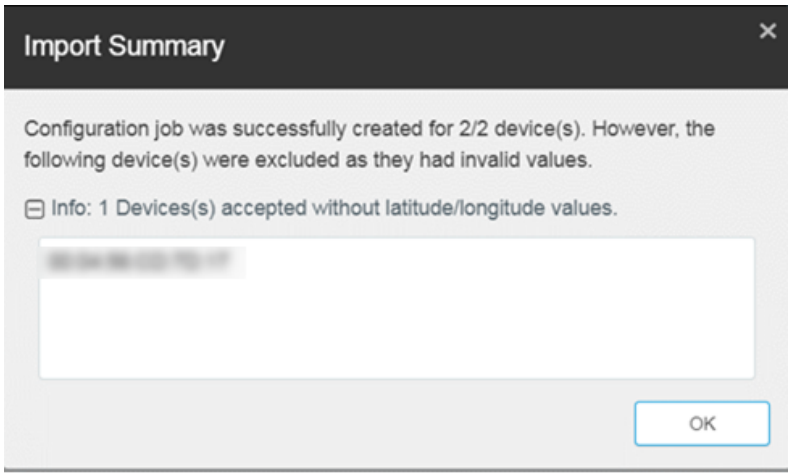
Error	Description
{Count of Devices} Device(s) with invalid MAC	This error is displayed if the uploaded CSV file contains an invalid MAC Address. 
{Count of Devices} Device(s) skipped due to invalid data	This error is displayed if the uploaded CSV file contains invalid Data or data not relevant for Latitude, Longitude, Azimuth, Height, and Elevation. 
Devices were not found for supplied MAC Address	This error message is displayed if the devices were not found with correct MAC address in the CSV file. 
Info: 1 Devices(s) accepted without latitude/longitude values	This error is displayed when the latitude and longitude values are tried to push on to ePMP AP or PMP AP which are under a Tower.

Table 58: Importing Error

Error	Description
	

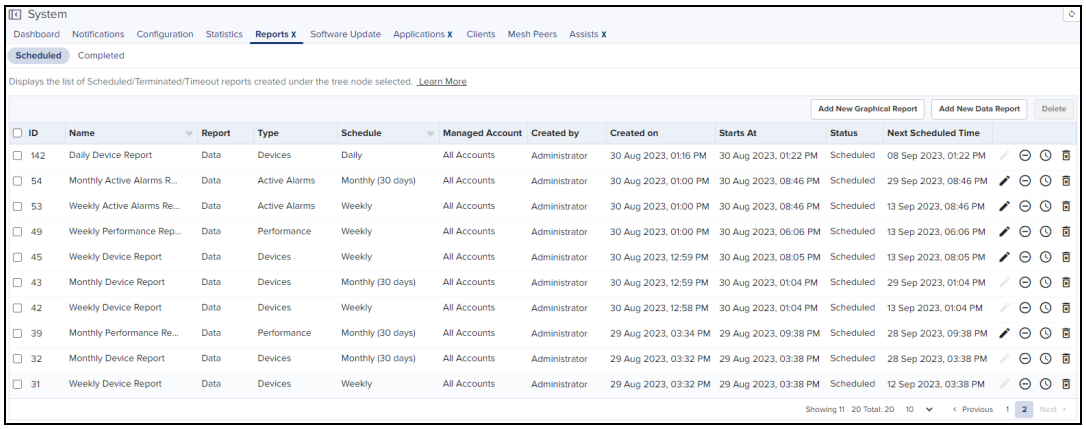
Reports

There are two types of reports: Data Reports and Graphical Reports. Data Reports generate a CSV file and are meant to be read by Excel, Power BI, or a custom application. Graphical Reports generate a PDF file meant for human consumption.

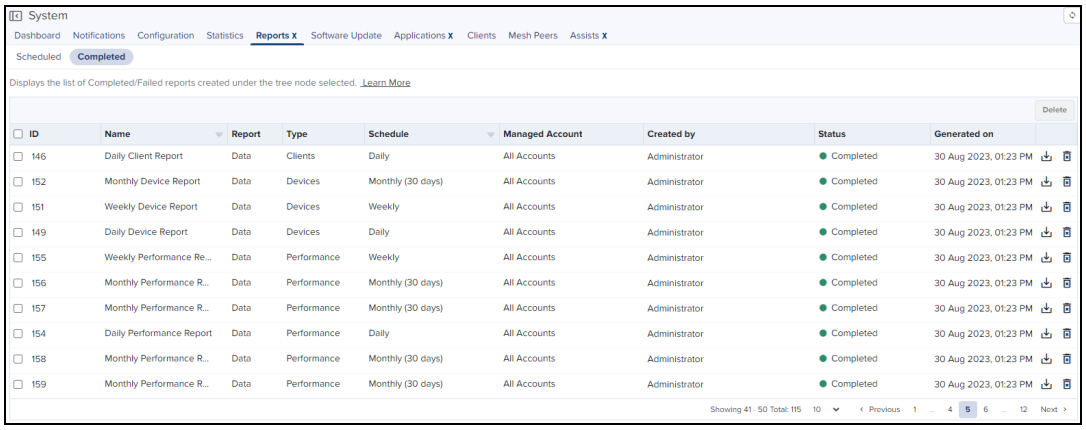
The **Scheduled** tab displays reports that have not run. This includes reports executed periodically and those meant to run a single time. The **Completed** tab lists all reports that have finished and are available for download.

Scheduled Reports include the Scheduled, Terminated, and Timeout status in the Status column. **Completed Reports** include the Completed and Failed status is the Status column. Data reports are displayed only in a tabular format while graphical reports include charts and graphs.

To view all scheduled data and graphical reports, navigate to **System > Monitor and Manage > Reports X > Scheduled**.



To download completed reports, navigate **System > Monitor and Manage > Reports X > Completed**.



NOTE:

- You can have 50 reports in the Scheduled tab and any number in the Completed tab. Only 50 reports can be generated in parallel in a cnMaestro account.
- The completed reports are available for download for 30 days in the Cloud and 7 days in On-Premises.
- While generating Alarm History, Events, Performance, Clients, and Guest Access reports, there is a delay of up to 20-30 minutes for the recent entries to be available in the report.

Data Reports

Data Reports generate a CSV document that can be viewed in Excel, Power BI or other data analysis tools.

This section details how to schedule and generate different types of data reports in cnMaestro.

- Device Report
- Performance Report
- Active Alarms Report
- Alarms History Report
- Events Report
- Clients Report
- Guest Access Login Events

NOTE:

cnMaestro supports 14 months of historical data for devices:

- cnPilot Home (R-Series)
- Enterprise devices (Enterprise Wi-Fi and cnMatrix)
- IIoT devices

cnMaestro supports 26 months of historical data for devices:

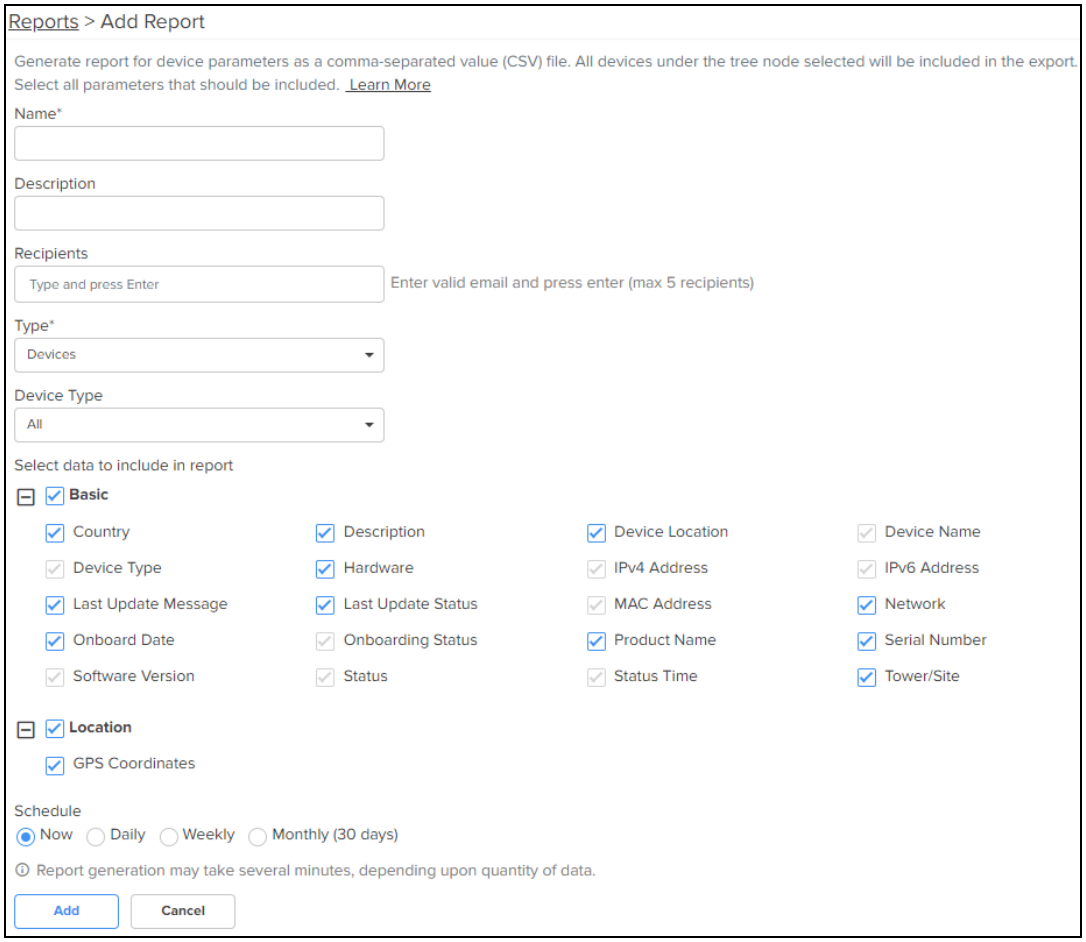
- Fixed Wireless

Device Report

Device Reports are generated as CSV files and include all devices under the selected tree node.

To generate Device Reports, perform the following steps:

1. Navigate to **Report X > Scheduled** tab within System, MSP, Site, Network, or Tower nodes in the hierarchical tree.
2. Click **Add New Data Report**. The following window is displayed.



3. Enter a **Name** and **Description** for the report.
4. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
5. Select the **Report Type** as **Devices**..
6. Select the **Device Type** such as cnMatrix, cnPilot Home, and cnRanger.
7. Select the data parameters to include in the report.
8. Select the **Schedule** such as Now, Daily, Weekly, or Monthly.
9. Click **Add**. The report is added to the **Scheduled Reports** page.

   If **Device Type** is **All**, then **Basic** data export parameters are available, rather than parameters specific to a device type.

The device data parameters exported for the following devices are listed below:

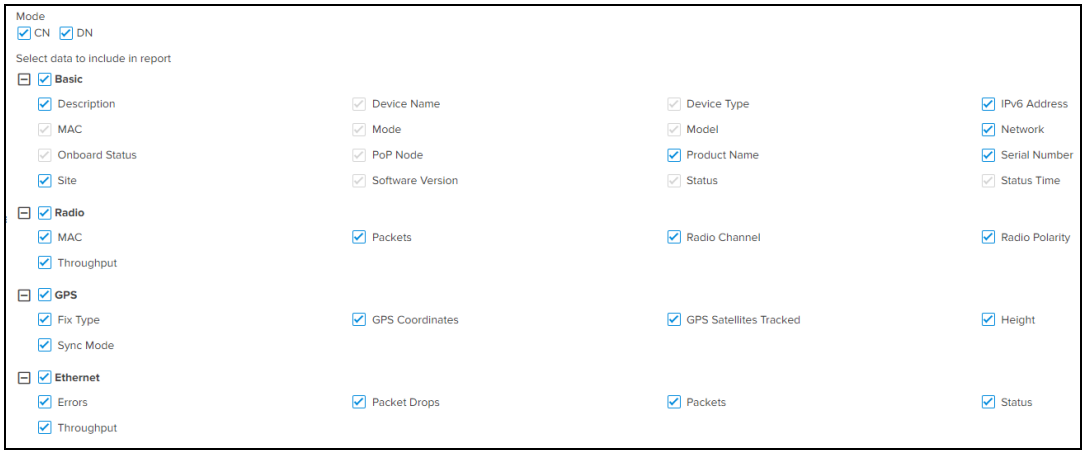
- 60 GHz cnWave
- cnMatrix
- cnPilot Home (R-Series)
- cnRanger
- cnReach
- cnReach XIO
- cnVision

- cnWave 5G Fixed
- Enterprise Wi-Fi
- ePMP
- Machfu
- PMP
- PTP 650/670/700
- PTP 820/850
- RV22 Home Mesh

If 60 GHz cnWave device is selected as **Device Type**, then the following parameter sections are available:

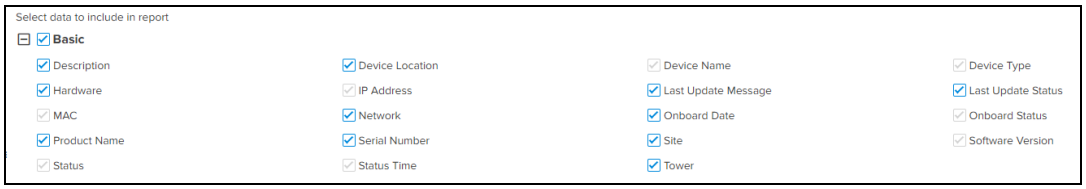
- Basic
- Ethernet
- GPS
- Mode (CN or DN)
- Radio

Figure 196 Device Report: 60 GHz cnWave



If cnMatrix is selected as the **Device Type**, then **Basic** data export parameters will be exported.

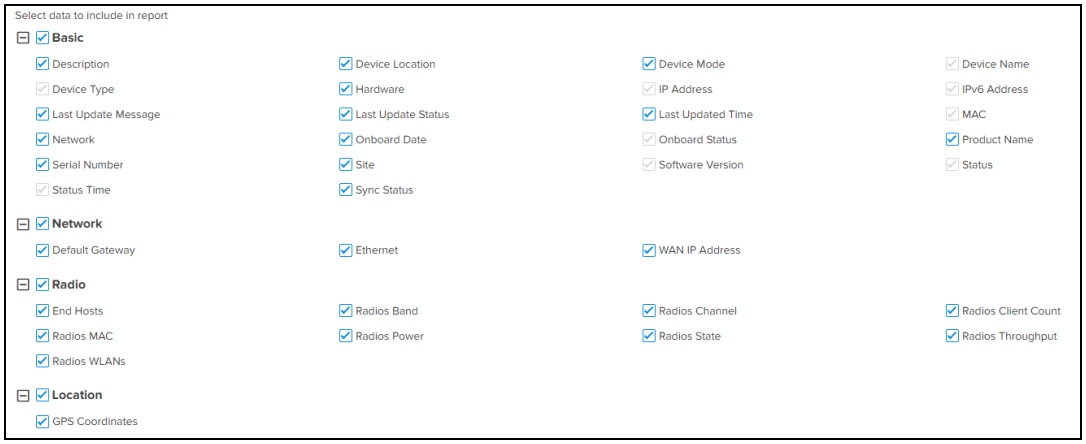
Figure 197 Device Report: cnMatrix



If cnPilot Home (R-Series) is selected as the **Device Type**, then the following parameter sections are available:

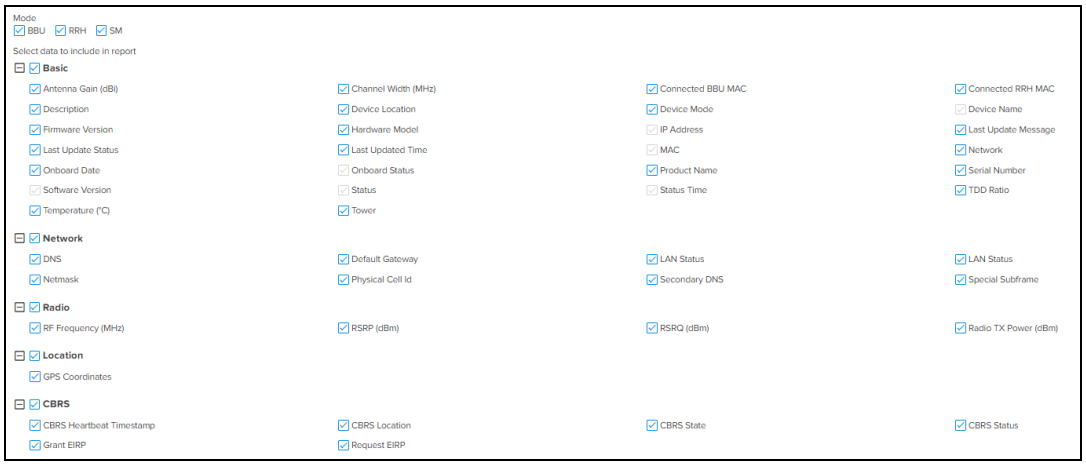
- Basic
- Network
- Radio
- Location

Figure 198 Device Report: cnPilot Home (R-Series)



If cnRanger is selected as the **Device Type**, then Basic, Network, Radio, Location, and CBRS parameter sections can be exported.

Figure 199 Device Report: cnRanger



If cnReach is selected as the **Device Type**, then the following sections are available:

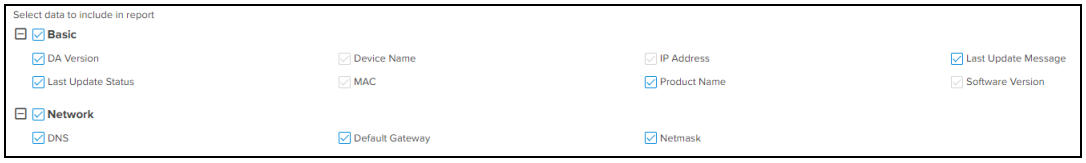
- Basic
- Network
- Radio

Figure 200 Device Report: cnReach

If cnReach XIO is selected as the **Device Type**, then the following sections are available:

- Basic
- Network
- Radio

Figure 201 Device Report: cnReach XIO



If cnVision is selected as the **Device Type**, then the following sections are available:

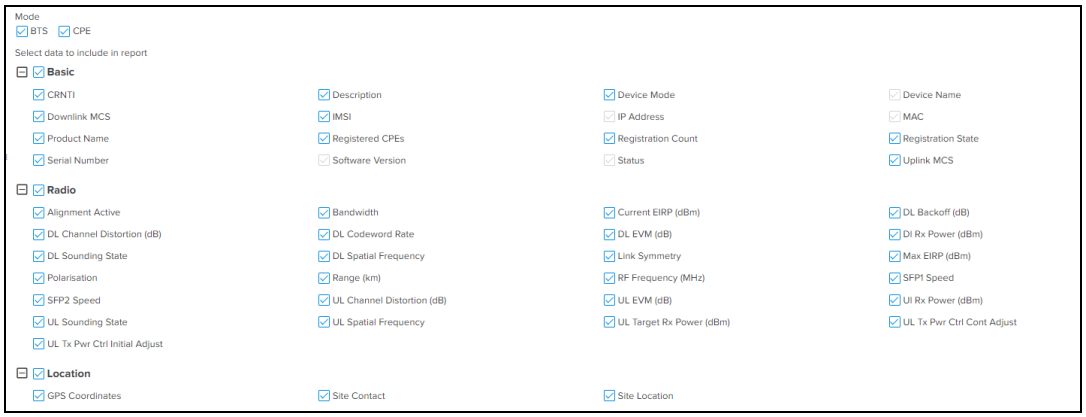
- Basic
- Location
- Network
- Radio
- Mode

Figure 202 Device Report: cnVision

If cnWave 5G Fixed device is selected as **Device Type**, choose the type of **Mode** (BTS or CPE) then the following sections are available:

- Basic
- Location
- Radio

Figure 203 Device Report: cnWave 5G Fixed



If Enterprise Wi-Fi is selected as the **Device Type**, then the following sections are available:

- Basic
- Location
- Network

- Radio

Figure 204 Device Report: Enterprise(Wi-Fi)

If ePMP is selected as the **Device Type** then the following sections are available:

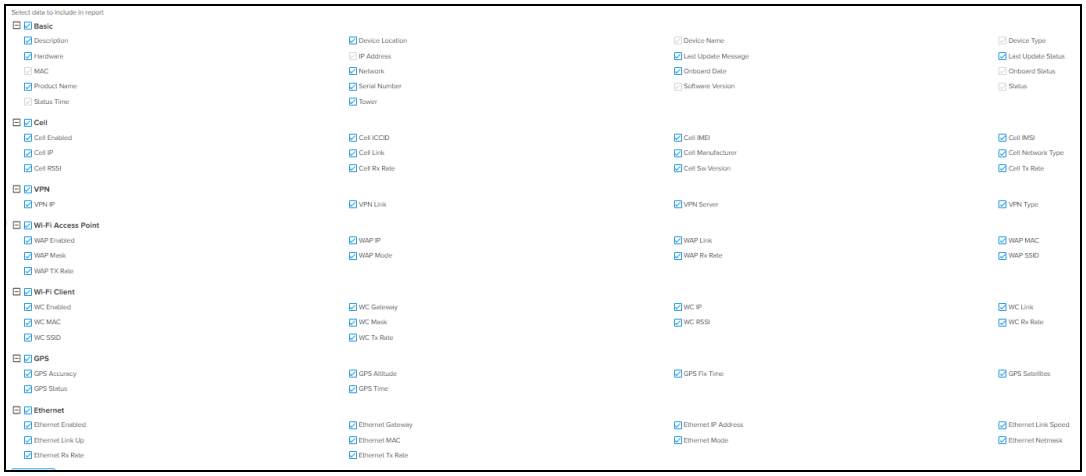
- Basic
- Location
- Mode(s) (AP or SM)
- Network
- Radio

Figure 205 Device Report: ePMP

If Machfu is selected as the **Device Type**, then the following sections are available:

- Basic
- Cell
- Ethernet
- GPS
- VPN
- Wi-Fi Access Point
- Wi-Fi Client

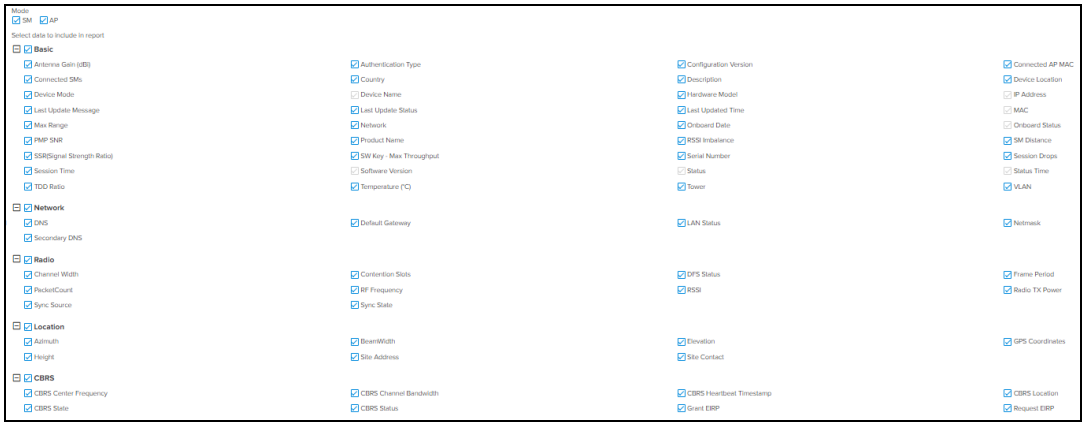
Figure 206 Device Report: Machfu



If PMP is selected as the **Device Type**, then the following sections are available:

- Basic
- CBRS
- Location
- Mode(s) (AP or SM)
- Network
- Radio

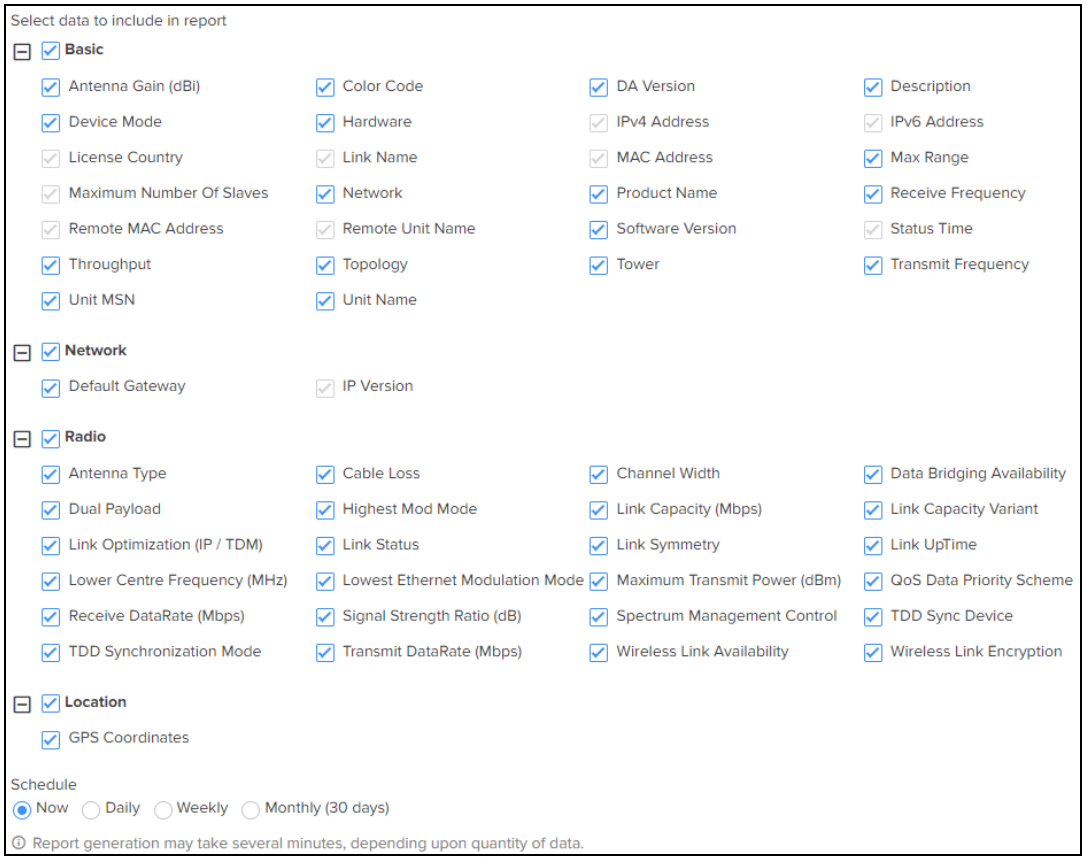
Figure 207 Device Report: PMP



If PTP 650/670/700 is selected as the **Device Type**, then the following sections are available:

- Basic
- Location
- Network
- Radio

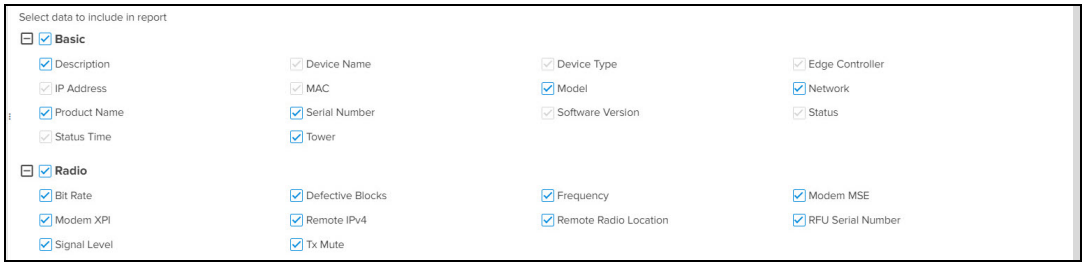
Figure 208 Device Report: PTP 650/670/700



If PTP 820/850 is selected as the **Device Type**, then the following sections are available:

- Basic
- Radio

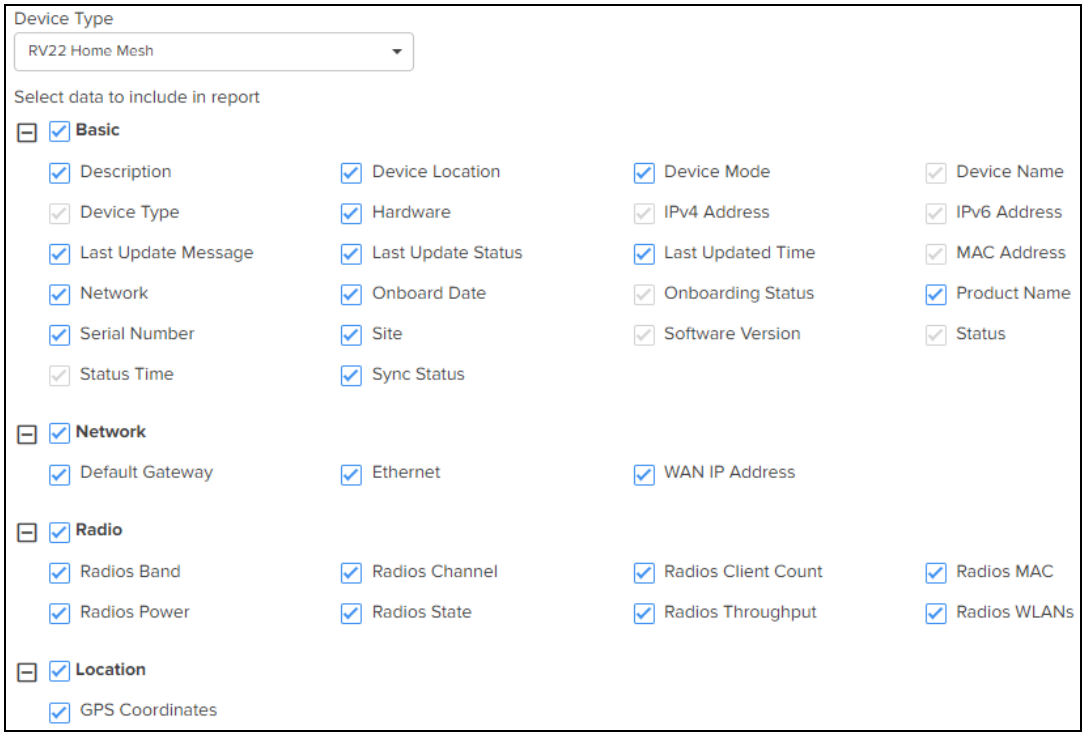
Figure 209 Device Report: PTP 820/850



The following sections are available for RV22 Home Mesh routers:

- Basic
- Network
- Radio
- Location

Figure 210 Device Report: RV22 Home Mesh



NOTE:

Reports are available for each of the following hierarchical nodes in the tree:

- System
- Managed Account
- Network
- Tower
- Site
- AP Group

Performance Report

The Performance Report generates device time-series performance data as a comma-separated value (CSV) file. All devices of selected type under the tree node will be included in the export.

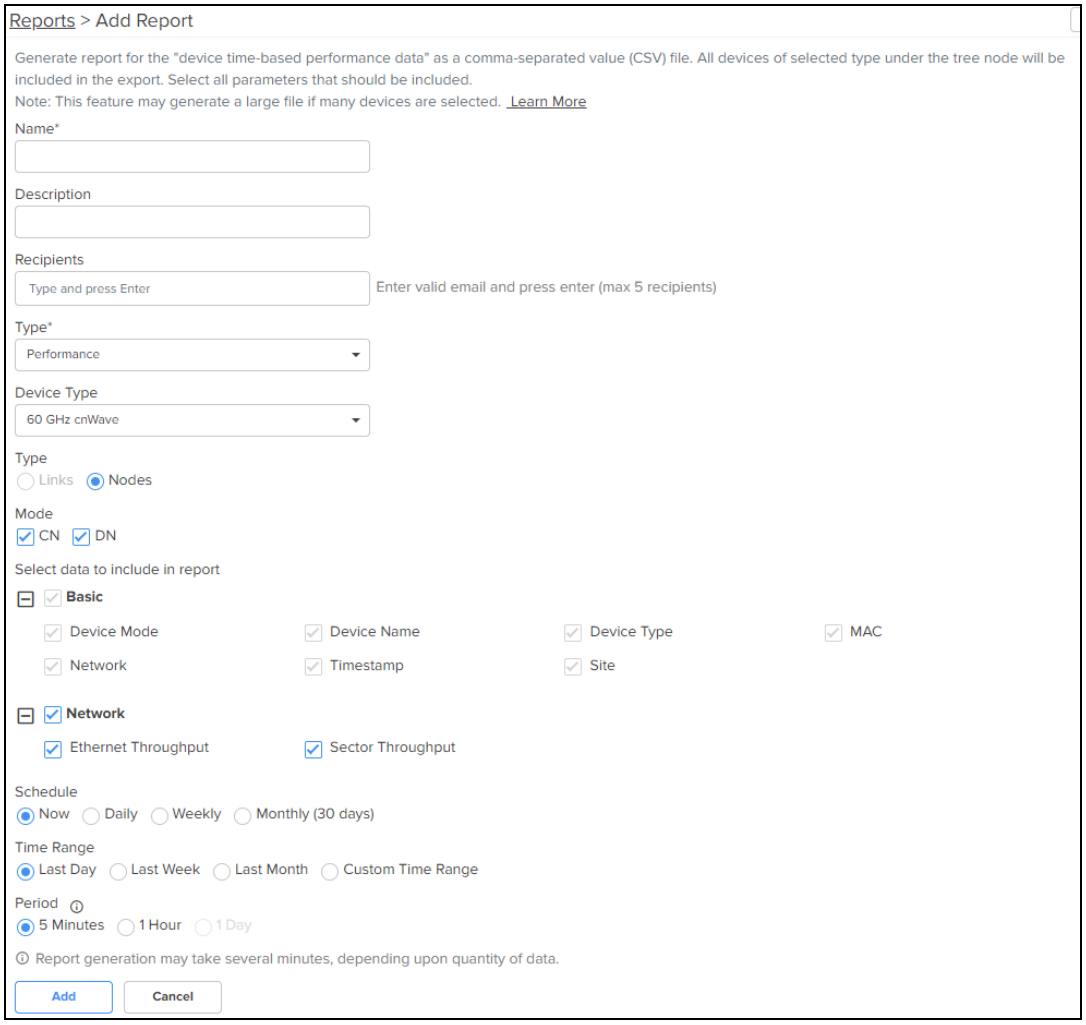
NOTE:

- You need to select the parameters.
- This feature may generate a large file if many devices are selected.

To generate Performance reports, perform the following steps:

1. Navigate to **Report X > Scheduled** tab.
2. Click **Add New Data Report**.
3. Enter a **Name** and **Description** for the report.
4. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.

5. Select **Type** as **Performance**.
6. Select the **Device Type**.



7. Select the data parameters to include in the report.
8. Select the following options:
   - Schedule type (Now, Daily, Weekly, or Monthly)
   - Time Range (Last Day, Last Week, Last Month, Custom Time Range)
   - Period (5 Minutes, 1 Hour, or 1 Day)
9. Click **Add** . The report is added to the Scheduled Reports page.

60 GHz cnWave Performance Report

Figure 211 Performance Report: 60 GHz cnWave (Links Type)

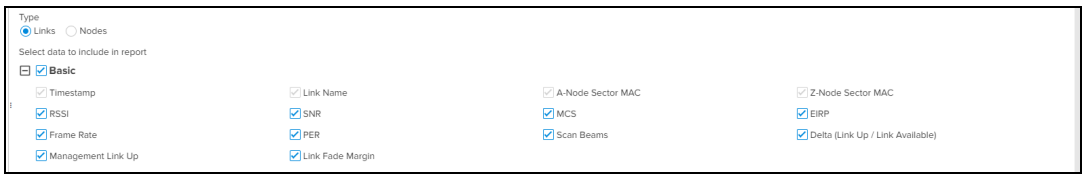
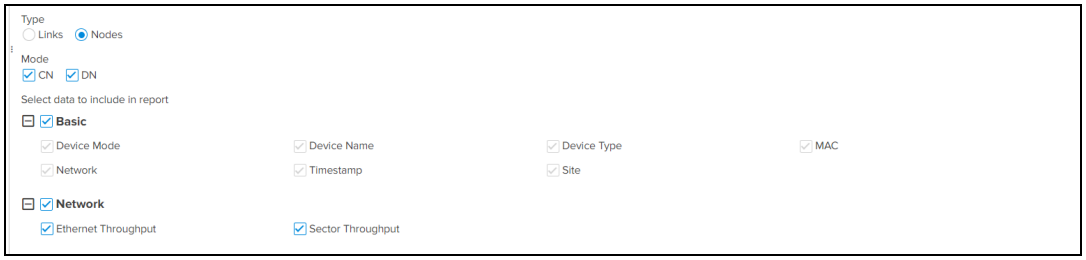


Figure 212 Performance Report: 60 GHz cnWave (Node Type)

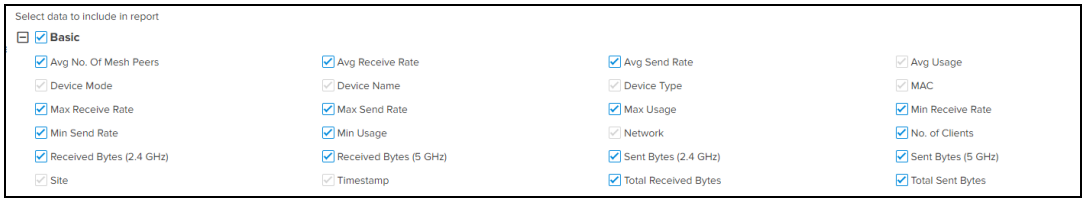


cnMatrix Performance Report

Figure 213 Performance Report: cnMatrix

cnPilot Home (R-Series) Performance Report

Figure 214 Performance Report: cnPilot Home (R-Series)

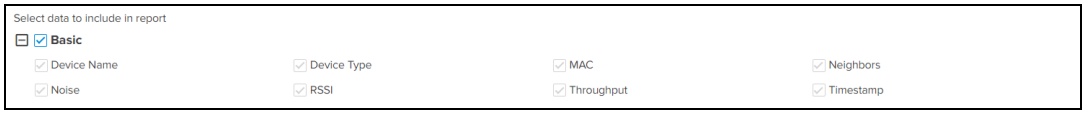


cnRanger Performance Report

Figure 215 Performance Report: cnRanger

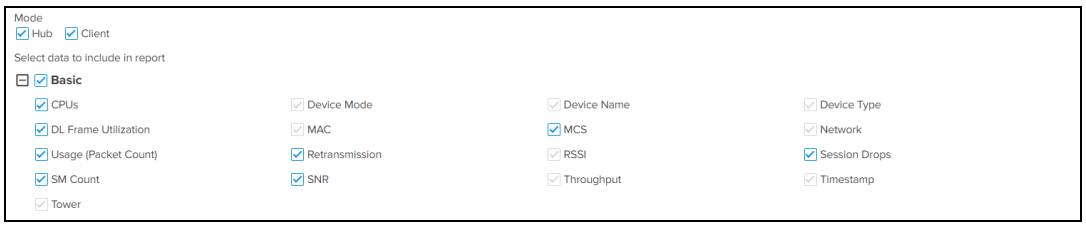
cnReach Performance Report

Figure 216 Performance Report: cnReach



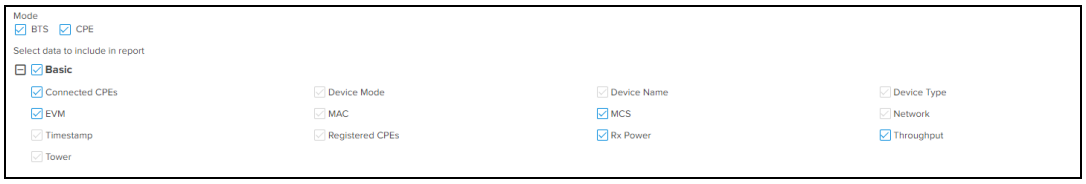
cnVision Performance Report

Figure 217 Performance Report: cnVision



cnWave 5G Fixed Performance Report

Figure 218 Performance Report: cnWave 5G Fixed

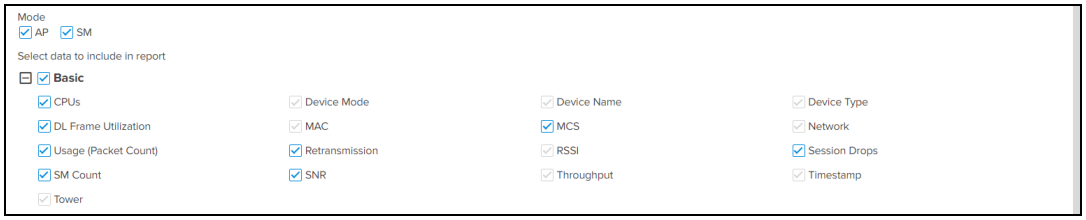


Enterprise Wi-Fi

Figure 219 Performance Report: Enterprise Wi-Fi

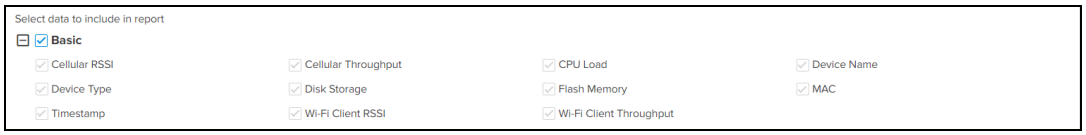
ePMP Performance Report

Figure 220 Performance Report: ePMP



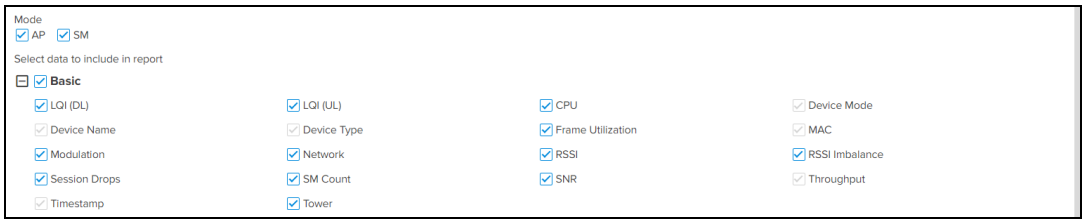
Machfu Performance Report

Figure 221 Performance Report: Machfu



PMP Performance Report

Figure 222 Performance Report: PMP



The modulation mappings for the PMP device are as follows:

Figure 223 Mapping PMP

Value	Description
-1	N/A
0	1X MIMO-A
1	2X MIMO-A
2	3X MIMO-A
3	4X MIMO-A
4	2X MIMO-B
5	3X MIMO-B
6	4X MIMO-B
7	5X MIMO-B
8	6X MIMO-B
9	7X MIMO-B
10	8X MIMO-B

Figure 224 PMP 450m

Value	Description
0	N/A
1	1X MIMO-A
2	2X MIMO-A
3	3X MIMO-A
4	4X MIMO-A

Figure 225 PMP 450m

Value	Description
0	N/A
2	2X MIMO-B
3	3X MIMO-B

Value	Description
4	4X MIMO-B
5	5X MIMO-B
6	6X MIMO-B
7	7X MIMO-B
8	8X MIMO-B

Figure 226 PMP 430

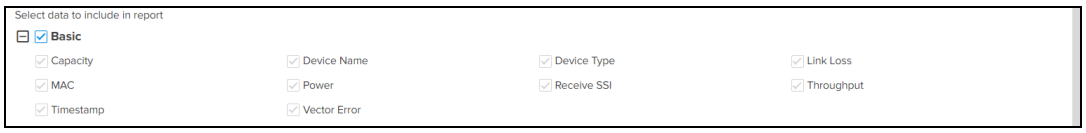
Value	Description
-1	N/A
0	1X SISO
1	2X SISO
2	3X SISO

Figure 227 PMP 450v

Value	Description
0	N/A
2	2X MIMO-B
3	3X MIMO-B
4	4X MIMO-B
5	5X MIMO-B
6	6X MIMO-B
7	7X MIMO-B
8	8X MIMO-B

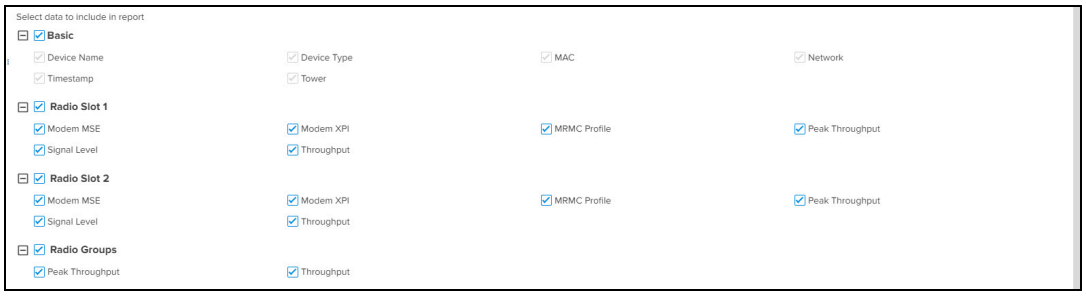
PTP 650/670/700 Performance Report

Figure 228 Performance Report: PTP 650/670/700



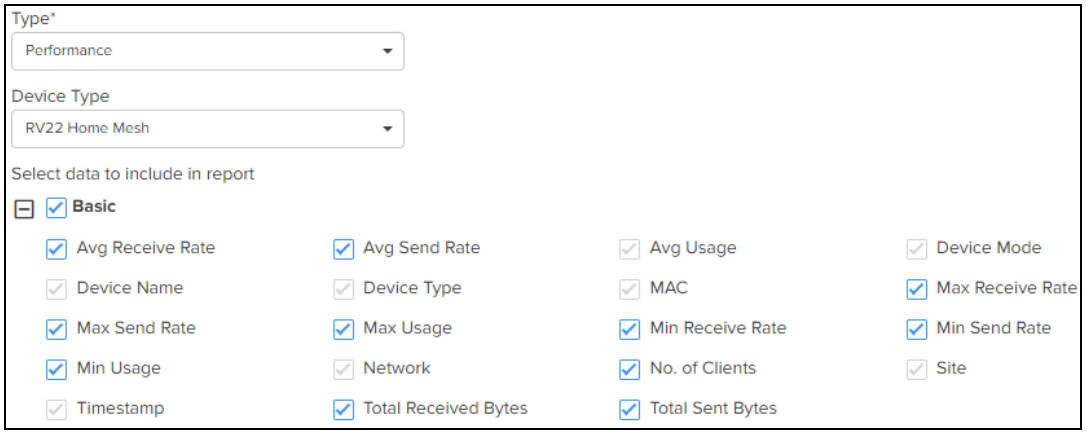
PTP 820/850 Performance Report

Figure 229 Performance Report: PTP 820/850



RV22 Home Mesh Performance Report

Figure 230 Performance Report: RV22 Home Mesh

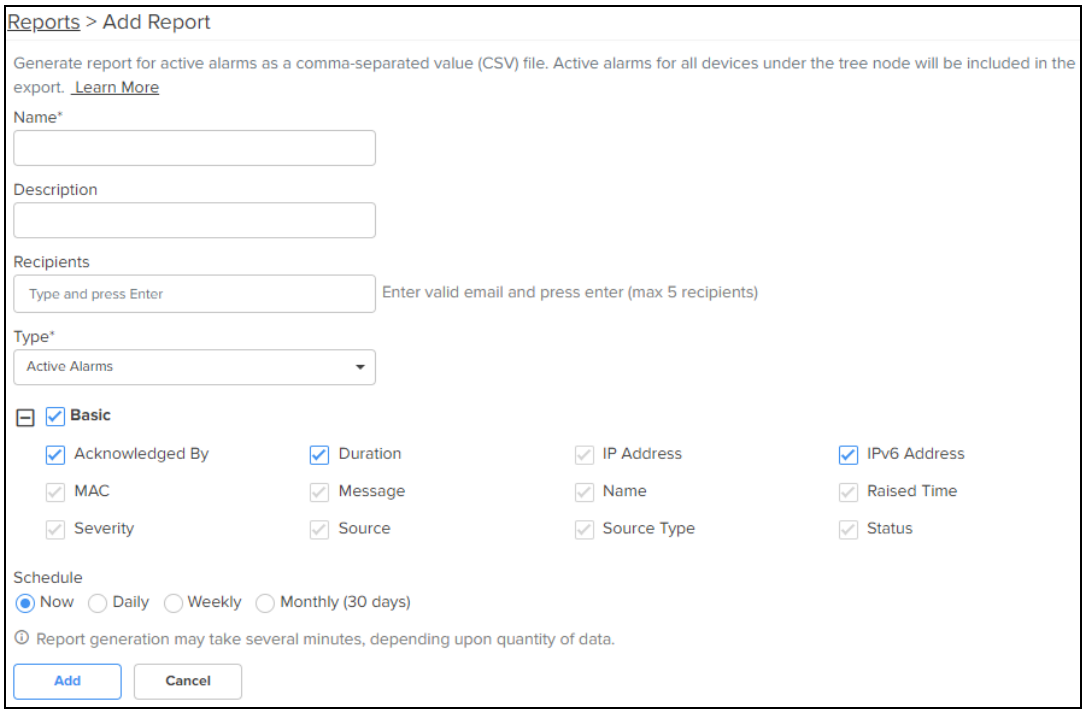


Active Alarms Report

The Active Alarms Report will export the data for the active alarms at the report generation time. Active alarms for all devices under the tree node will be included in the export.

To generate the Active Alarms reports, perform the following steps:

1. Navigate to **Reports X > Scheduled** tab.
2. Enter a **Name** and **Description** for the report.
3. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
4. Select the **Report Type** as *Active Alarms*.
5. Select data parameters to include in the report.
6. Select the following options:
   - Schedule type (Now, Daily, Weekly, or Monthly)
7. Click **Add**. The report gets added to the Scheduled Reports page.

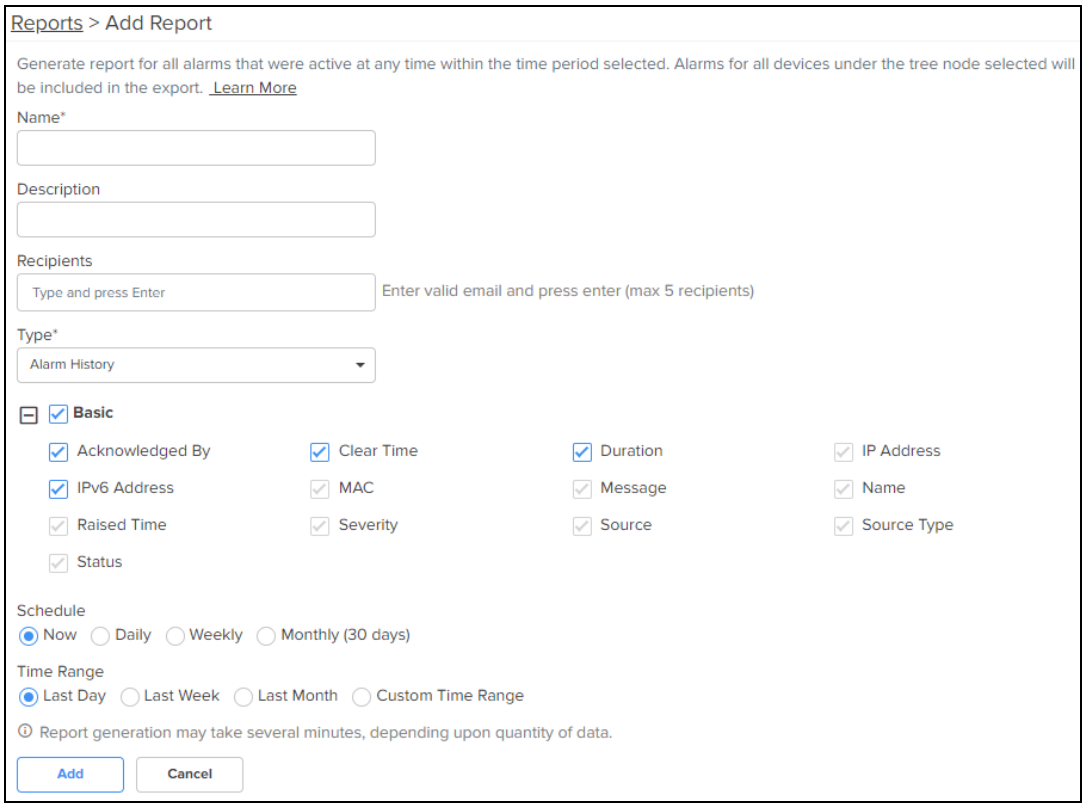


Alarms History Report

The Alarms History Report will generate data for all alarms that were active at any time within the time period. Alarms for all devices under the tree node selected will be included.

To generate the Alarms History reports, perform the following steps:

1. Navigate to **Reports X > Scheduled** tab.
2. Enter a **Name** and **Description** for the report.
3. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
4. Select the **Report Type** as Alarms History.
5. Select data parameters to include in the report.
6. Select the following options:
   - Schedule type (Now, Daily, Weekly, or Monthly)
   - Time Range (Last Day, Last Week, Last Month, Custom Time Range)
7. Click **Add** . The report gets added to the **Scheduled Reports** page.
8. Click **View Jobs** to view the reports.

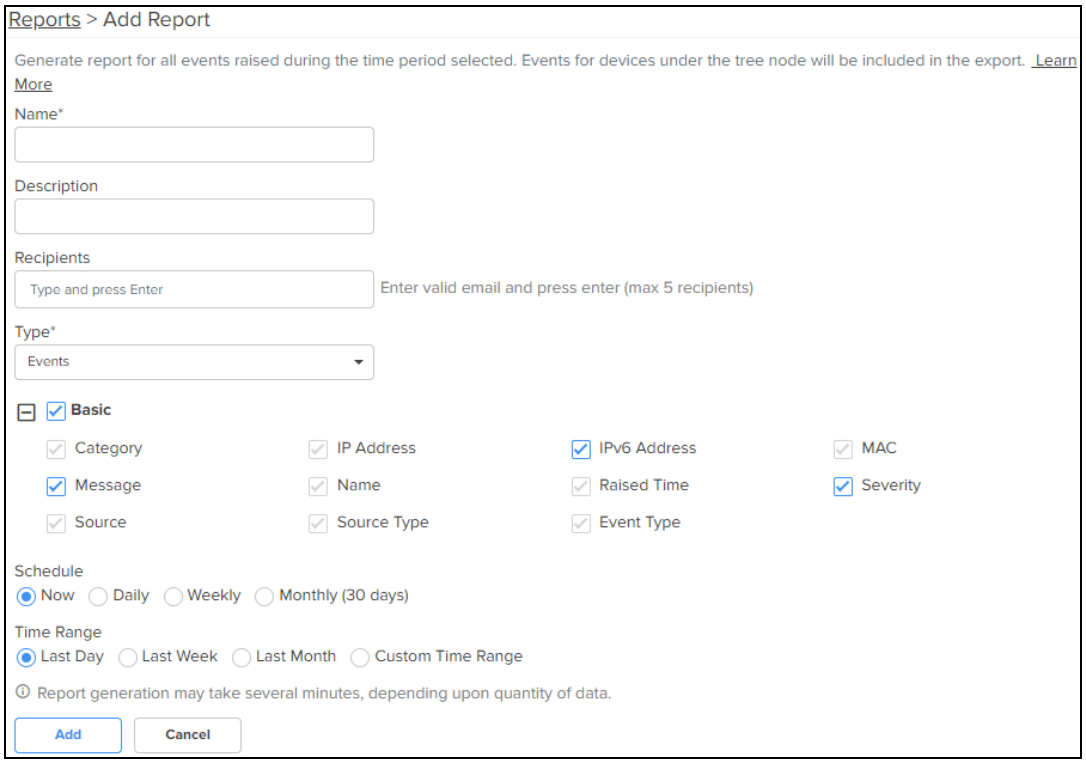


Events Report

The Events Report is generated for the events raised during the time period. Events for devices under the tree node will be included in the export.

To generate the Events reports, perform the following steps:

1. Navigate to **Reports X > Scheduled** tab.
2. Enter a **Name** and **Description** for the report.
3. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
4. Select the **Report Type** as Events.
5. Select data parameters to include in the report.
6. Select the following options:
   - Schedule type (Now, Daily, Weekly, or Monthly)
   - Time Range (Last Day, Last Week, Last Month, Custom Time Range)
7. Click **Add**. The report gets added to the **Scheduled Reports** page.



Clients Report

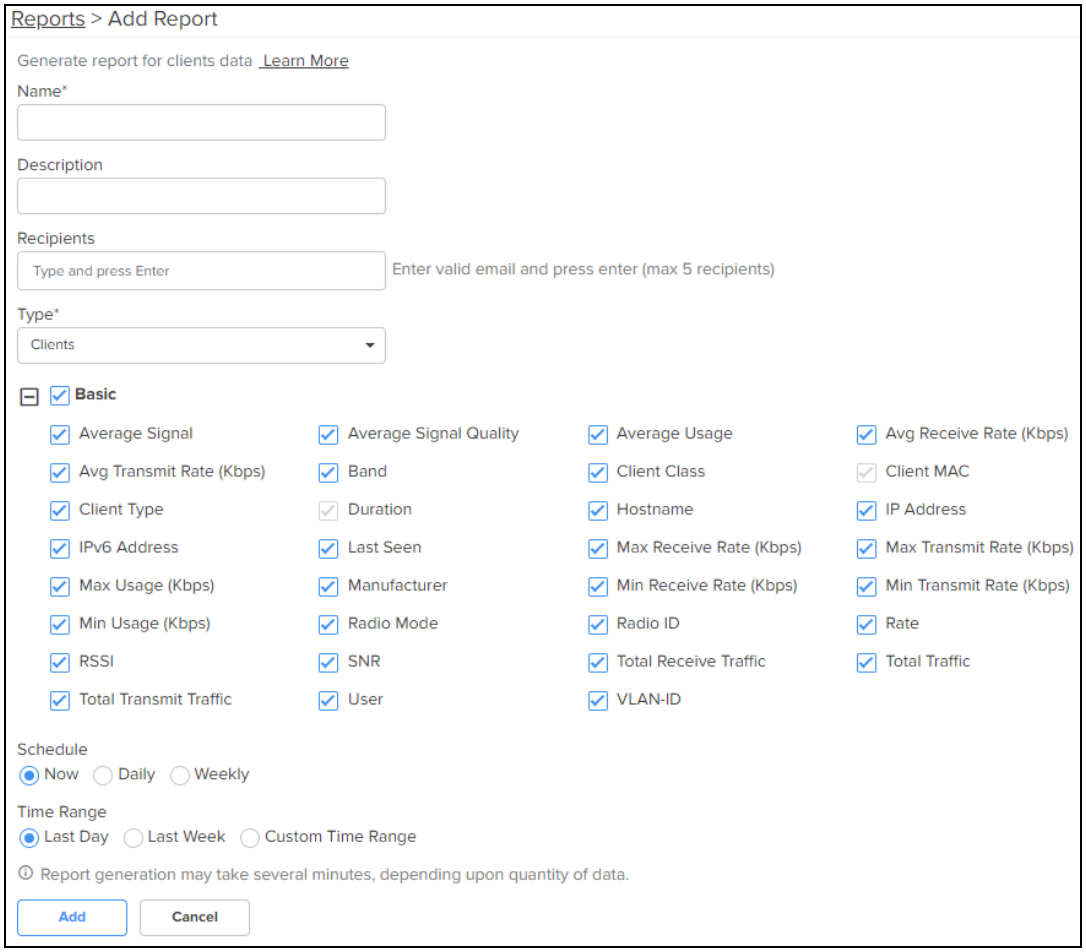
The clients report generates data for Wi-Fi clients.

	NOTE: Client Data is available for the last day, last 24 hours, and last week.

To generate the clients reports, perform the following steps:

1. Navigate to **Reports X > Scheduled** tab.
2. Enter a **Name** and **Description** for the report.
3. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
4. Select the **Report Type** as Clients.
5. Select data parameters to include in the report.
6. Select the following options:
   - Schedule type (Now, Daily, or Weekly)
   - Time Range (Last Day, Last Week. or Custom Range)
7. Click **Add** . The report gets added to the **Scheduled Reports** page.

Figure 231 Clients Report



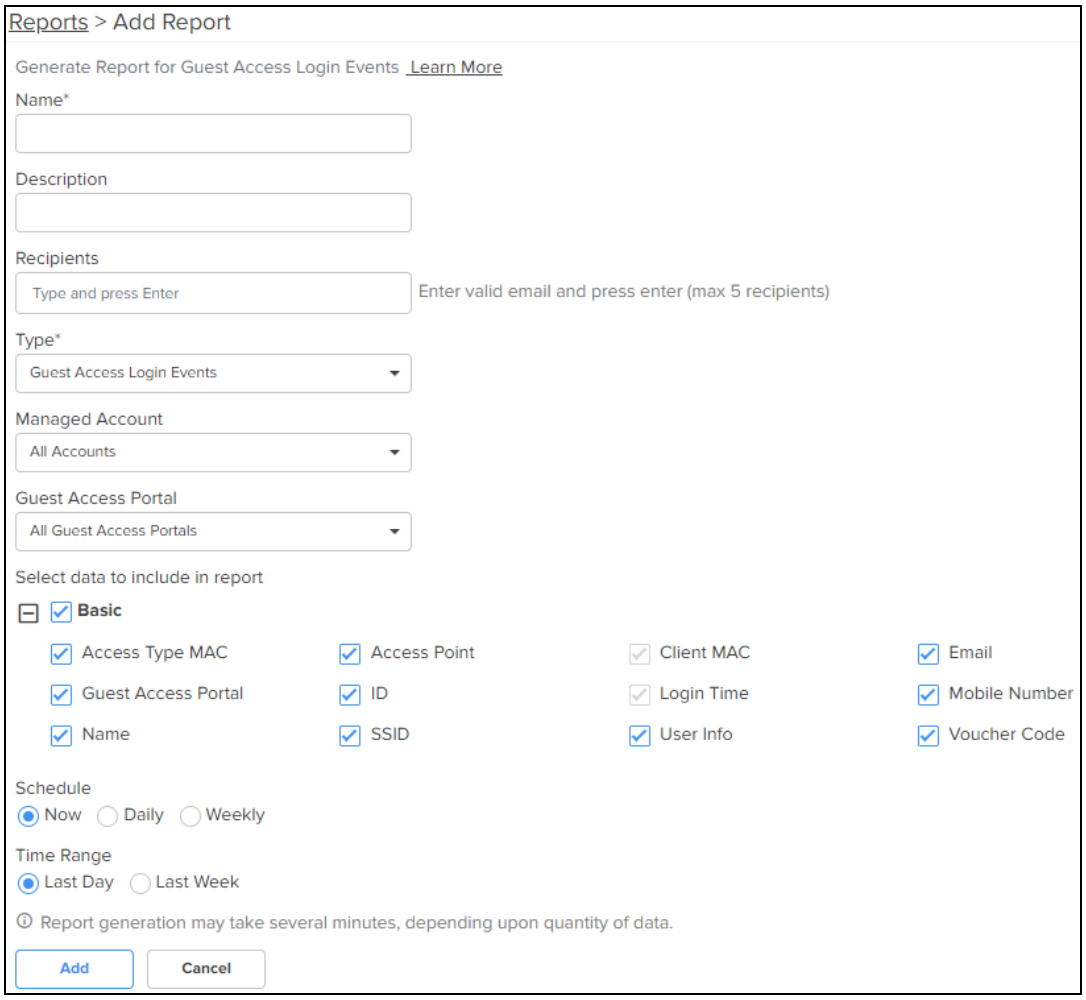
Guest Access Login Events

The Guest Access Login Events represent Wi-Fi Guest Access Logins.

Guest access report can be generated only at system level.

To generate the Guest Access Login Events report, perform the following steps:

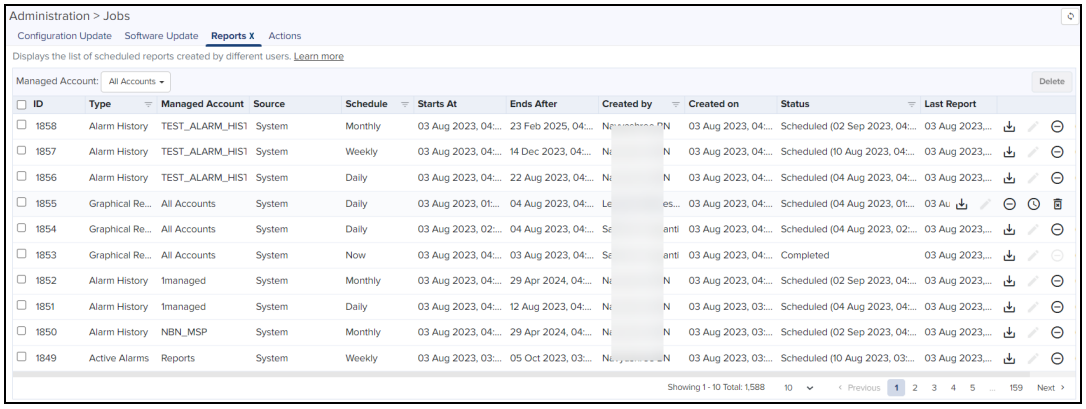
1. Navigate to **Report X > Scheduled** tab.
2. Enter a **Name** and **Description** for the report.
3. Enter email addresses (maximum of 5) in the **Recipients** field to send reports.
4. Select the **Report Type** as Guest Access Login Events.
5. Select the **Managed Account**, if applicable.
6. Select the **Guest Access Portal**, if applicable.
7. Select data parameters to include in the report.
8. Select the following options:
   - Schedule type (Now, Daily, or Weekly)
   - Time Range (Last Day, Last Week).
9. Click **Add**. The report gets added to the **Scheduled Reports** page.



Report Jobs

The report jobs displays the list of scheduled jobs created by different users. To view jobs, navigate to **Administration** > **Jobs** > **Reports**.

Figure 232 Report Jobs



A scheduled report job displays the following **Action** buttons:

- **Edit**: Visible only for **Active Jobs** which have not yet run. You can reschedule a job with this option.
- **Terminate**: Stop the **Active Jobs**.
- **Show History**: Display the detailed status of the generated reports and the file transfer status.
- **Delete**: Delete **Active** and **Completed Jobs**.

- **Instant Download**: Download the latest report without checking the **Show History**.

Graphical Reports

The data reports contain a lot of data that need to be represented graphically so that you can quickly summarize and get a better visualization. In such cases, you can use the Graphical Reports. Graphical Reports can be created by first building a template of the report you want to view, optionally with your own branding such as your logo and brand name. Then, apply the template at a level in the hierarchical tree in cnMaestro such managed service, system, or site. Each graphical report can consist of multiple pages called widgets. The following widgets are available with applicable type of graphs and charts based on context. Each widget has both a graphical and tabular representation of the data. The output is a PDF file.

- **Analytics[XA]: Top APs Reporting Client Disconnections**—Top APs by number of client disconnections.
- **Analytics[XA]: Top Client Connection Failures**—Top client connection failure types by number of failures
- **6E Clients by Radio**— 6E Clients on 6GHz Radios Vs 6E Clients on Non 6GHz Radios.
- **Client Count by Manufacturers**—Top manufacturers by number of clients.
- **Client Capability Trend**—Client Capability Trend over time.
- **Client Count over Time**—Connected clients by band over time.
- **Top Applications by Usage**—Top applications by data usage.
- **Top Category by Usage**—Top application categories by data usage.
- **Client Count by Band**—Client count by band.
- **Client Count by Types**—Top client types by number of clients
- **Peak and Unique Clients**—Total unique clients and peak time number of unique clients.
- **Top APs by Unique Clients**—Top APs by number of unique clients.
- **Client Traffic over Time**—Client uplink and downlink traffic over time.

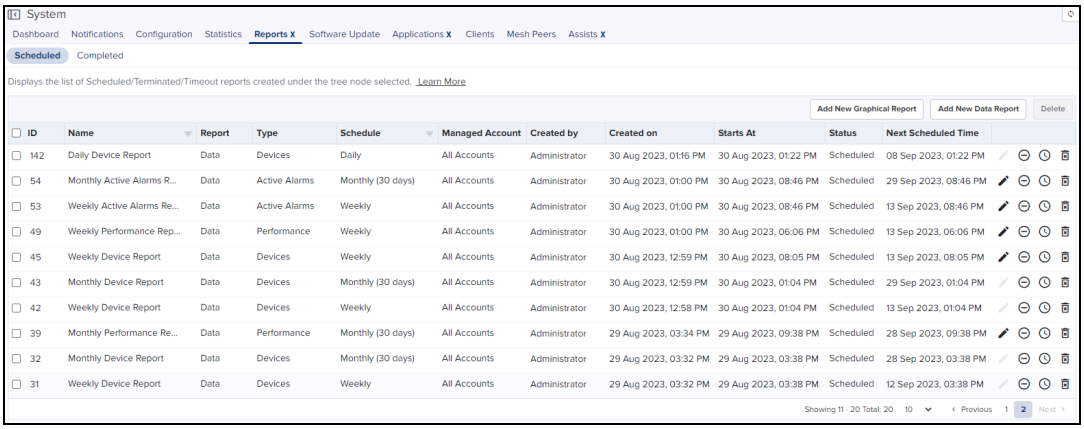
The standard process for graphical report generation includes the following:

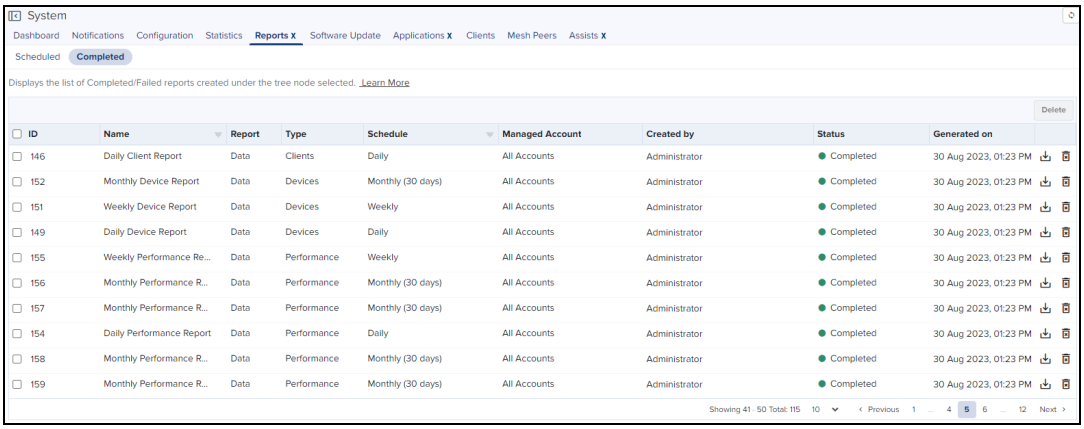
1. Create a template using the widgets listed above.
2. Select a level of the hierarchy on which to apply the template.
3. Schedule the report to either execute one-time or periodically.

NOTE:

- Graphical reports are only supported for Wi-Fi Access Points and Clients, and they can only be applied at the Managed Service, System, and Site levels.
- If there is no data for the specific period, then a blank page is displayed in PDF.
- The title page of the PDF has the date and time zone of the user who scheduled the report.

The **Scheduled** tab presents reports pending execution, and the **Completed** tab provides access to reports that have finished running. The already generated reports are listed as **Completed Reports** (includes Success and Failed status in the status column) and those that are not yet generated but scheduled for a future time are listed as **Scheduled reports** (includes and Future and Terminated status in the status column).





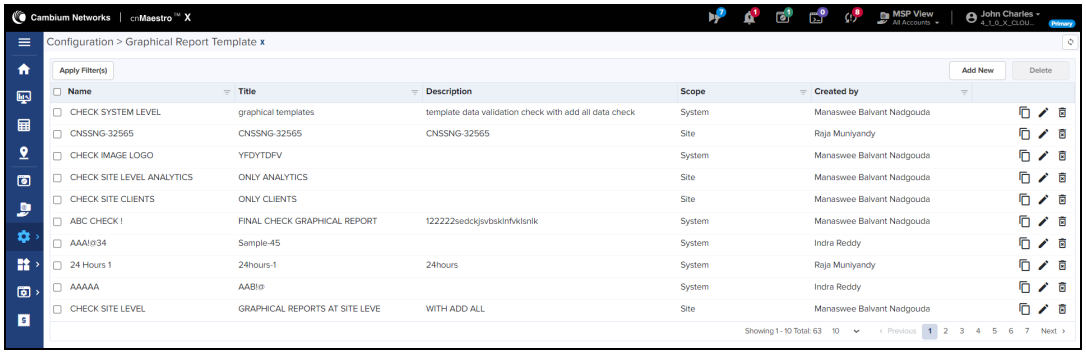
Refer to the following topics to create templates and schedule reports:

- Create Graphical Report Templates
- Generate Reports Based on Templates

Create Graphical Report Templates

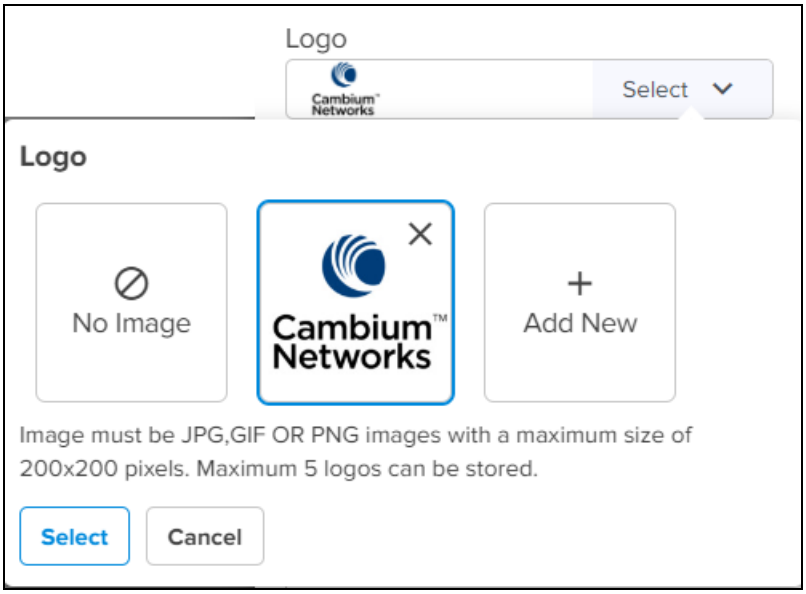
To create a graphical report template, complete the following steps:

1. Navigate to **Configuration > Graphical Report Template X** page.

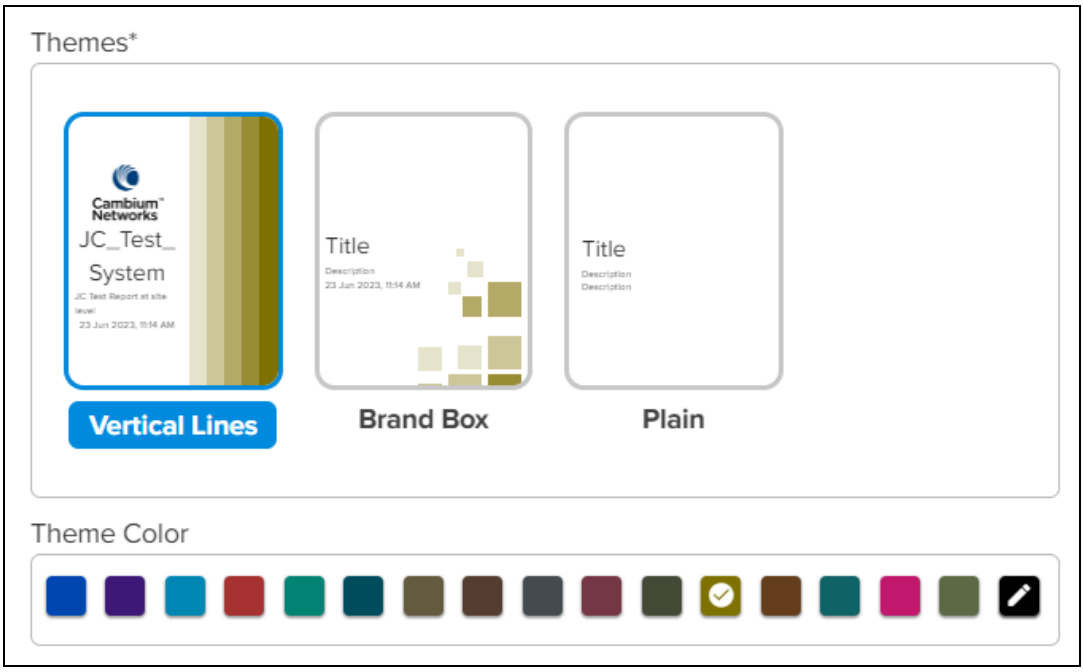


2. Click **Add New** and complete the following details:
   - **Name**—Enter a meaningful name for the template.
   - **Scope**—Select the scope of the report such as **System**or **Site** from the drop-down list.
   - **Title**—Enter the title that you want to see in the Title page of the generated PDF document.
   - **Description**—Optionally, describe the report in details.

3. Optionally, brand the report as per your requirement.
   - **Logo**—To select an existing logo, click the down arrow and then click **Select**. You can also add a new logo by clicking **Add New**.

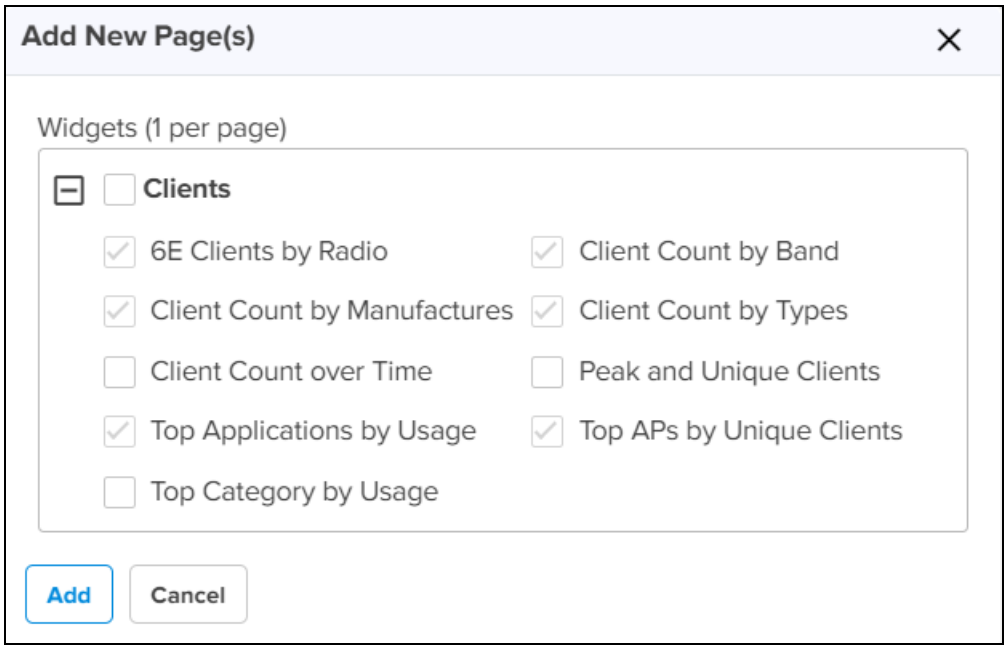


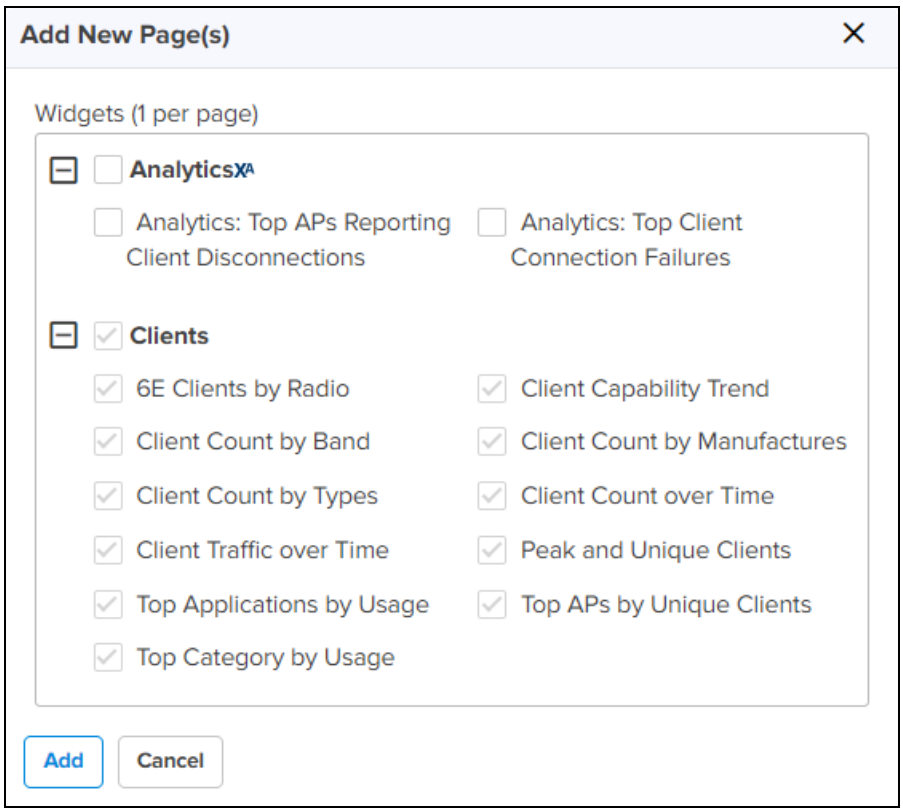
   - **Brand Image**—To select an existing brand image, click the down arrow, and then click **Select**. You can also add a new brand image by clicking **Add New**.
   - **Theme**—Select a theme for the title page of the report as either **Vertical Lines**, **Brand Box**, or **Plain**.



   - **Theme Color**—Select the Theme Color by clicking the desired colored square.
4. Click **Add**.

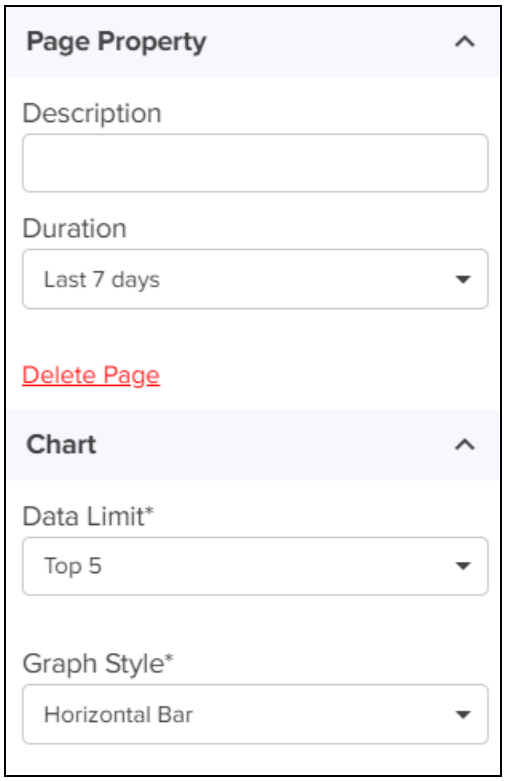
   The report template design page is displayed. You can add one or more widgets to the report, one per page.
5. Click **Add New** in the left pane. The following widgets are available:



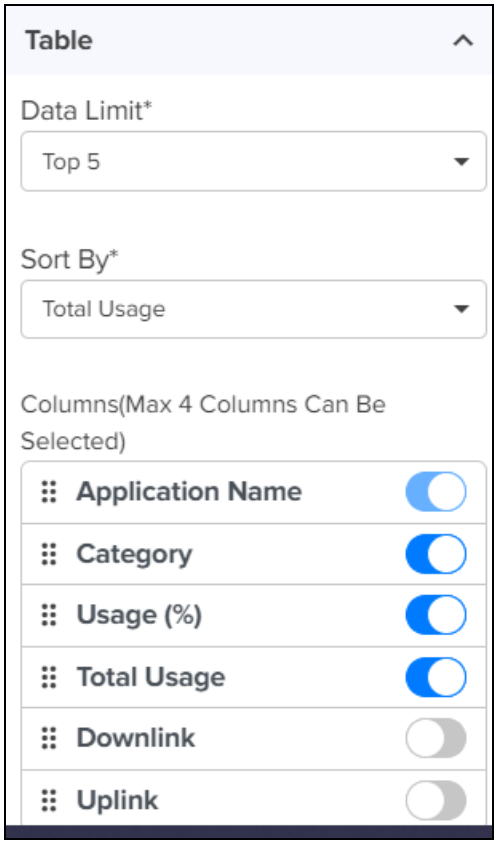


6. Select the check-box for one or more Widgets and click **Add**. Each page can have only one widget. The pages can be rearranged by drag and drop in the left pane.

7. For each page, select the page properties in the right pane. They differ based on widget and options that you have chosen.



8. You can also select the Table columns for each page.



The following options are available based on the page type:

- **Title**—Title for the report.
- **Description**—Detailed information about the report criteria.

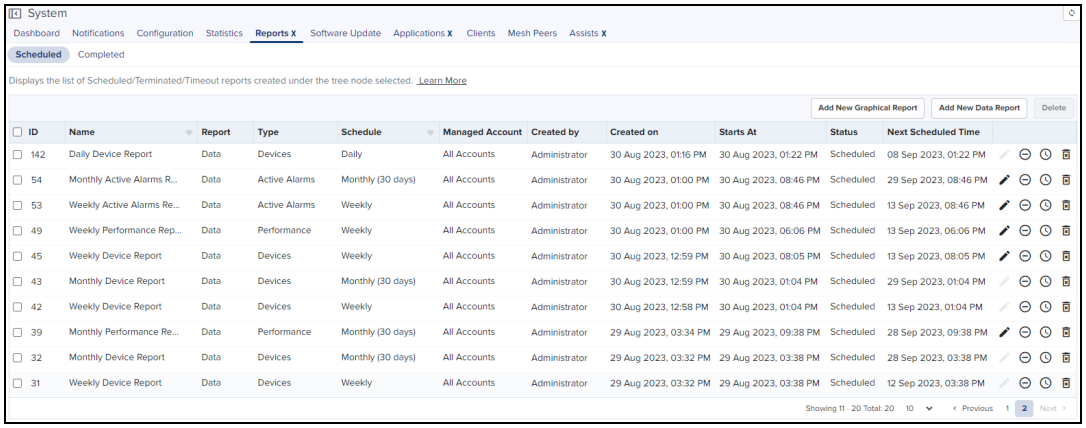
- **Duration**— Time interval. For example, **Last Day** or **Last 7 Days**.
- **Chart/Graph Style**— Type of graph. For example, **Horizontal Bar** or **Pie Chart**
- **Data Limit**—Volume of data to be filtered. For example, **Top 5** or **Top 10**.
- **Sort By**—Column name in the tabular format. For example, **Count**, or **Total Usage**.

9. Click **Save**.

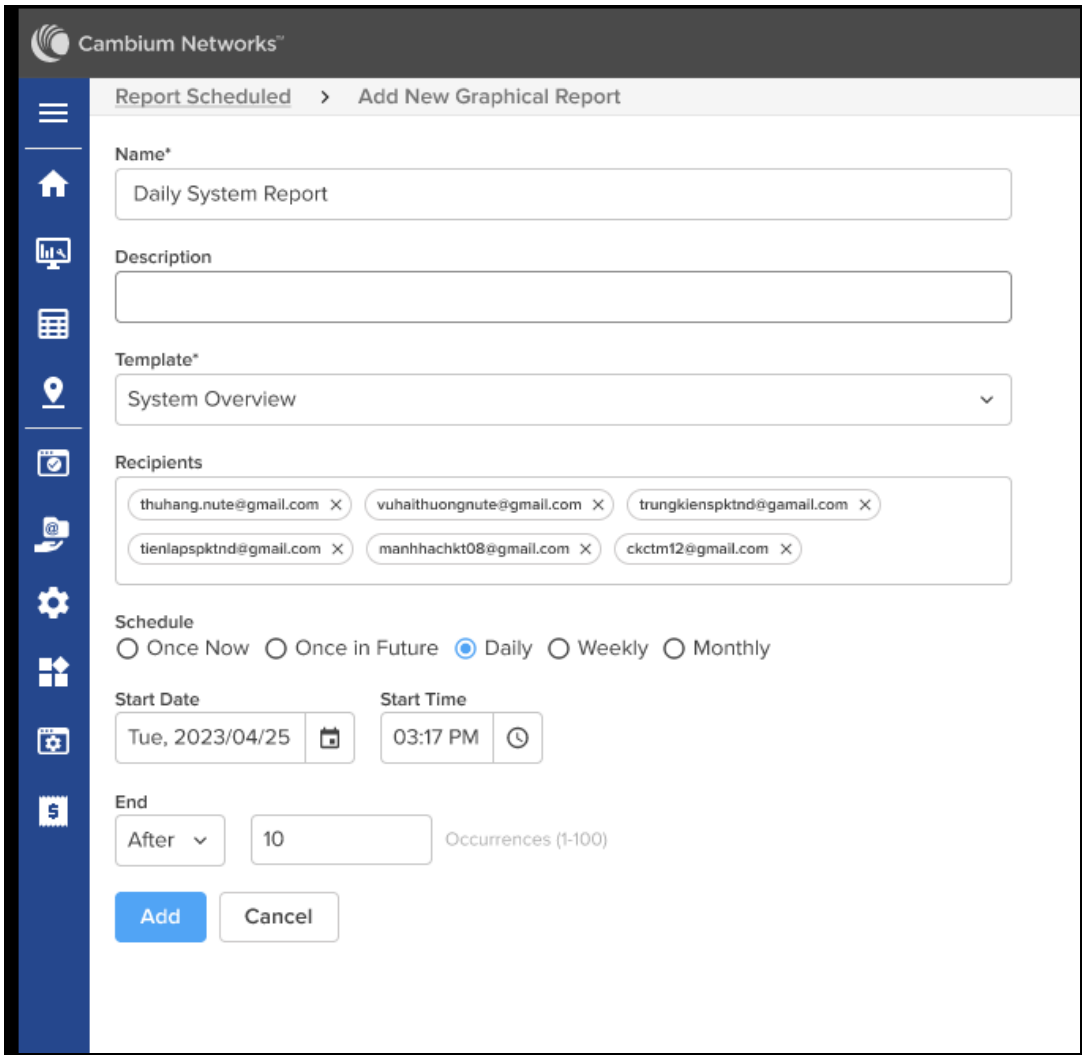
Generate Reports Based on Templates

To add a new report, follow the steps below:

1. Navigate to **Monitor and Manage > System** or **Site > Reports X > Scheduled** tab.



2. Click **Add New Graphical Report**.



3. Complete the following details:
   - **Name**—Enter a name for the report.
   - **Description**—Enter a detailed description for the report.
   - **Template**— Select the PDF template from the drop-down list. If there is no template listed, click **Add New** to create a new PDF template.
   - **Recipients** — Add email addresses of the recipients or requesters to whom the report is applicable.
   - **Schedule**— Select a schedule to generate the report from the following options:
     - **Now**— Generate the report immediately after you click **Add**.
     - **Daily**—Generate the report at the following interval:
       - **Start Date**—Select the date.
       - **Start Time**—Select the time.
       - **End**—Stop generating this report:
         - **After**— Enter the number of instances. The maximum is 100 instances.
         - **By**—Select the date when the report generations should be completely stopped.
     - **Weekly**—Generates the report at the following interval.
     - **Monthly**—Generates the report at the following interval.
4. Click **Schedule**. Adds the report to the list of Scheduled Reports.

Provisioning

The Provisioning chapter includes both Device Software Update and Configuration. It is separated into the following topics:

- Software Update
- Fixed Wireless Configuration
- Wireless LAN Configuration
- Switch Groups Configuration
- 60 GHz cnWave Configuration
- NSE 3000 Configuration
- Configuring Advanced Features

Software Update

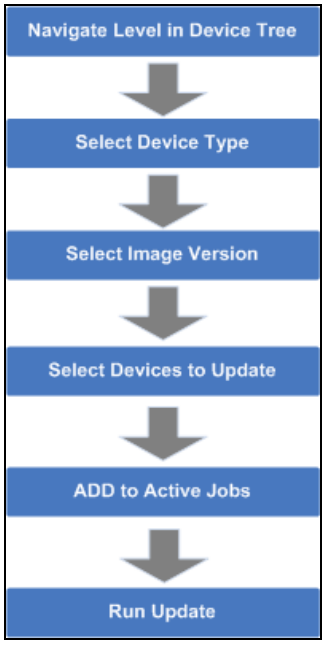
The **Software Update** tab displays the device update details. This section includes the following:

- Overview
- Create Software Update Job
- Viewing Running Jobs in header

Software Update Overview

The Software Update feature allows users to deploy the latest software images to devices. Software updates can be started at any level in the Device Tree. Updates are created as Jobs and placed into the Jobs Queue. When the update is ready to run, it can be started. The process flow of Software Update is shown below:

Figure 233 Software Update Overview



When a Job completes, it is placed in the completed Jobs table. Jobs are available for one week before they are deleted.

Create Software Update Job

Device Selection

Navigate the Device Tree to an appropriate level for the devices to be updated. For example, selecting a Fixed Wireless AP will filter the devices to include the AP and its children.

Device Type

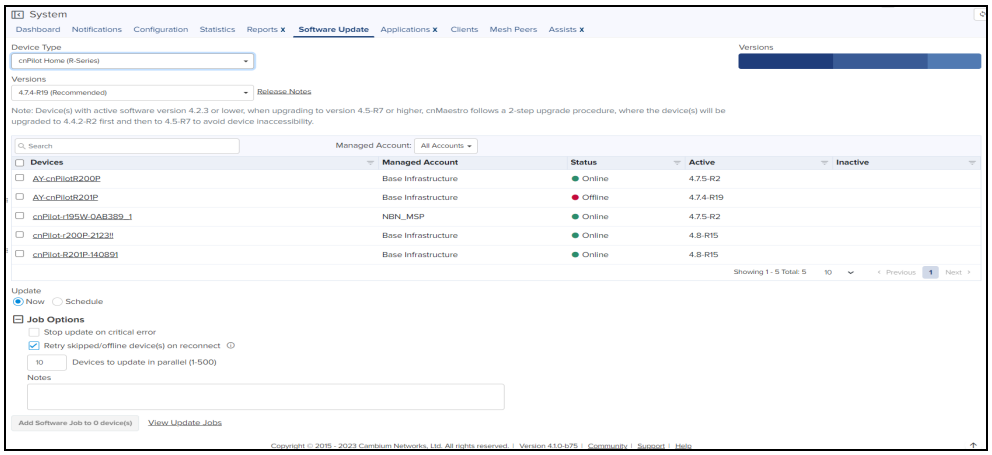
Software Updates are executed on one type of device at a time.

Software Update Dashboard

Once the device type is chosen, the UI displays the most recent software release version for that device type. It also displays a breakdown of the different software versions currently installed on the devices.

	NOTE: Enterprise Wi-Fi shown below contains device types on the **Software Update** page: • Enterprise Wi-Fi (E-Series) • Enterprise Wi-Fi (XE/XV-Series) • Enterprise Wi-Fi (Xirrus-Series)

Figure 234 Software Update: Enterprise Wi-Fi

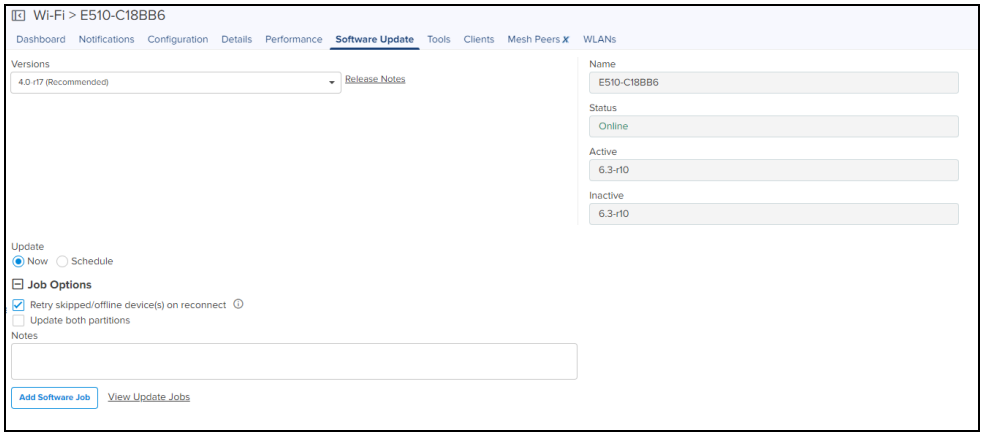


	NOTE: **Update both partitions** option is available at System/Network/Site/Device levels. It is only available for the devices that support it. **Perform sequential updates within a site** option is available at System/Network/Site level except the Device level.

If the **Update both partition** option is enabled/ disabled, the device level of the Software Update will be displayed as follows:

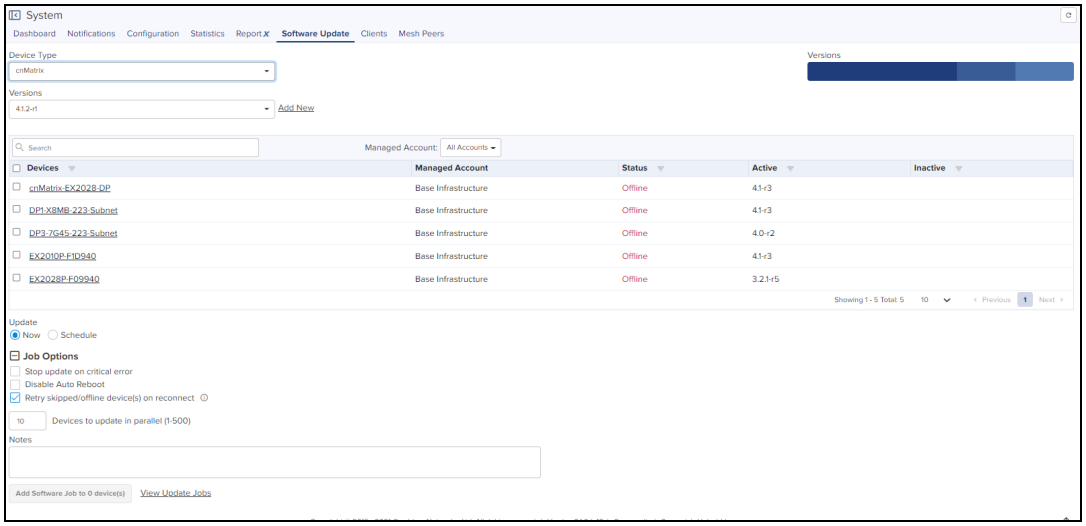
- **Enable**: The selected target image will be upgraded in both active and inactive portions of the device.
- **Disable**: The selected target image will be upgraded in only active portion of the device.

Figure 235 Software Update: Device level



If **Perform sequential updates within a site** is enabled, the image upgrade will happen only on one device at a time.

Figure 236 Software Update: cnMatrix



Disable Auto Reboot option disables reboot after applying the new software image. The user must manually reboot the device to complete the software update.

Figure 237 Software Update: cnRanger

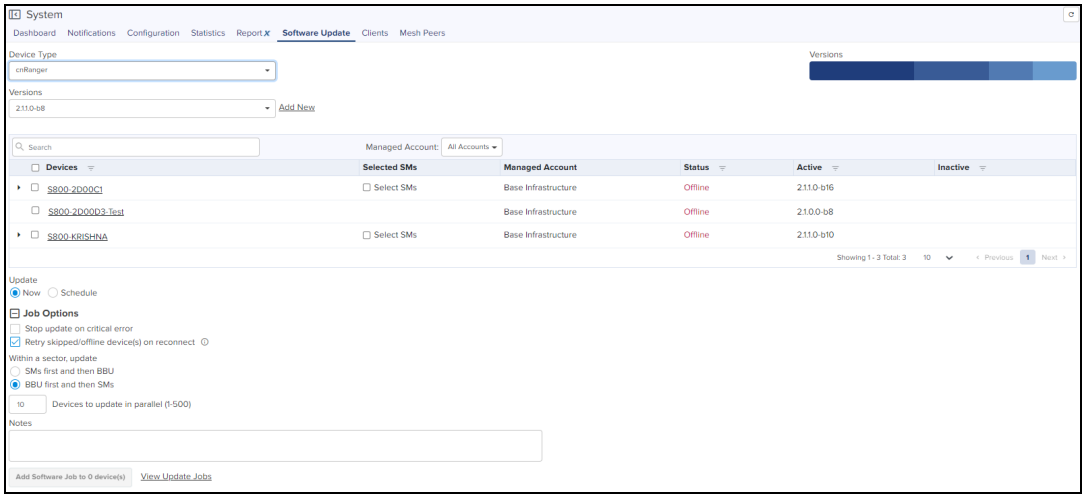


Figure 238 Software Update: 60 GHz cnWave

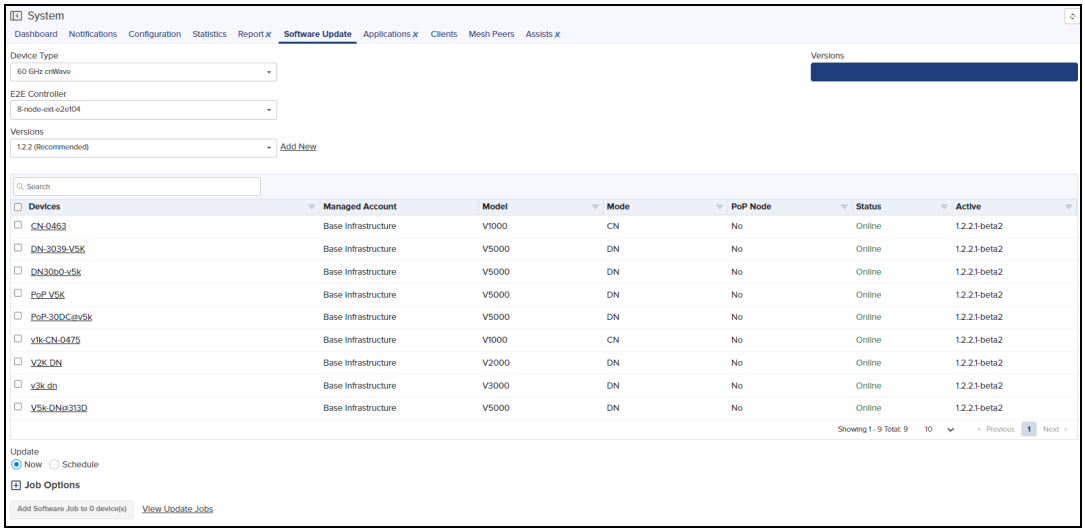
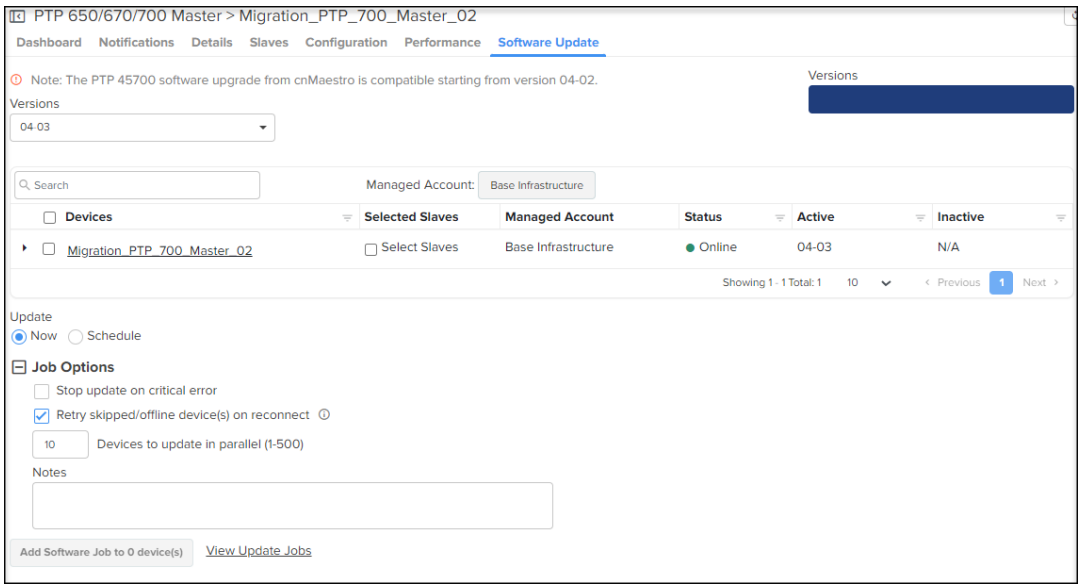


Figure 239 Software Update: PTP 700



	NOTE: Ensure that your PTP 45700 devices run software version 04-02 or higher before proceeding with the upgrade.

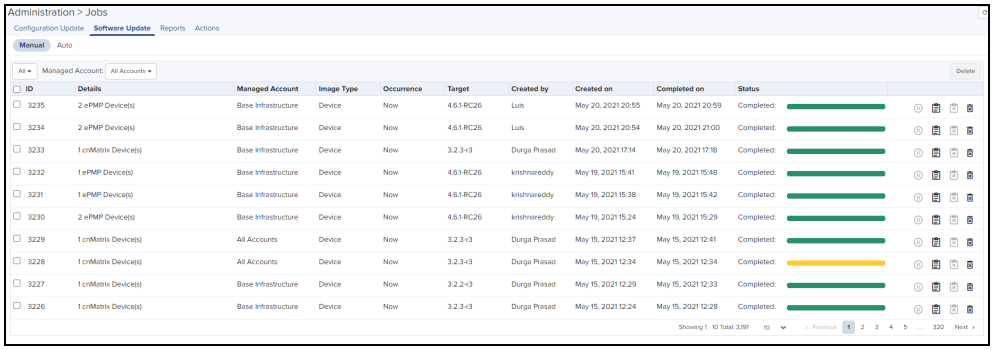
Software Update

The software version on the devices can be automatically updated to the preferred version when the device first contacts cnMaestro.

Enable the automatic update of device software as follows:

1. Navigate to **Administration > Jobs > Software Update** page.
2. Select the **Manual** or **Auto** page for updating the device software feature.
3. Choose the software version depending on the device type.
4. Click **Start.**

Figure 240 Manual update



NOTE:

A Manual Update can be aborted at any point of time by clicking the Abort.

Figure 241 Auto update

NOTE:

Auto update can't be manually aborted.

You need to download the new image version released from the Support Site. For more details refer to Managing Device Software Images.

Device Table

Select the devices to upgrade in the Devices Table.

NOTE:

- You can upgrade a device only when status is Up. If you try to upgrade a device when it is Down, you will receive a message the selected device is down.
- If the device is under the Auto Software Upgrade, the manual software update is not possible.

The following parameters are visible (though some are only available for certain device types).

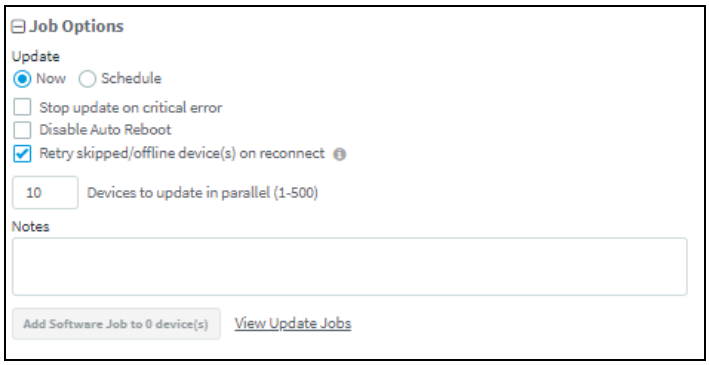
Table 59: Parameters in Device Table

Parameter	Description
Current Version	The version of the active software image running on the device.
Devices	The names of available devices in a system. The list is pre-filtered based upon the node selected in the Device Tree.
Selected SMs	If the AP is selected, the corresponding SMs will also be selected.
Status	The status of a particular device in a system. Devices that are not connected cannot updated.

Retry Software Update

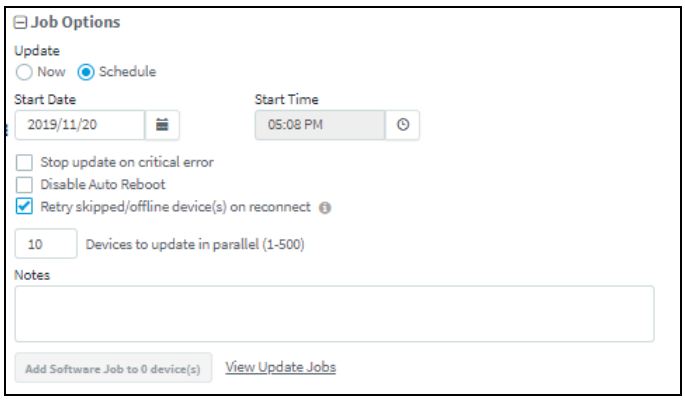
The **Retry Software Update** option is available in every **Software Update** tab; it is enabled by default.

Figure 242 Retry Software Update



When you select **Schedule** to update, the following options are available as shown below:

Figure 243 Retry Software Update: Schedule



If the Software Update Job was Skipped for a device because it was offline, an icon ( ) appears next to the Active Software version of the device. This indicates the software update for the device will be done with the Target device version in the Job, whenever it reconnects to cnMaestro.

If the software update job was skipped while upgrading with the same version as the device active version, the icon will not be displayed, and the device will not update when it reconnects.

	NOTE: The device which undergoes **Retry Software Update**, does not create a new Job.

Options

Stop Updates on Critical Error

If one of the updates fails, do not start any additional updates and instead pause the update job. All existing, concurrent updates will be allowed to proceed until completion. The administrator will be able to continue the update where it left off if desired.

Sector Upgrade Order

The recommended update order for devices within a sector will be pre-configured according to the recommendations for the device. It can be changed if desired.

	NOTE: Device update occurs sector-by-sector. One sector needs to complete before a second sector is started.

Parallel Upgrades

Specify how many device upgrades to perform in parallel to complete the upgrade faster. However if the job is configured to halt on an error, all concurrent sessions will still be allowed to complete.

Upgrade Steps

To upgrade an ePMP (Sectors) device, perform the following steps:

1. Navigate to System/Network/Tower/Device level. and select the device.
2. To update the device, navigate to **Manage** > **Software Update**.
3. Select the following **ePMP (Sectors)** from the **Device Type** drop-down:
   a. 60 GHz cnWave
   b. cnMatrix
   c. cnPilot Enterprise (ePMP Hotspot)
   d. cnPilot Home (R-Series)
   e. cnRanger
   f. cnReach
   g. cnVision
   h. cnWave 5G Fixed
   i. Enterprise Wi-Fi (E-Series)
   j. Enterprise Wi-Fi (XV-Series)
   k. ePMP (Sectors)
   l. ePMP 1000 Hotspot
   m. Machfu
   n. NSE
   o. PMP (Sectors)
   p. PTP 650/670/700

q. PTP 820/850

4. Select the software image to update from the **Version** drop-down.
5. Select checkbox for the devices to update.
6. Select **Job Options**.
7. Click **Add Software Job**.

Software Update Jobs and Parameters

The Software Update Jobs table lists all currently running, queued, and completed jobs. The jobs can be triggered immediately, or they can be run later.

(**Administration > Jobs > Software Update** tab.)

The following table displays the list of parameters in the **Software Update Jobs** tab:

Table 60: Parameters in Software Update Jobs

Parameter	Description
Action	Use the **Start** or **Delete** button to manage the upgrade process. After the upgrade has started, the **Pause** button will stop new upgrades from the beginning. If the upgrade process fails or the upgrade has been paused, you can restart the process by clicking the **Resume** button.
Created By	The user who has created this job.
Created On	Date and time the job is created.
Details	Count of devices and date and time the upgrade process is initiated.
ID	Identification number of the active job.
Image Type	Displays **Device** for Device Firmware Upgrade.
Occurrence	Displays **Now** and **Scheduled** depending upon the job options selected during Software Update Job.
Parallel	Number of devices to start in parallel.
Sector Priority	For cnVision, ePMP/PMP, the priority of AP/SM to start.
Status	Status of update.
Stop on Error	Stop the job on an error in any device update.
Target	Target software version to upgrade.
By selecting the **Show More** icon, you can view the following parameters:	
Device	Device for which the upgrade is initiated.
Message	The message that is displayed after the update.

Table 60: Parameters in Software Update Jobs

Parameter	Description
Original Version	The current software image version of the device.
Result	The upgrade status of the device.
Status	Status of the device.

The user can filter the jobs based on the running status. The user can also filter the devices in a particular job based on the parameters mentioned in the above table.

Abort Software Job

Abort operation will skip devices that are waiting for an update to begin. Devices already being updated may continue, but cnMaestro will stop tracking their progress. Aborting a Software Job puts the device into a "Completed" state that cannot be manually restarted by the user. The "pending" devices will not begin their updates.

Figure 244 Abort Software Job

NOTE:

1. Devices which are already updated display as **Completed** with a message **Update Complete** along with the status as Completed.
2. Devices that are ongoing display as **Aborted** with a message **Manually Aborted** with the status as Aborted.
3. Devices that have not yet started display as **Skipped** with a message **Job was aborted** with the status as **Skipped**.
4. Software update jobs can be scheduled in parallel irrespective of other running jobs in cnMaestro X accounts.
5. Only **Configuration** or **Software Update Job** operation can be performed on the device, as the job locks the device.

Viewing Running Jobs in header

Click the  icon in the top right corner of the UI. This navigates to the **Software Update** tab > **Jobs** page of the Software Update section. For more information, see Software Update

Fixed Wireless Configuration

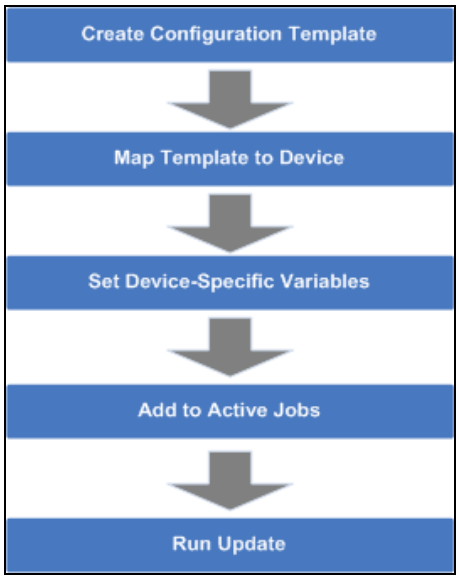
This chapter provides the following information:

Overview

Template configuration is supported for ePMP, PMP, cnWave 5G Fixed devices. Templates are textual representations of device settings that contain a full or partial configuration. When a template is applied to a device, the only parameters changed are those in the template.

The process flow of the basic template configuration is shown below:

Figure 245 Basic Template Configuration Flow



Configuration Templates

Templates can be pushed to a device manually through a configuration job. This is accomplished in the configuration management page. Templates can also be applied prior to onboarding, in which they would be provisioned in the On-boarding Queue.

Some sample templates are listed below. The ellipses (...) represents additional content that has been excised from the example to limit the size of the text. Each device type has its own template syntax, which can be examined by viewing the device configuration.

Sample ePMP Template

The ePMP template uses the exported ePMP configuration format, which is JSON-encoded.

Figure 246 Sample ePMP Template

```
"device_props": {
      "acsEnable":      "0",
      "acsScanMinDwellTime":  "200",
      "acsScanMaxDwellTime":  "300",
      "acsControl":     "0",
      "bcPriority":     "0",
      "cambiumInternetConnectionServerIP":      "",
      "centerFrequency":      "5670",
      "dataVLANEnable": "0",
      "dataVLANVID":    "",
      ...,
      "snmpTrapTable": [{
            "snmpTrapEntryIP":      "10.120.143.176",
            "snmpTrapEntryPort":    "162"
      }],
      ...
}
```

Configuration Variables

Administrators can embed variables into templates that will be replaced when the template is applied to a device. This allows one to leverage a shared, generic template, but to tailor it to individual devices when it is pushed. Template variables are added to a configuration file by replacing an existing parameter with a customer-defined string of the format ${VARIABLE}. An example configuration line with a single variable replacement is shown below:

“networkLanIPAddr”: ${IP ADDRESS}

The above variable is named IP_ADDRESS. When the template is pushed to a device, this variable will be replaced with a value specific to the device. This value needs to be set for the device prior to the template application, else the configuration will not be pushed. Default values can also be specified for variables, as shown below:

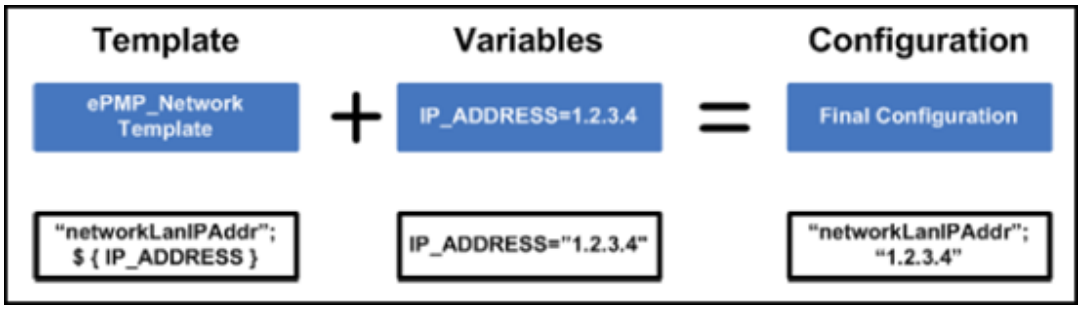
“networkLanIPAddr”: ${IP ADDRESS="10.1.1.254"},

The default value is "10.1.1.254". In this case, if the variable is not set for a device, the default value is used.

Variable Usage

The Templates and Variables are merged to create the final configuration that is pushed to the device. The figure below explains the usage of variables for configuration:

Figure 247 Variable Usage



Macros

Macros can be used in templates similar to variables except that they automatically embed values provided by the device itself.

- %{ESN} will be replaced with the MAC address of the device

- %{MSN} will be replaced with the Serial Number of the device

Variable Caching

Variables set for a particular device will be cached, so they can be reused later. This means the next time a template is applied that leverages a variable with the same name as used previously that value will be pre-populated with the previous value. It is therefore beneficial to define a uniform variable naming and usage scheme for variables across different templates.

Device Type-Specific Configurations

The format and values of a configuration template are unique to the different device types. Templates that work with device type do not work with others, and all templates need to be mapped to a specific device type upon creation.

Device Mode restrictions

Some devices, such as ePMP execute in AP and SM modes. The ePMP templates can be configured to only apply to devices that support a selected mode.

Variable validation

All variables for a selected template must be mapped to a value in order to create a configuration job. If any variables are not mapped, an error will be generated. Variables with default settings do not cause an error if they are unset.

Sample Templates

A number of sample templates are provided for each device type. These are not meant to be applied directly, but rather serve as an example of the configuration data format accepted by the device. Refer to the device documentation for complete information.

Template file creation

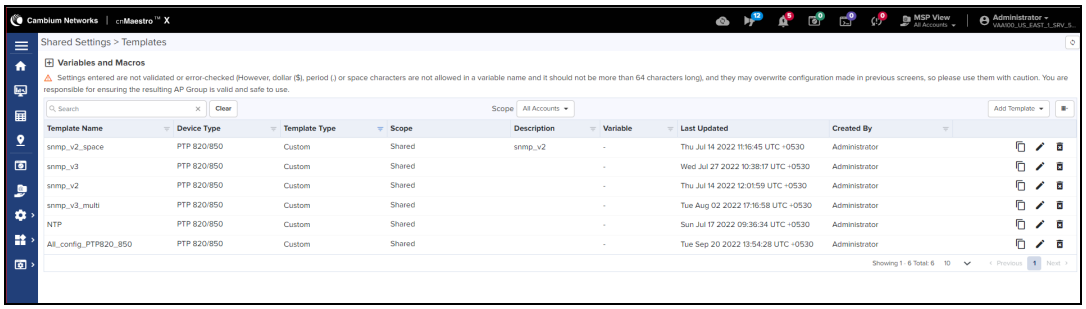
The typical process for creating your own configuration templates is below:

1. On a test device configure the parameters to the devices. This can be done directly on the device UI .
2. Export the device configuration using cnMaestro.
   - Navigate to **Configuration > Templates**, select the device in the left-hand tree and click the **View Device Configuration** link. This can also be done via the device GUI, typically in the Administration or Operations section where there will be an **Export** for configuration.
3. View the configuration file in a text editor like Notepad++ and search for the values entered in step 1. You can also search for the parameter name to find the correct lines.
4. Copy and paste the relevant lines into a new file.
5. Optionally replace values with replacement variable text. This will allow you to set the value per device.
6. Once you have this partial template, it can be copied into the template creation text field and saved.

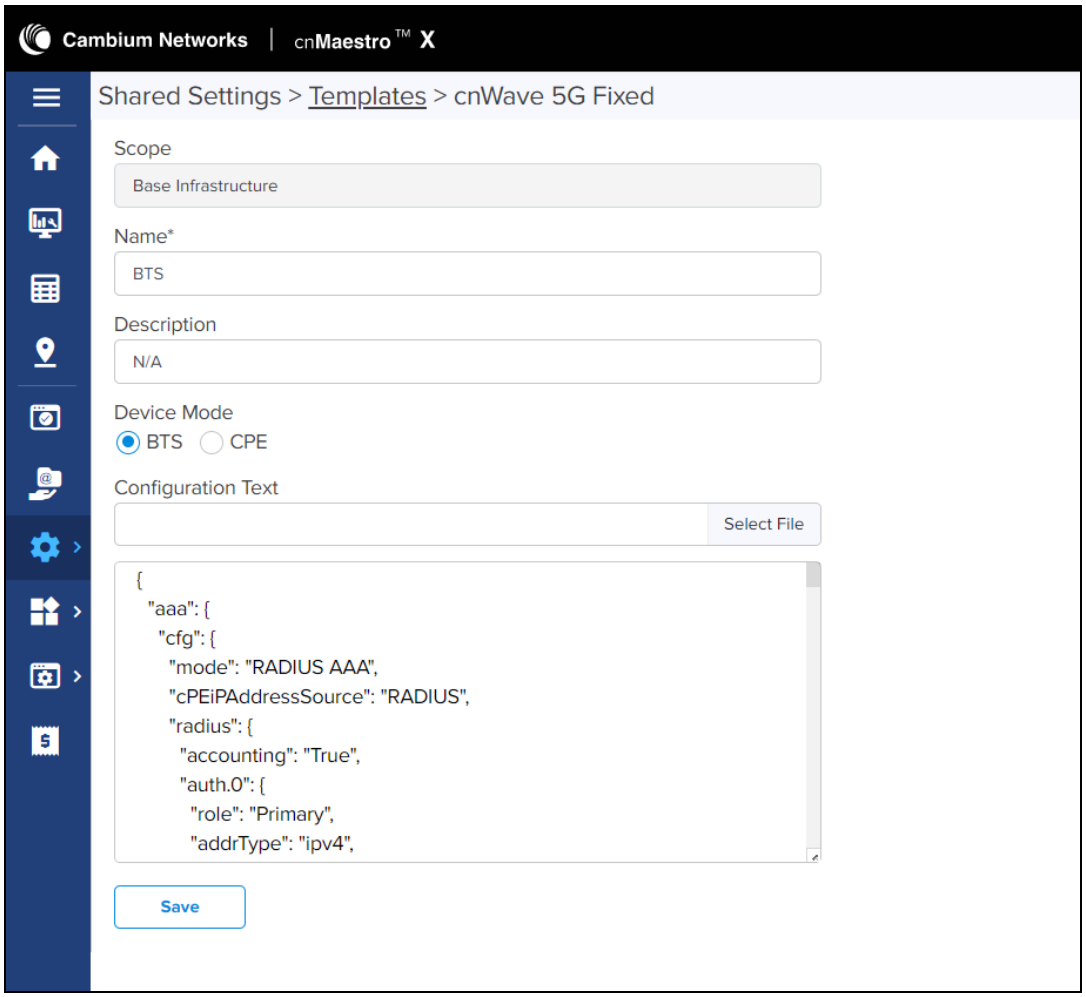
Template

To create a configuration template:

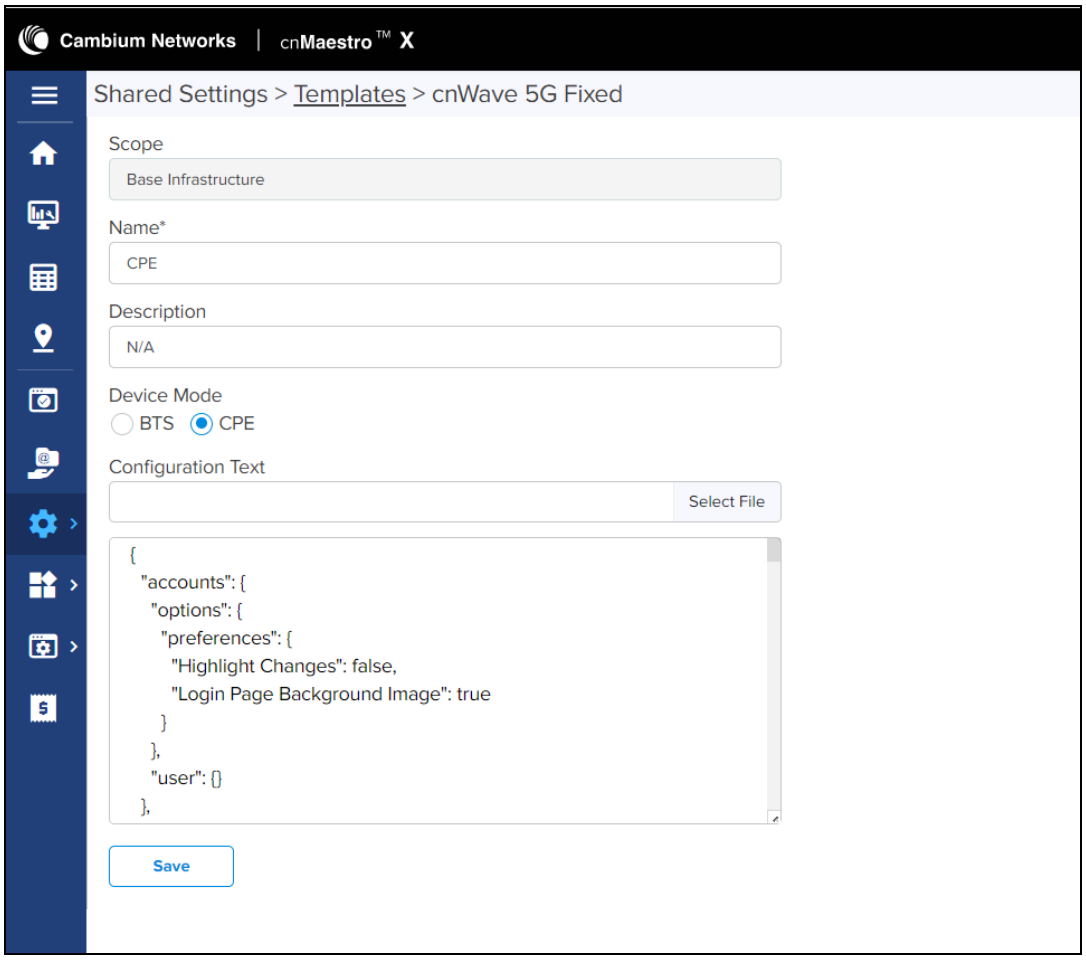
1. Navigate to **Configuration > Templates** in the main menu.



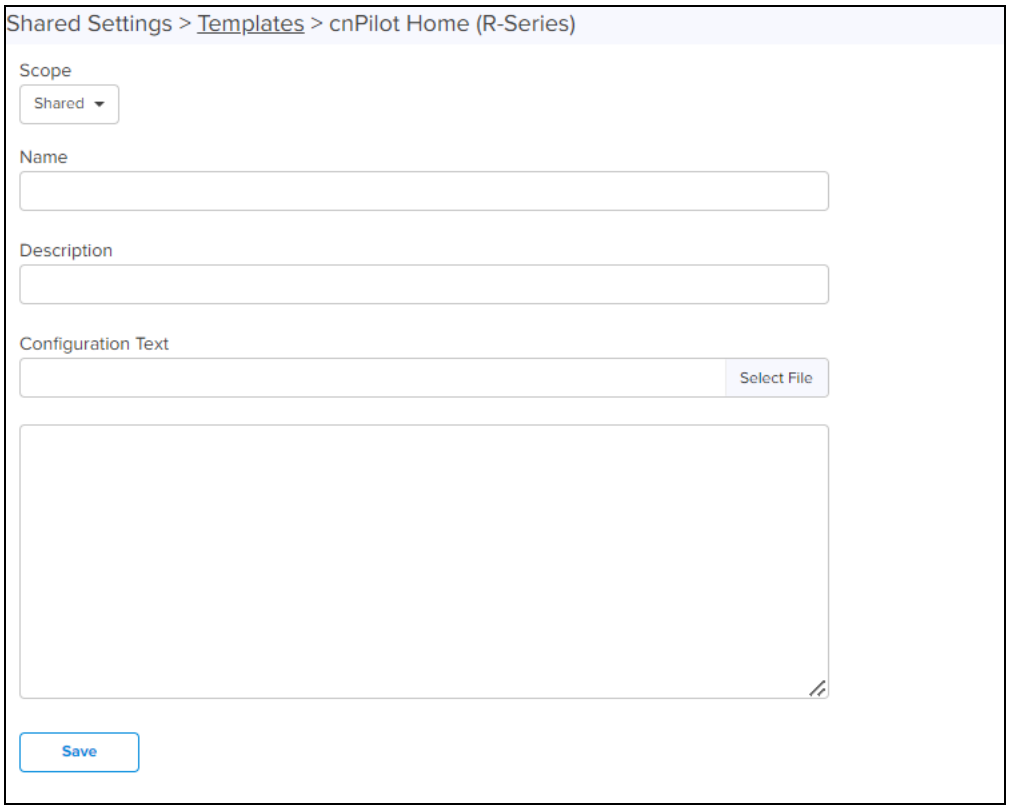
The following template is for BTS:



The following template is for CPE:



2. Click **Add Template** button.



3. Choose a **Device Type**, **Name**, and **Description** for the template. For ePMP, PMP, cnWave 5G Fixed, cnReach, cnMatrix, and Machfu templates, you should select a **Device Type** as well.
4. Either upload your template into the UI or paste the template text into the text area.

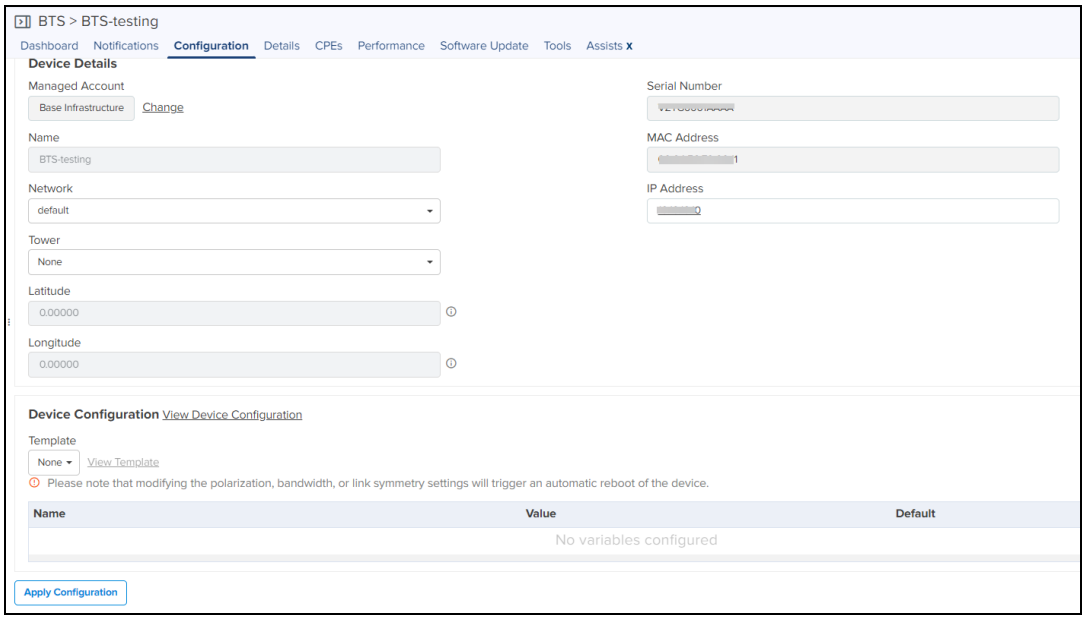
	NOTE: No default templates available for R-series. User needs to create a new template.

5. After clicking **Save**, the template will be available in the selection menu on the configuration and onboarding pages, as long as the device type and model match the device selected.
6. By selecting the Custom option under the Template type filter All Default templates will be hidden.

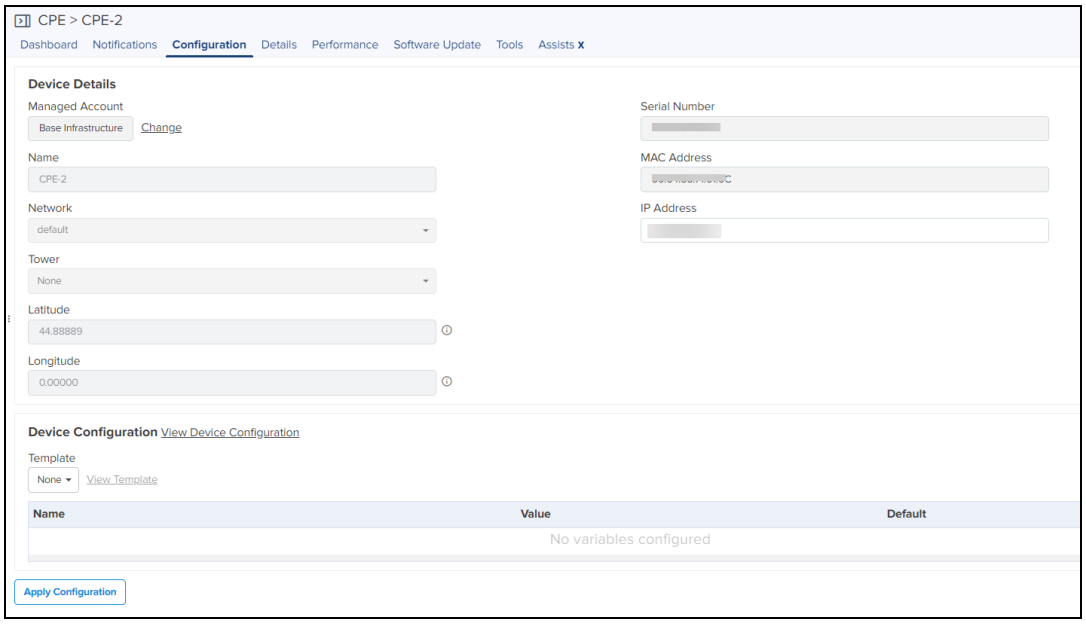
	NOTE: When you navigate to the Template page default template type filter will be custom. User needs to select **All** or **Default** to view other templates.

BTS and CPE Configuration

To configure BTS, navigate to **Monitor and Manage > BTS > Configuration**.



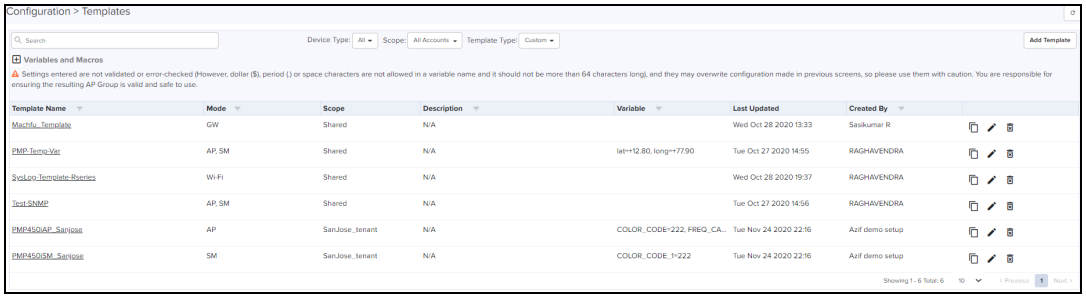
To configure CPE, navigate to **Monitor and Manage > BTS > CPE > Configuration**.



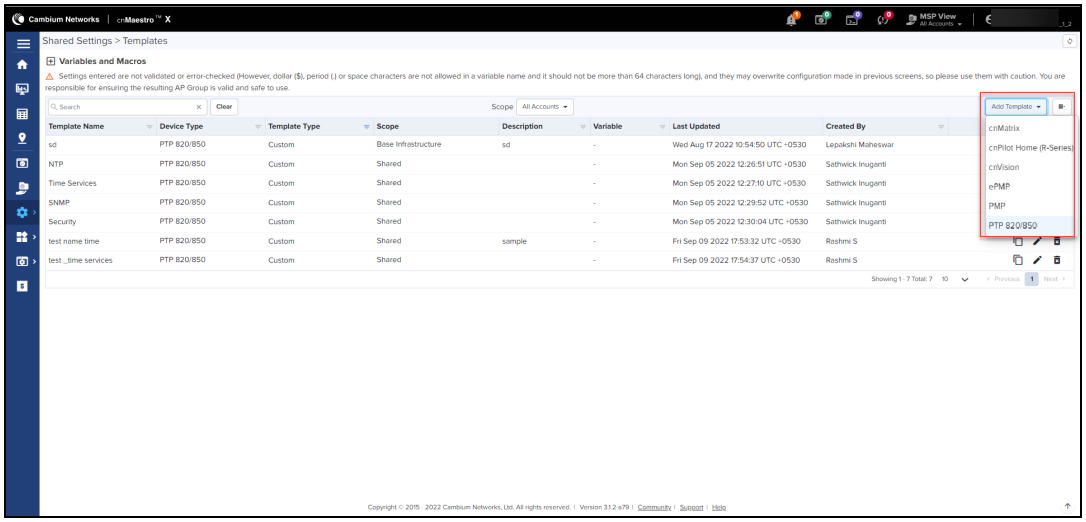
Configuration Template for PTP 820/850

To create a configuration template of PTP 820/850 device, perform the following steps:

1. Navigate to **Configuration > Templates** in the main menu.



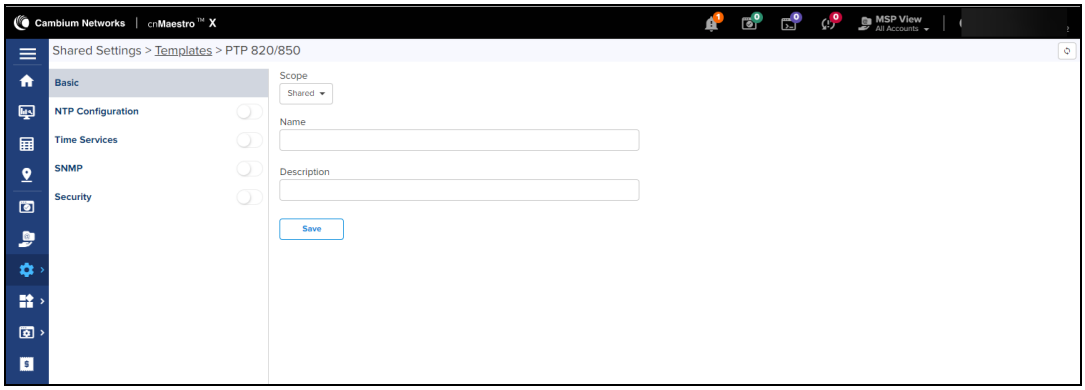
2. In the **Add Template** drop-down, select PTP 820/850.



The **Basic** template page appears.

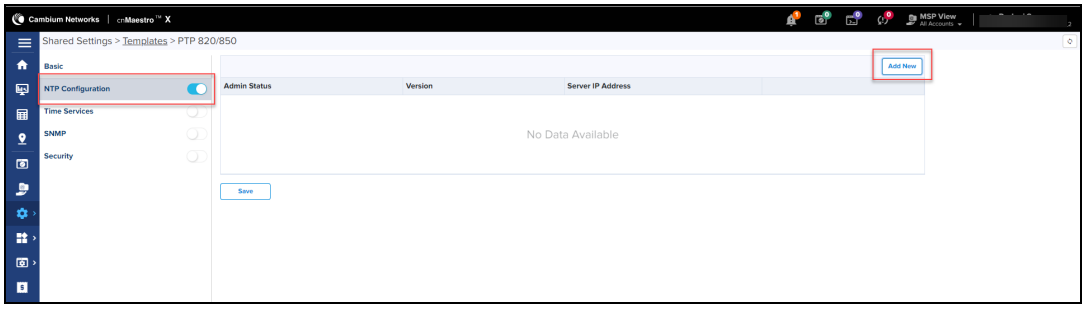
3. In the **Basic** page, enter **Name** and **Description** and click **Save**.

By default, **NTP Configuration, Time Services**, **SNMP,** and **Security** pages are disabled. Click slider icon next to the fields to enable the pages and configure the template.

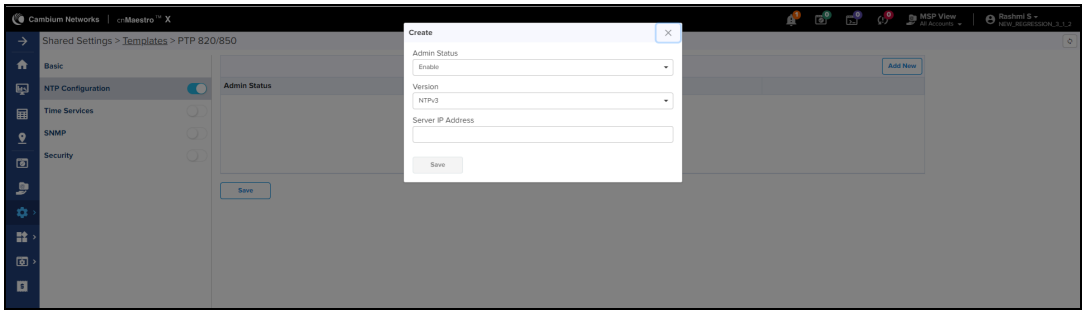


NTP Configuration

1. In the **NTP Configuration,** click **Add New**.



Create window appears.



2. Select **Admin Status** from drop-down.
3. Select **Version** from drop-down.
4. Enter **Server IP Address**.
5. Click **Save.**

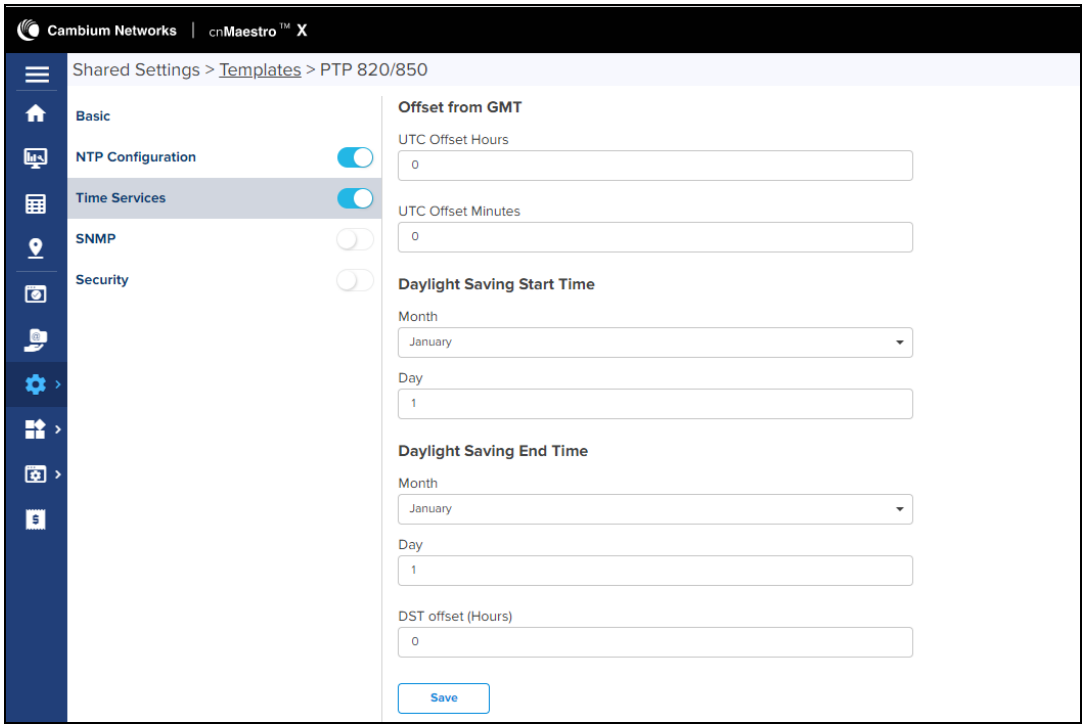
NTP configuration is added to the table. You can perform the following actions for configurations added in the table.

1. Click edit icon to edit the configuration
2. Click delete icon to delete the configuration.

Time Services

1. Enter the values for the following fields:
   - Offset from GMT
   - Daylight Saving Start Time

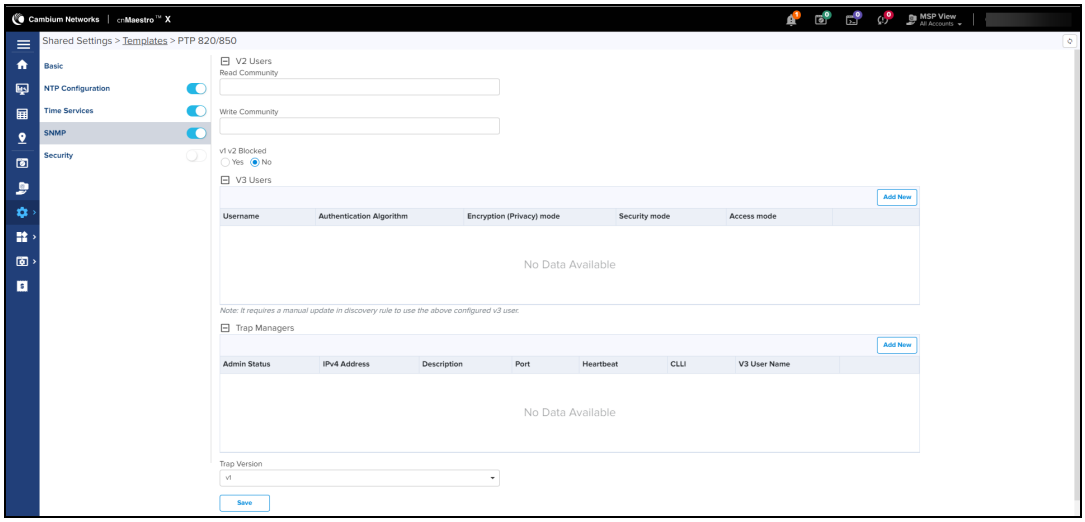
- Daylight Saving End Time



2. Click **Save**.

SNMP

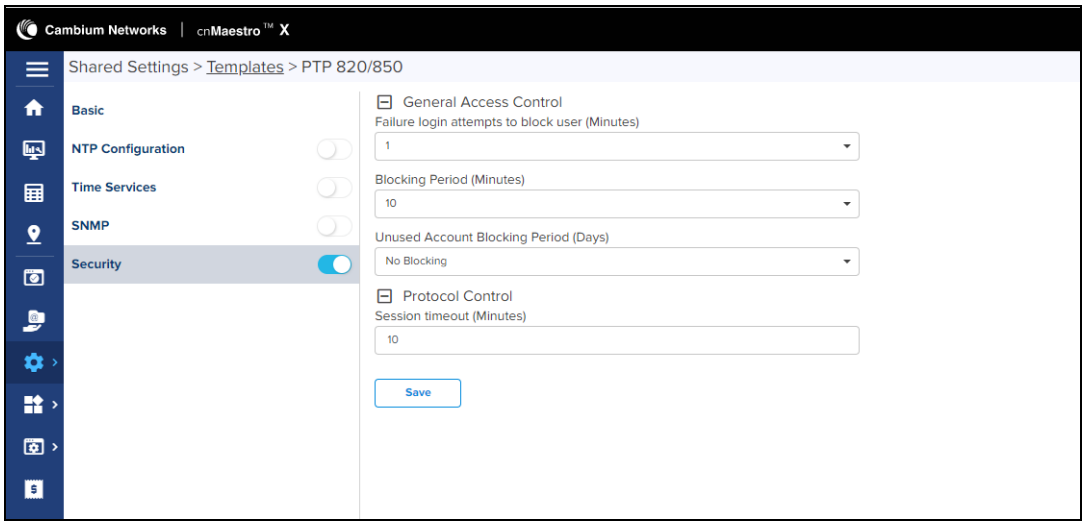
1. Enter the details for **V2 Users**, add **V3 Users** and **Trap Managers**, and select **Trap Version**.



2. Click **Save**.

Security

1. Select the values for **General Access Control**.
2. Select **Protocol Control**.



3. Click **Save**.

Configuration Update

Device Selection

Navigate to the **Configuration Update** tab, and then navigate the Device Tree to the appropriate level for device selection. For example, selecting a Fixed Wireless AP will enable selection of the AP and all its SMs.

Device Type

Configuration jobs are created for a single device type. The type includes the specific hardware (ePMP, PMP) as well as the mode of the device (cnVision, PMP or PTP mode for ePMP for example).

Device Table

Select the devices to upgrade in the Devices Table. The following parameters are visible in the table:

Table 61: Device Table parameters

Parameter	Description
Devices	The names of available devices in a system. The list is pre-filtered based upon the node selected in the Device Tree.
Network/Tower	The network and the tower on which the device is located.
Status	The status of a particular device in a system. Devices that are “Down” can not have images pushed to them.

NOTE:
- You can only push configuration to a device when its status is **Up**.
- The user should validate the configuration before pushing it to the device from cnMaestro.

Options

Stop all Configuration on a Critical Error

If one of the configuration updates fails, then do not start any additional updates and instead pause the update job. All existing, concurrent updates will be allowed to proceed until completion. The administrator will be able to continue the update where it left off.

Parallel Upgrades

Define how many configuration updates to perform in parallel.

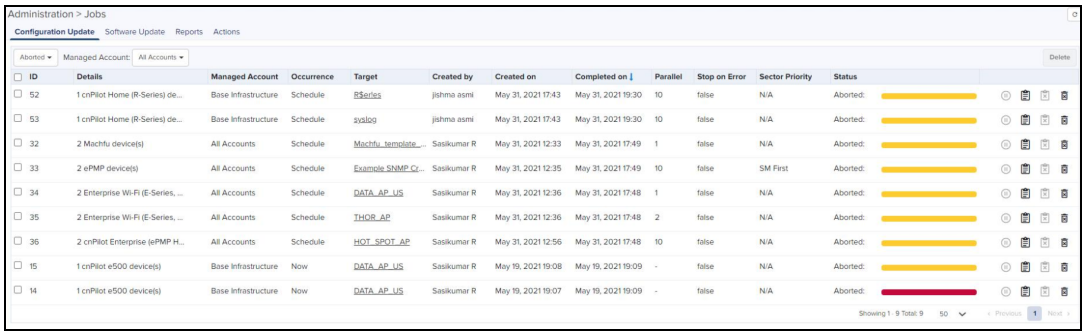
Update Ordering

Allows you to specify update ordering within a Fixed Wireless sector. Options are SMs first and then AP or AP first and then SMs.

Abort Configuration

Abort operation will skip devices that are waiting for update to begin. Devices already being updated may continue but cnMaestro will stop tracking their progress. Aborting a Configuration Job puts the device into a complete state that cannot be manually restarted by the user. The pending devices will not begin their updates.

Figure 248 Abort Configuration



NOTE:

1. Devices which are already updated display as **Completed** with a message Update Complete along with the status as **Completed**.

2. Devices which are ongoing display as **Aborted** with a message Manually Aborted with the status as **Aborted**.

3. Devices which have not yet started display as **Skipped** with a message Job was Aborted with the status as **Skipped**.

Configuration Update Steps

To update the configuration of an ePMP (Sectors) device, perform the following steps:

1. Navigate to **Manage > Configuration > Device Details** in the Main Menu.
2. Navigate to **System > Network** in the Device Tree. From the list of available networks, select a network in which the device belongs.
3. Select ePMP (Sectors) from the **Device Type** drop-down.
4. Select the configuration template to upgrade from the **Template** drop-down.
5. Select the device(s) to upgrade.
6. Click the gear icon to view or edit variables that are required for selected devices.
7. Click **Apply Configuration**.

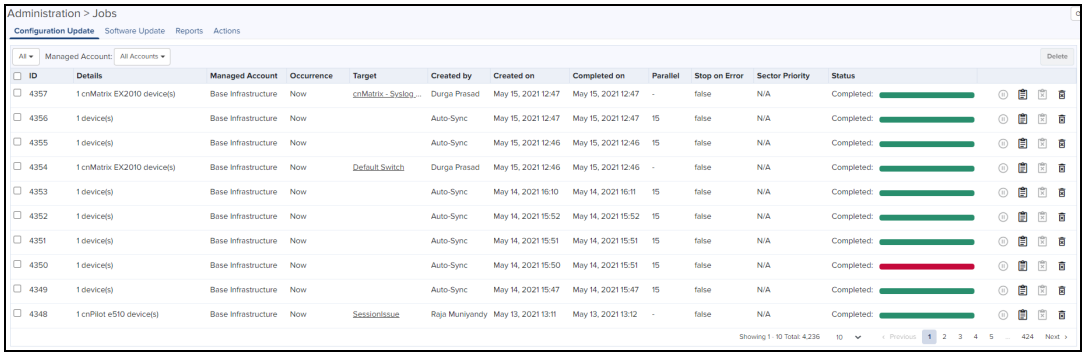
NOTE:

- The Configuration Upgrade cannot proceed until all required variables (those without default parameters) are entered. If you attempt to create a configuration job without setting required variables, the gear icon will turn red for any devices not meeting this requirement.
- To save and download the existing Device Configuration as Template, click **View Device Configuration** link.

Configuration Jobs

Navigate to **Administration > Jobs > Configuration Update** tab.

Jobs are presented with various Status values: Running, Queued, Skipped, and Completed. They can be triggered to execute immediately or run later. The list of parameters in the Jobs tab is shown below:



NOTE:

cnMaestro X account user can run any number of **Jobs** in parallel.

The following table displays the list of parameters in the **Jobs** tab:

Table 62: Configuration Update parameters

Parameter	Description
Action	Use the **Start** or **Delete** button to manage the upgrade process. After the upgrade has started, the **Pause** button will stop new upgrades from the beginning. If the upgrade process fails or the upgrade has been paused, you can restart the process by clicking the **Resume** button.
Created By	The user who has created this job.
Created On	Date and time on which the job is created.
Details	Count of devices and date and time the upgrade process is initiated.
ID	Identification number of the active job.
Parallel	Number of devices to start in parallel.

Table 62: Configuration Update parameters

Parameter	Description
Sector Priority	For ePMP/PMP, cnRanger, cnVision Hub/Client, the priority of AP/BBU/SM to start.
Status	Status of update.
Stop on Error	Stop the job, if any device in middle finds any error.
Target	Target software version to upgrade.
By selecting the **Show More** icon, you can view the following parameters:	
Device	Device for which the upgrade is initiated.
Message	The message displayed after the update.
Result	The upgrade status of the device.
Status	Status of the device.
Mode	SM or AP mode selected.
Network	Type of Network.
Tower	Name of the Tower.

Configuration Update at Onboarding

Administrators can apply the configuration to devices during the onboarding process: Prior to approving the device in the Onboarding Queue, the configuration template and variables can be specified. These will then be pushed to the device during onboarding. For more details on onboarding, see Device Onboarding.

Wi-Fi Configuration

Wi-Fi configuration is handled through AP Groups or Templates, which Fixed Wireless devices, such as ePMP and PMP, exclusively use Templates. This section will focus exclusively on AP Groups.

This chapter provides details on the following sections:

- cnPilot Home and Enterprise Wi-Fi
- Factory Reset
- Association ACL
- Access Control Policies
- Custom Applications[X]

cnPilot Home and Enterprise Wi-Fi

There are four types of Wi-Fi hardware:

1. Enterprise Wi-Fi (E, XE, and XV-Series)
2. cnPilot Enterprise (ePMP 1000 Hotspot devices)
3. cnPilot Home (cnPilot R-series devices)

4. Enterprise Wi-Fi (Xirrus-Series)

These four hardware types map to the following AP group types:

1. Enterprise Wi-Fi (E-Series,XE/XV-Series)
2. Enterprise Wi-Fi (Xirrus-Series)
3. cnPilot Home (R-Series)
4. RV22 Home Mesh

Multiple AP Group types are needed, because the features available across the groups are different.

	**Note:** Wi-Fi devices can alternately be configured using a template mechanism, in which a subset of configuration is pushed to the device manually through a user-defined template of parameters. See the section on Templates for more information. Template configuration and AP Group configuration cannot be used simultaneously.

Configure cnPilot using Wi-Fi Profiles

Wi-Fi devices are configured by creating an AP Group, mapping it to shared WLANs, and assigning it to devices through the Configuration tab. Once assigned, the configuration is pushed manually or automatically (if **Auto Sync** is enabled).

	**Note:** Xirrus devices embed WLAN configuration directly into the AP Group Full Configuration tab and do not support separate WLAN profiles.

Auto Synchronization

AP Groups can automatically synchronize device configuration whenever the AP Group or associated WLANs are updated. This is done by enabling **Auto Sync** in the AP Group **Configuration** page.

Manual Synchronization

When a device is mapped to an AP Group without **Auto Sync** turned on, the device is placed in an **Unsynchronized** state until it is manually synchronized. Manual synchronization can be done as follows:

- Navigate to device **Configuration** page > **Sync Now** or
- Navigate to **Administration > Sync Configuration > Sync Configuration.** page.

Create an AP Group

	**Note:** • This example demonstrates how to create an Enterprise Wi-Fi (E-Series, XV-Series) AP Group. A similar process can be followed for the cnPilot Home (R-Series) AP Group. • The Enterprise Wi-Fi (Xirrus-Series) AP Group is different than the others. It embeds a full configuration template of CLI commands that needs to be updated manually. The Xirrus AP Group will support Auto Synchronization when the embedded template is changed, which makes it different than applying the configuration through the standalone Template mechanism.

To create an AP Group, perform the following steps:

1. Navigate to **Configuration > Wi-Fi Profiles > AP Groups** page.
2. Click **New** and select Enterprise Wi-Fi (E-Series, XV-Series) Type.

	Note: • The special characters can be used to create AP Group and WLAN Password (Eg: a-zA-Z_ -*&%#@!<>.() []^~`$1234567890). The user can also rename them if required. • By default password will not be configured. User has to configure the password for AP Groups.

Basic

In the **Basic** page, configure the following details such as:

1. Select **Type** from one of the following:
   - cnPilot Home (R-Series)
   - Enterprise Wi-Fi (E, XE, XV, and Xirrus-Series)
2. Enter the mandatory fields based on device type.
   - Name
   - Country
   - Description
   - WLAN
3. Click **Add WLAN** and select **WLAN** from the list.
4. Click **Save**.

Figure 249 Basic: cnPilot Home (R-Series)

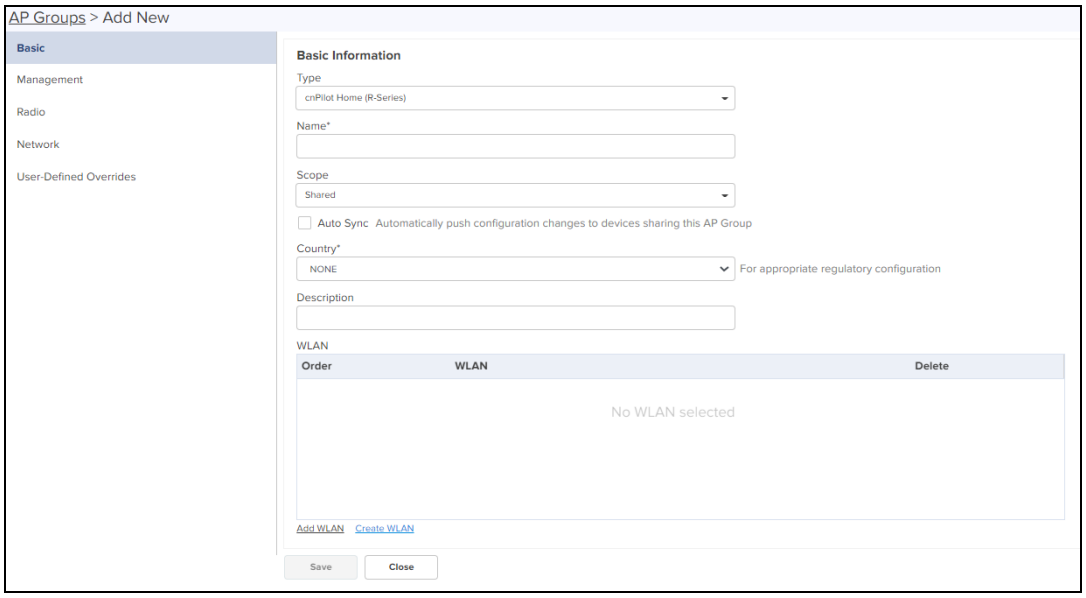


Figure 250 Basic: Enterprise Wi-Fi (E, XE, and XV-Series)

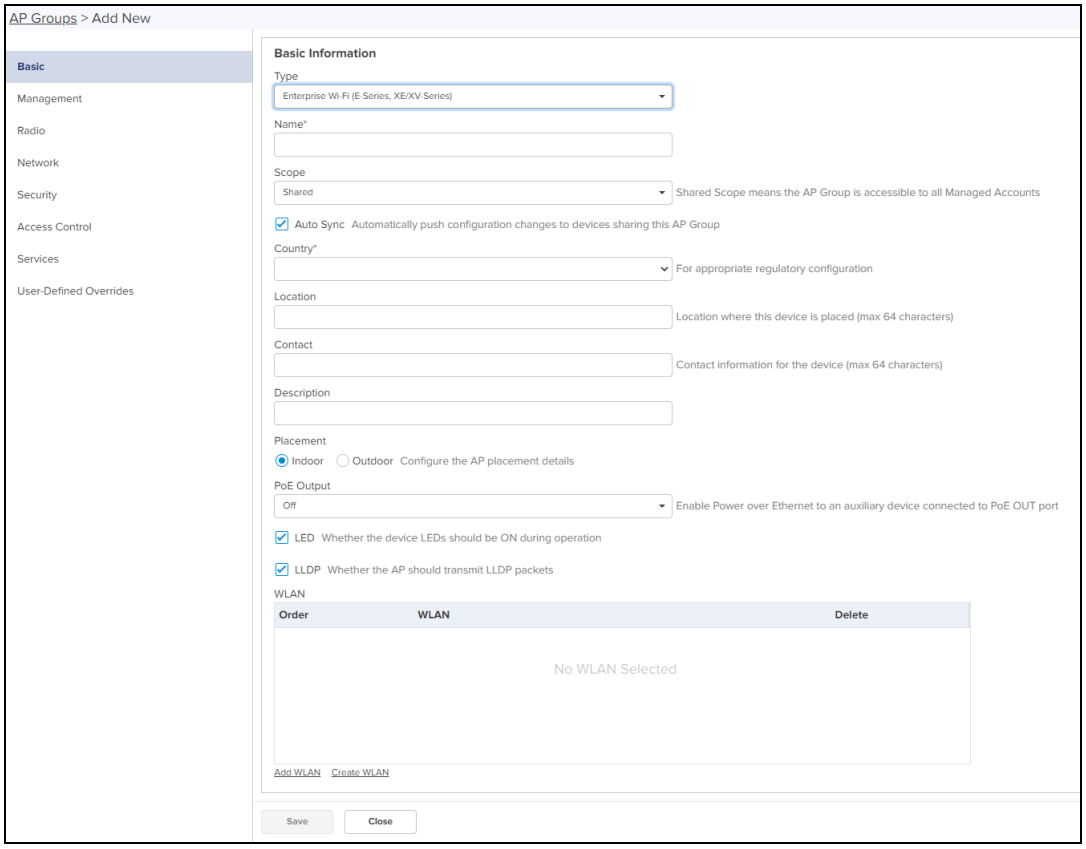
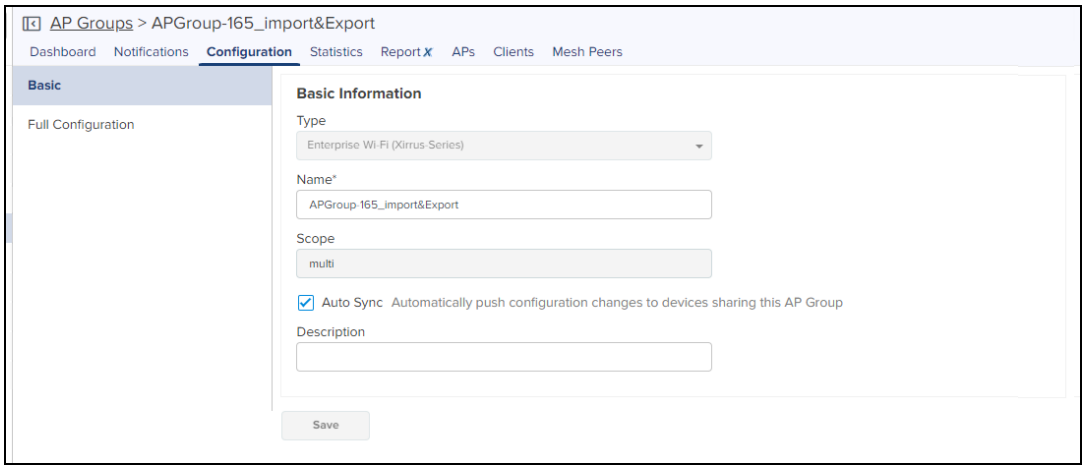
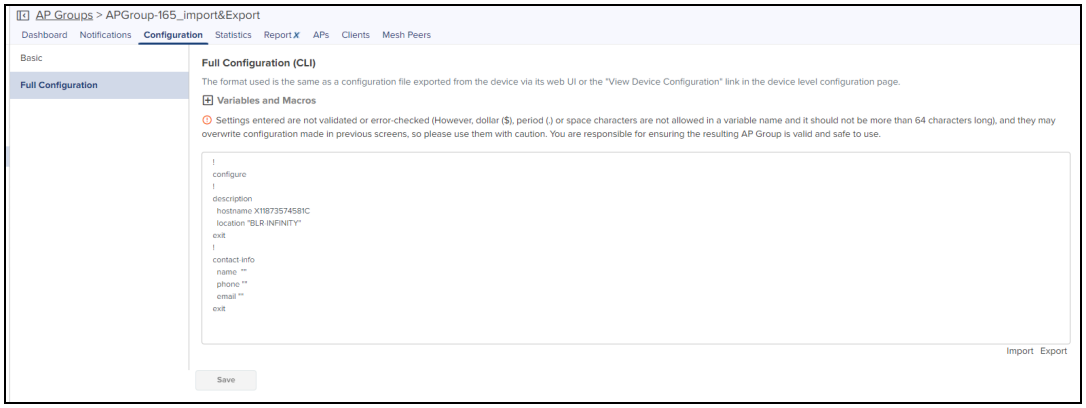


Figure 251 Basic: Enterprise Wi-Fi (Xirrus-Series)



The Xirrus AP Group embeds a Full Configuration of CLI commands.

Figure 252 Full Configuration: Enterprise Wi-Fi (Xirrus-Series)

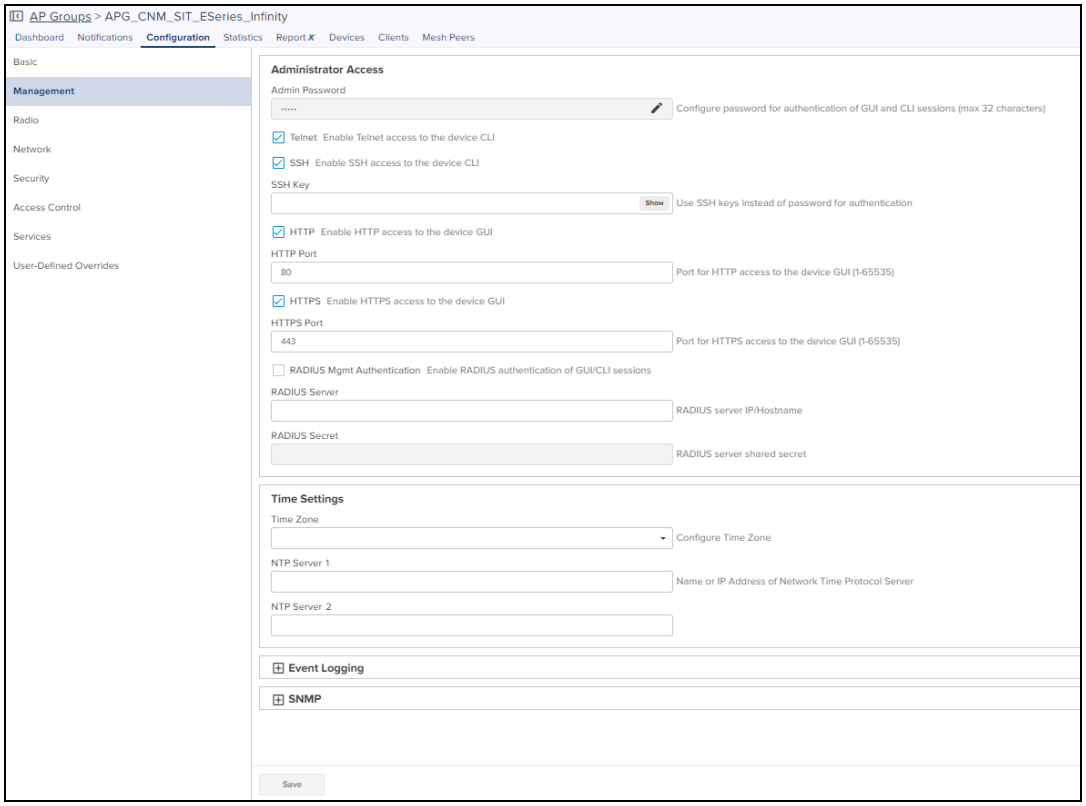


Management

The **Management** page allows to configure the **Administrator Access, Time Settings, Event Logging** and **SNMP.**

	Note: The AP uses the AES algorithm for encryption and SNMPv3 password configuration parameter is used for encryption and authentication.

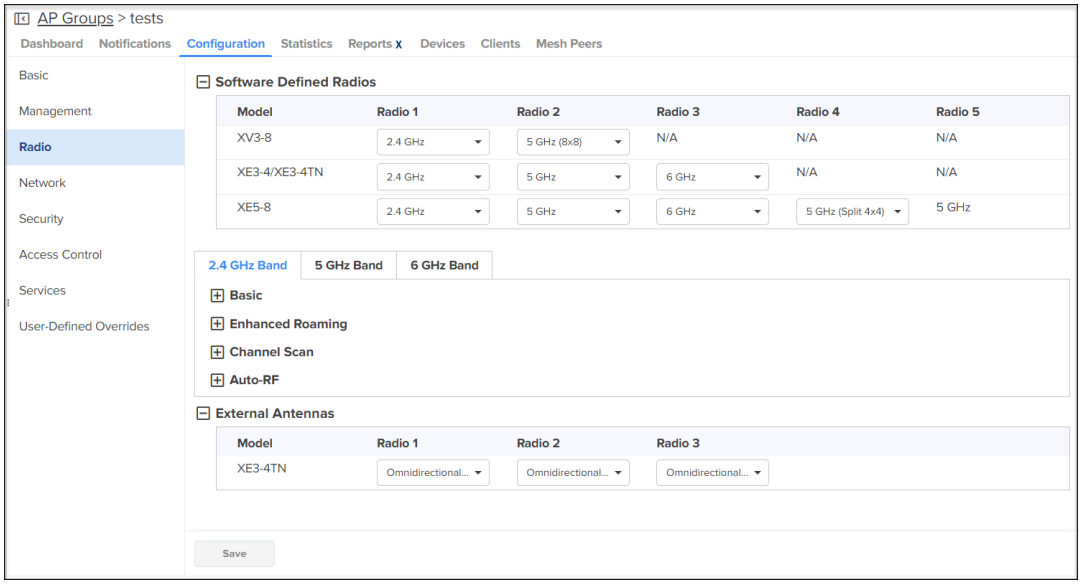
Figure 253 Management: Enterprise Wi-Fi (E-Series, XV-Series and XE-Series)



Radio

The **Radio** page allows the user to enable or disable the Software Defined Radio operations. It allows to configure **Software Defined Radios, Basic**, **Enhanced Roaming**, **Off Channel Scan**, **Auto-RF, and External Antennas**.

Figure 254 Radio: Enterprise Wi-Fi (E-Series, XE-Series, XV-Series)



Note:

- The software defined radio creation and channel listing are populated based on the country-specific restrictions, device type, and release version.

Software Defined Radios

The Software Defined Radios (SDR) allows you to configure radio parameters for XV3-8, XE3-4, and XE5-8 device models. By default these device models are configured for radio bands as shown in Figure 254. The other radio bands for which the devices can be configured are as shown in Table 63.

Table 63: Supported Radio bands for Enterprise Wi-Fi Series (E-Series, XV-Series and XE-Series)

Models	Radios	Supported Radio Bands	Channel Specification		
			Channel width	Default Channel width	Supported channel list
XV3-8	Radio 1	2.4 GHz	20/40	20	1 to 13
	Radio 2	5 GHz (8x8 - single radio) or 5 GHz (Split 4x4 dual radio)	20 / 40 / 80	40	100 to 165 in Split 4x4 dual radio 36 to 165 in 8x8 - single radio
	Radio 3		20 / 40 / 80	40	36 to 64 in Split 4x4 dual radio
XE3-4	Radio 1	2.4 GHz	20/40	20	1 to 13
	Radio 2	5 GHz	20 / 40 / 80	40	36 to 64
	Radio 3	5 GHz	20 / 40 / 80 / 160	40	100 to 165
		6 GHz		160	Any 6 GHz channel
XE3-4TN	Radio 1	2.4 GHz	20/40	20	1 to 13
	Radio 2	5 GHz	20 / 40 / 80	40	36 to 64
	Radio 3	5 GHz	20 / 40 / 80 / 160	40	100 to 165
		6 GHz		160	Any 6 GHz channel
XE5-8	Radio 1	2.4 GHz	20/40	20	1 to 13
	Radio 2	5 GHz or 6 GHz	20 / 40 / 80 / 160	20*/80**	Refer to Table 64 for Supported Channel list in 5 GHz and 6 GHz
	Radio 3	5 GHz or 6 GHz	20 / 40 / 80 / 160	20*/80**	
	Radio 4	5 GHz (8x8 - single radio) or 5 GHz (Split 4x4 dual radio)	20 / 40 / 80	20	
	Radio 5		20 / 40 / 80		

* 5 GHz **6 GHz

NOTE:

- Split 4x4 is applicable only for 8x8 spatial streams supported devices. (Supported device models are XV3-8 and XE5-8).
- Dual 5 GHz Radio (Only supported for XV3-8 and XE5-8 Access Points) Splits 8x8 5 GHz radio into two 4x4 5 GHz radios.

Table 64: Supported Channel list 5 GHz or 6 GHz in XE5-8

Radio Index				Radio 1	Radio 2	Radio 3	Radio 4	Radio 5
8x8 mode of operation: Radio 4 & 5 as single radio with 8x8								
Radio 2	Radio 3	Radio 4 & 5						
5 GHz	5 GHz	5 GHz		NA	100 to 128	149 to 165	36 to 64	
6 GHz	5 GHz	5 GHz		NA	Any 6 GHz channel	100 to 165	36 to 64	
5 GHz	6 GHz	5 GHz		NA	100 to 165	Any 6 GHz channel	36 to 64	
6 GHz	6 GHz	5 GHz		NA	* 1 to 93	** 97 to 233 / 65 to 93	36 to 165	
Split 4x4 mode of operation: Radio 4 and 5 as individual radio with 4x4								
Radio 2	Radio 3	Radio 4	Radio 5					
5 GHz	5 GHz	5 GHz	5 GHz	NA	60 to 64	100 to 128	149 to 165	36 to 40
6 GHz	5 GHz	5 GHz	5 GHz	NA	Any 6 GHz channel	100 to 128	149 to 165	36 to 64
5 GHz	6 GHz	5 GHz	5 GHz	NA	100 to 128	Any 6 GHz channel	149 to 165	36 to 64
6 GHz	6 GHz	5 GHz	5 GHz	NA	* 1 to 93	** 97 to 233	100 to 165	36 to 64
Note: *FCC SKU 6GHz UNII-5 or 6 (1 - 93) EU SKU UNII-5 low (1 - 61) **FCC SKU 6GHz UNII-7 or 8 (97 - 233) EU SKU UNII-5 High (65 - 93)								

NOTE:

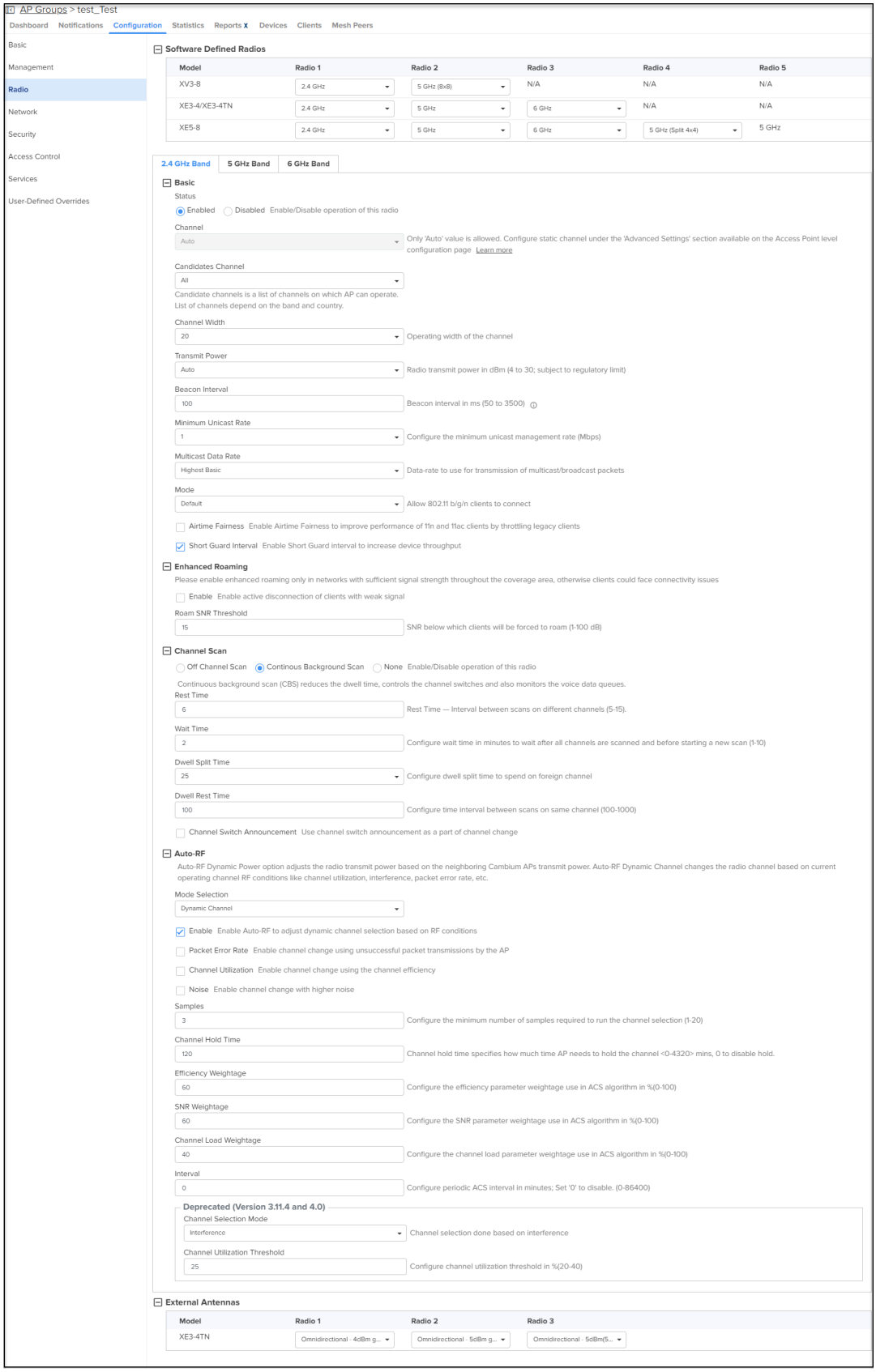
You can use `no channels-distribution` global configuration CLI command for all multi-radio platforms, such as XV3-8, XE3-4, and XE5-8 APs. When configured on device, default channel list can be overridden.

1. In the **Radio** tab, you can configure **Software Defined Radios** for the required **Model** as shown in Table 63.

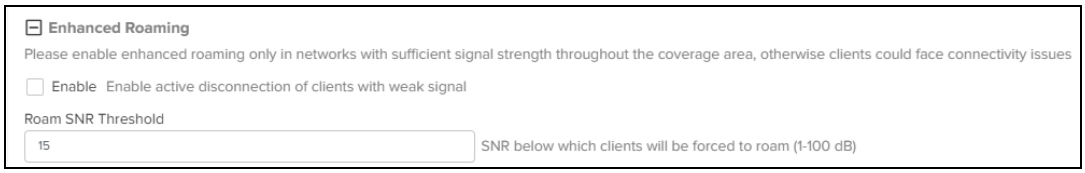
The Enterprise Wi-Fi (E-Series, XV-Series, and XE-Series) devices can be configured with radio features for **2.4 GHz**, **5 GHz** and **6 GHz** radio bands.

2. Click the plus sign (+) next **Basic,** select **Enable** or **Disable** status of the radio.
3. Select the **Auto** value in the **Channel** drop-down.
4. In the **Candidates Channel** select **All.**
5. Select the parameter values from the drop-down for the following fields:.
   - Channel Width
   - Transmit Power
   - Beacon Interval
   - Minimum Unicast Rate
   - Multicast Data Rate
   - Mode

Figure 255 Radio page



6. Click the (+) plus sign next to **Enhanced Roaming** and configure **Roam SNR Threshold**.

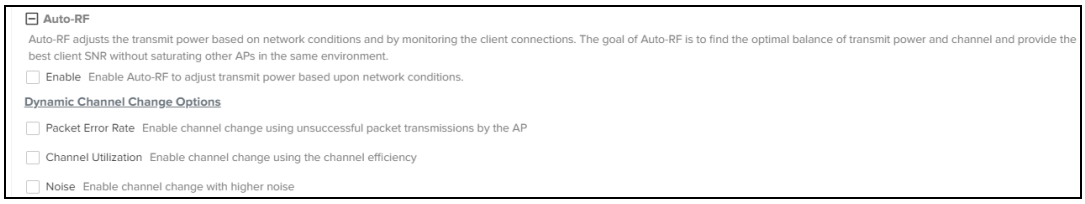


NOTE:

Enable **Enhanced Roaming** only in networks with sufficient signal strength throughout the coverage area, otherwise clients could face connectivity issues.

7. Click the (+) plus sign next to **Off Channel Scan** and enable OCS.

8. Click the (+) plus sign next to **Auto-RF** and enable Auto-RF.



9. Select **Dynamic Channel Change Options** as required.
10. Click **Save**.

External Antennas

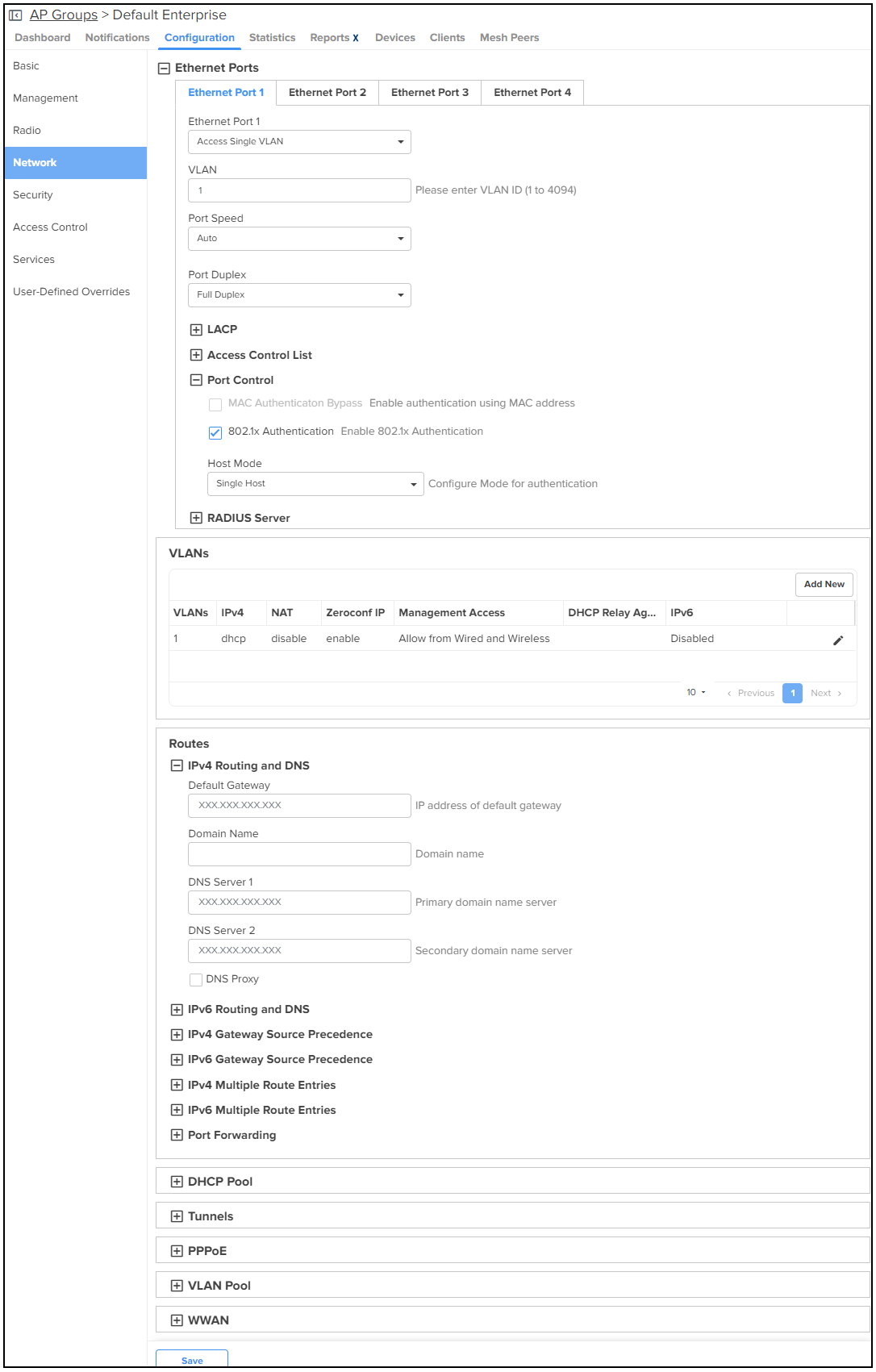
This feature allows users to customize the antenna models for each of the three radios in the XE3-4TN AP as shown in Figure 256. This customization helps in achieving optimal wireless network performance customized for specific deployment scenarios.

Figure 256 External Antennas for XE3-4TN APs

Network

The **Network** page allows to configure **Ethernet Ports**, **VLANs**, **Routes** for IPv4 and IPv6, **DHCP Pool, Tunnels, PPPoE , VLAN Pool,** and **WWAN**.

Figure 257 Network: Enterprise Wi-Fi (E-Series, XV-Series and XE-Series)



Configuring 802.1X port-based authentication

802.1X authentication on Ethernet ports enhance the network security of the AP.

The AP supports 802.1X port-based authentication with the following authentication modes:

- Single-host authentication—Only one client is allowed to access the network after successful 802.1X port-based authentication. After successful authentication, the port VLAN is assigned based on RADIUS assigned VLAN.
- Multi-host authentication—Authentication is enforced on all clients connecting to the wired port. After the first client authenticates, the port VLAN is assigned based on RADIUS assigned VLAN. Any further client connections to the port will be part of the initial Radius VLAN that was assigned.

Note

- By default, the 802.1X port-based authentication feature is enabled in the single-host authentication mode.
- 802.1X port-based authentication does not support CoA messages.

802.1X port-based authentication also requires a RADIUS AAA server for authentication and accounting.

To configure 802.1X, complete the following steps:

1. Navigate to **Configuration** > **Network** > **Ethernet Ports**.
2. Expand the **Port Control** section and select the **802.1x Authentication** check box.
   The **Host Mode** field is enabled.
3. Select from the following authentication modes in the **Host Mode** drop-down list.
   - Single Host
   - Multi Host
4. Expand the **RADIUS Server** section and configure the RADIUS server parameters for 802.1X authentication.

Table 65: RADIUS Server parameters

Parameters	Description	Range	Default
Authentication Server	Specifies the authentication server details, such as: • **Host**—IPv4 or IPv6 address or hostname of the server • **Secret**—Text string that is used to encrypt data in RADIUS packets shared between the AP and the sever. Format—Text string • **Port**—Port number of the authentication server. Default—1812 A maximum of three RADIUS authentication servers can be configured.	-	Disabled
Accounting Server	Specifies the accounting server details, such as: • **Host**—IPv4 or IPv6 address or hostname of the server • **Secret**—Text string that is used to encrypt data in RADIUS packets shared between the AP and the sever. Format—Text string • **Port**—Port number of the accounting server. Default—1813 A maximum of three RADIUS accounting servers can be configured.	-	Disabled
Timeout	Time (in seconds) to wait for a response from the RADIUS server.	1-30	3
Attempts	Number of retry attempts for contacting the RADIUS server.	1-3	1
Accounting Mode	Specifies the accounting mode to be used. The following modes are supported: • **Start-Stop**—Accounting packets are transmitted by APs to the AAA server when a wireless client is connected and when the client disconnects. • **Start-Interim-Stop**—Accounting packets are transmitted by APs to the AAA server when a wireless client connects, then at regular intervals (configured in the **Interim Update Interval** field) and also when the client disconnects. • **None**—Disables the accounting mode. This is the default mode.	-	**None** (Disabled)
Server Pool Mode	Users can configure multiple Authorization and Accounting servers. Based on a number of wireless stations, the user can choose Failover mode.	-	Failover

Parameters	Description	Range	Default
	• **Load Balance**—AP equally distributes the requests between the configured RADIUS servers, • **Failover**—AP selects the RADIUS server that is functional based on the order of configuration.		
Interim update interval	Time (in seconds) to wait for sending RADIUS interim accounting update packets. **Note**: This interval is applicable only when you select the **Start-Interim-Stop** option in the **Accounting Mode** parameter.	10-65535	1800
Dynamic Authorization	This option is required, where there is CoA request from AAA/RADIUS server.	-	Enabled

IPv6 Support

IPv6 enables the next generation of large-scale IP networks by supporting addresses that are 128 bits long.

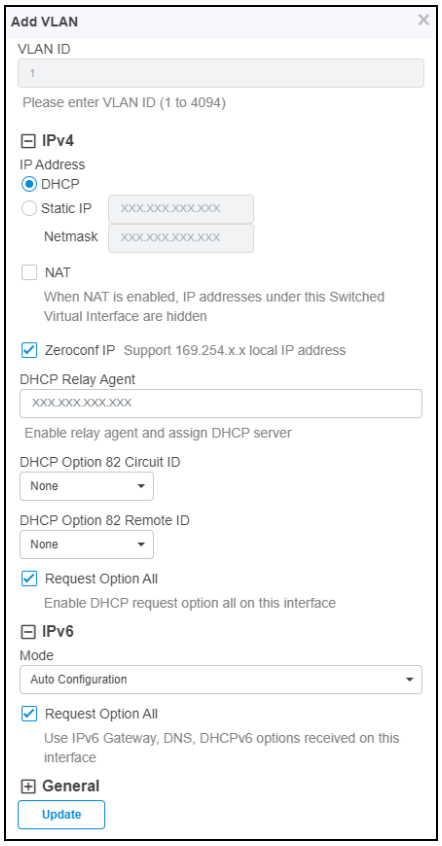
NOTE:

- In the current release, IPv6 functionality is supported only for cnPilot Enterprise devices.
- IPv6 functionality is supported on cnPilot from System Release 4.0.

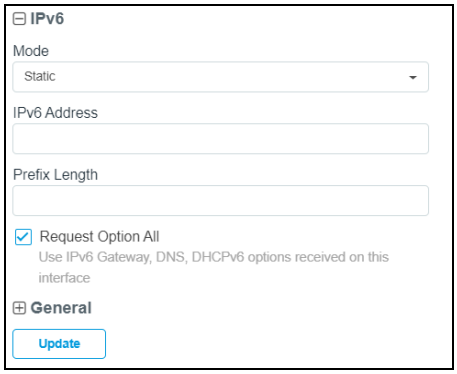
Configuring IPv6

To configure IPv6, perform the following:

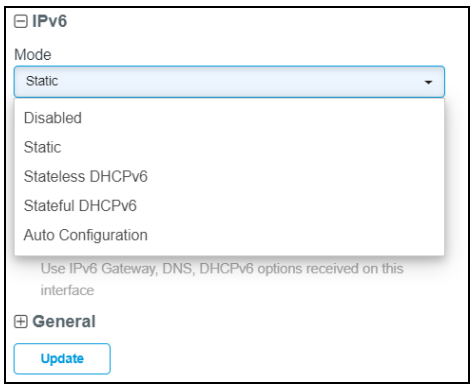
1. Navigate to **Configuration Wi-Fi Profiles > AP Groups** tab.
2. Select **Network** tab and click **Edit VLAN**.



3. Click the (+) plus sign next to **IPv6** option.



4. Select **Mode** from drop-down list. By default, the IPv6 Mode is **Disabled**. The different IPv6 modes are **Static**, **Stateless DHCPv6**, **Stateful DHCPv6**, and **Auto Configuration**.



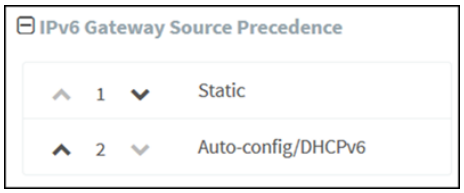
If **Static** is selected, provide the following details:

- **IPv6 Address**: Enter IPv6 address.

- **Prefix Length**: Enter IPv6 prefix. For example: 2001:1111:2222:3333::/64.

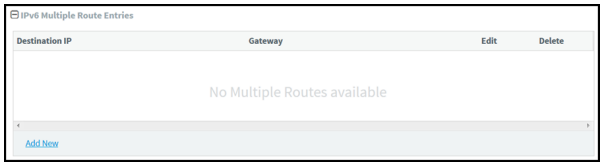
5. Enable **Request Option All** to use the IPv6 Gateway, DNS, DHCPv6 options received on this interface.

By default the priority of **IPv6 Gateway Source Precedence** is **Static** and then **Auto-config/DHCPv6**.

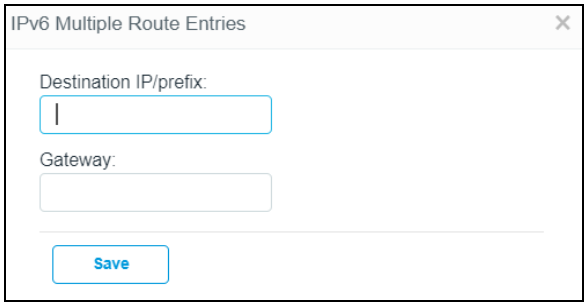


To create a new static Route,

1. Navigate to **IPv6 Multiple Route Entries** section.
2. Click **Add New.**



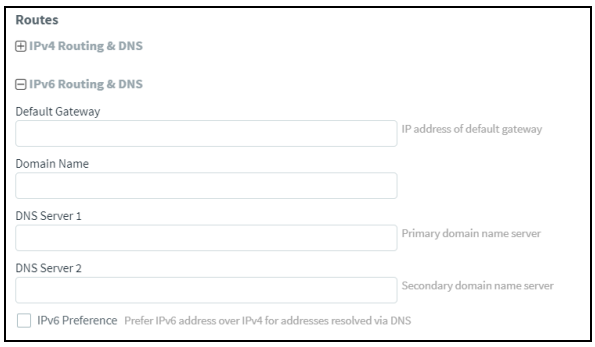
3. Enter **Destination IP/Prefix** and **Gateway**.



4. Click **Save**.

To set the preference of IPv4 and IPv6:

1. Navigate to **Routes** tab.
2. Select the **IPv6 Preference** checkbox.



Security

The **Security** page allows to configure **DoS Protection** and **Rogue AP**.

Map WLANs to AP Groups

WLANs are added in the AP Group configuration. Ensure the WLANs are ordered correctly if Mesh mode is used. When a WLAN uses Mesh Client mode it must always be the first WLAN in the AP Group, and only one Mesh Client WLAN is allowed per AP Group.

The ordering when using Mesh mode is as follows:

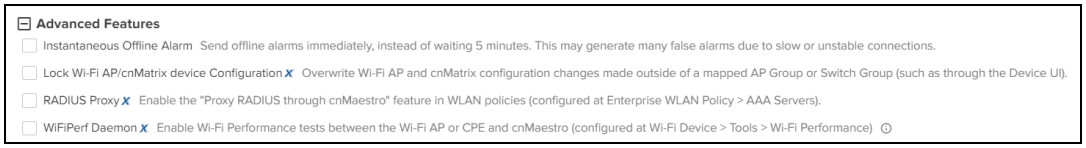
1. Client (maximum of one Mesh Client is selected)
2. Base (maximum of two Mesh Base is selected)
3. Recovery (maximum of one Mesh Recovery is selected)
4. WLANs with Mesh Mode Off (total WLAN limit including Mesh WLANs)

NOTE:

Maximum of 16 WLAN policies are supported for E-Series and XV-Series devices and 8 WLAN policies are supported for ePMP 1000 Hotspot. Only one WLAN is available for cnPilot Home.

Lock device Configuration

Locking automatically restores the configuration of devices if it is changed outside of cnMaestro. When this feature is enabled, external configuration changes are automatically reverted by reapplying the AP Group configuration. The configuration is pushed only if the device is in Sync status.

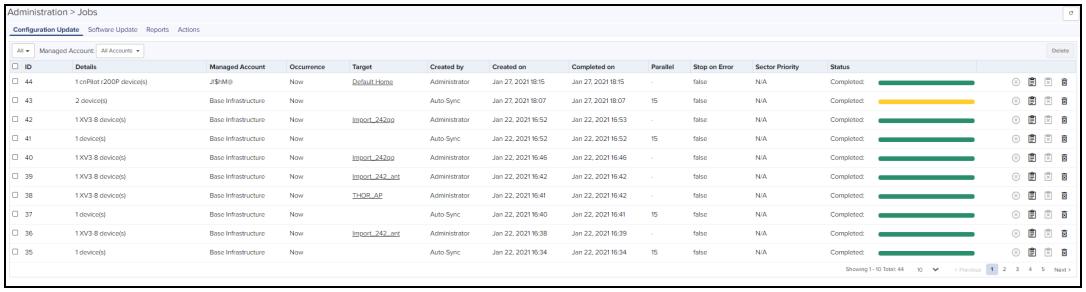


To enable this feature, perform the following steps:

1. Navigate to **Configuration > Advanced Features** page.
2. Select the **Lock cnPilot/cnMatrix device Configuration** checkbox.
3. Click **Save**.

When a configuration change is made on the device using UI or CLI, cnMaestro detects the change and the device is marked **Not In Sync**. In this scenario, an **Auto-Sync** job is triggered to automatically revert the changes.

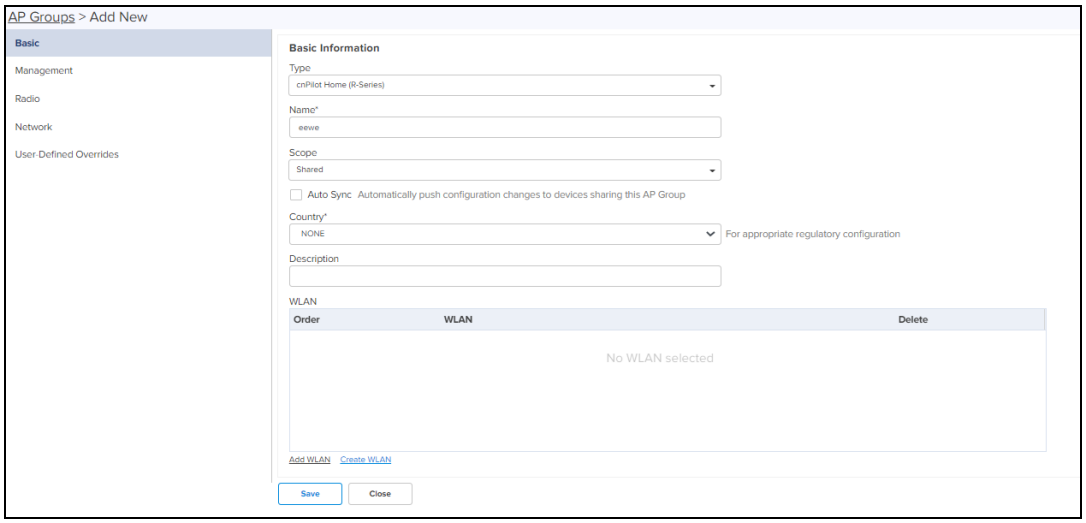
The **Auto-Sync** job can be viewed in **Administration > Jobs > Configuration Update** page.



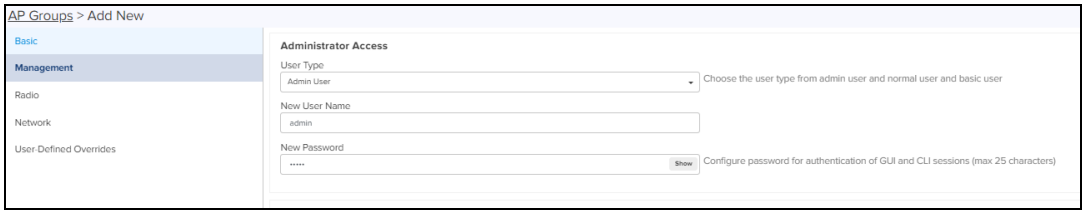
Retry Configure

When the user applies an AP Group to the device, and the Job is skipped because the device is Offline, the reason for the skip will be displayed as **Device was offline** in the **Jobs** page. When device comes up and connects to cnMaestro, an **Auto-Sync** job pushes the AP Group to the device. (It will not apply the AP Group if **Auto-Sync** is disabled in the AP Group).

	NOTE: The Config Update (**Auto-Sync**) will happen only when the **Auto-Sync** option is enabled in the AP Groups page. If the device was Skipped/Failed for any reason other than the **Device was offline**, the device will not be updated.



The default password **admin** of cnPilot R-Series should be changed before upgrading to the build 4.6-RX.



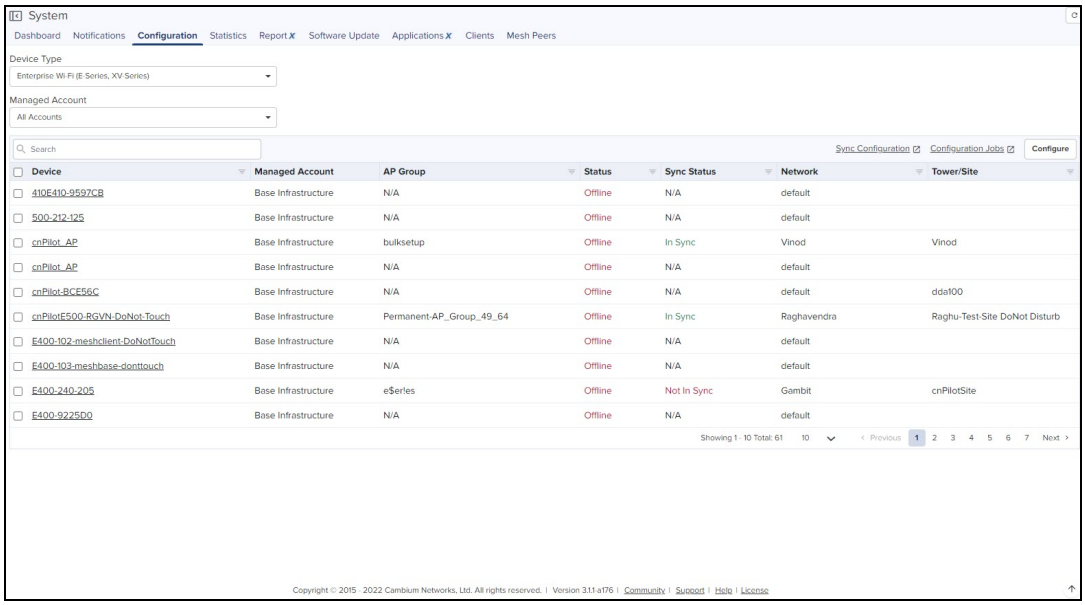
After upgrading to 4.6-RX, the default password **admin** is invalid and needs to be reset through the WAN.

	NOTE: Default User Name: **admin** can be used after the upgrade.

Apply AP Group to Device

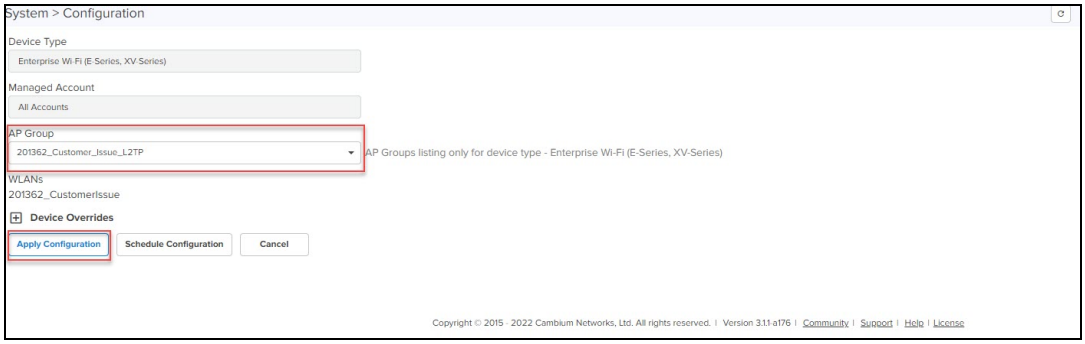
A Configuration Job can be created as follows:

1. Navigate to **Monitor and Manage > System > Configuration**.
2. Select **Device Type** and set of devices along with AP groups to which they will be mapped.



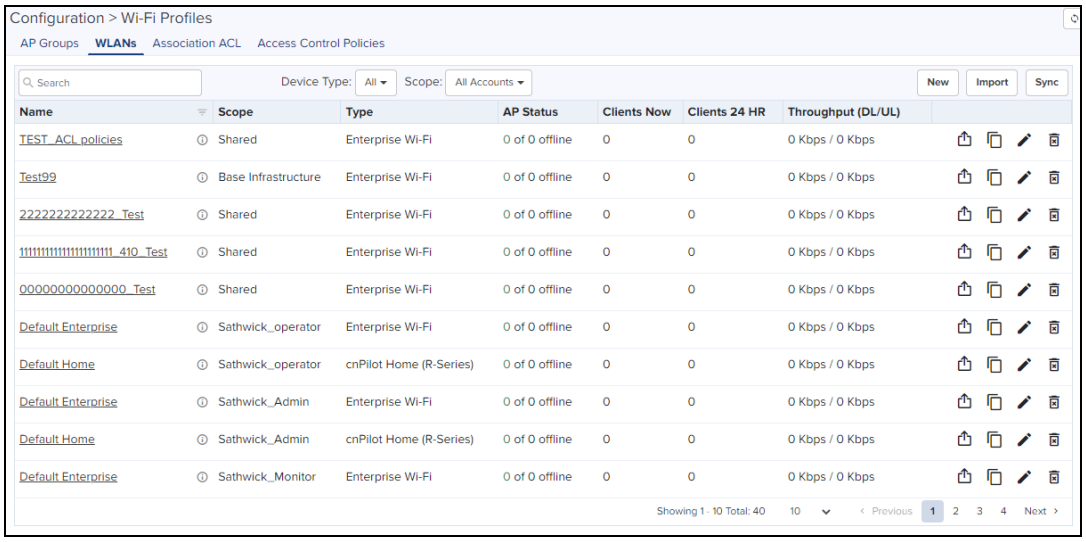
This can be done in three steps:

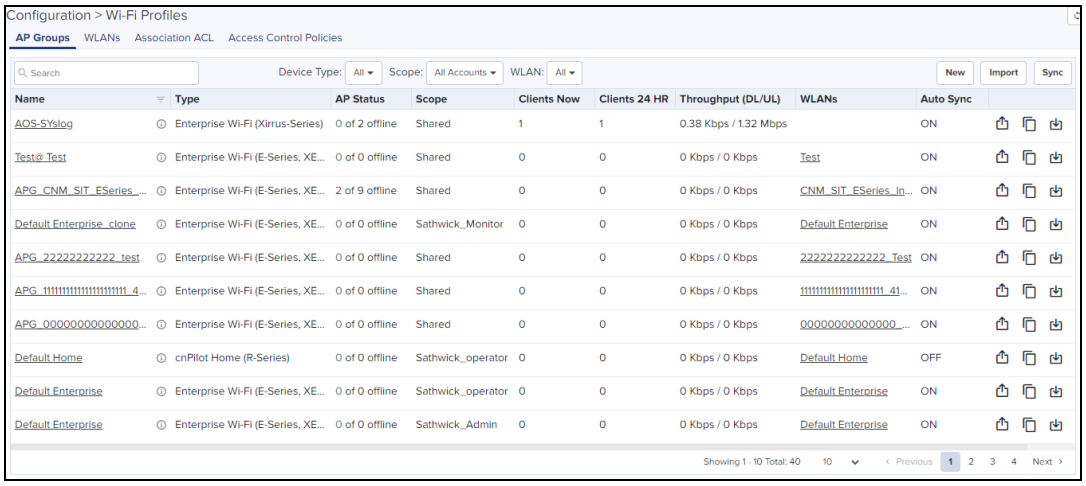
1. Select the **AP Group**.
2. Select **Device Type** from the drop-down:
   - cnPilot Home (R-Series)
   - cnPilot Enterprise (ePMP Hotspot)
   - Enterprise Wi-Fi (E-Series, XV-Series)
   - Enterprise Wi-Fi (Xirrus-Series)
3. Click **Apply Configuration.**



AP Group and WLAN Import/Export

The AP Groups and WLANs are created for cnPilot Home and Enterprise devices. The configurations that are created for each WLAN and AP Groups in a server can be exported and imported to a different server.





Export AP Groups and WLANs

To export AP Group or WLANs, perform the following steps:

1. Navigate to **Configuration > Wi-Fi Profiles** page.
2. Select **AP Group** or **WLAN** tab.
3. Click **Export** icon in the row of the AP Group or WLANs to export.

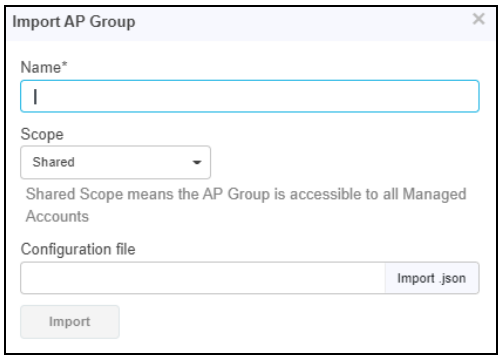
	NOTE: • The AP Groups and WLANs should be exported separately as the associated WLANs are not included while exporting an AP Group. • The AP Groups and WLANs will be exported with proper name and timestamp.

Import AP Groups and WLANs

To import AP Group and WLANs, perform the following steps:

1. Navigate to **Configuration > Wi-Fi Profiles** page.
2. Select **AP Group** or **WLAN** tab.
3. Click **Import.**

Import AP Group window appears.



4. Enter the **Name.**
5. Select the **Scope** from drop-down.
6. Select the **Configuration file** in JSON format.
7. Click **Import**.

	NOTE: • To import an AP Group, ensure all associated WLANs in the AP Group are already imported. If the WLAN associated with the AP Group is unavailable, an error message will be displayed during import. • If the name is not provided for WLAN or AP Group while importing, it will take the name of the imported file. • If the name provided for the AP Group/WLAN is already in use, an error message **The specified policy name already exists** will be displayed.

Create a WLAN

To create a WLAN, perform the following steps:

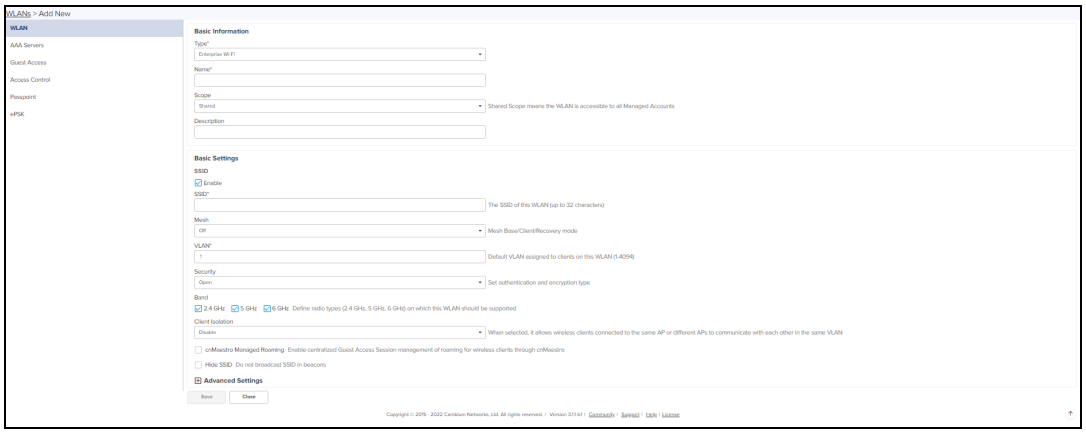
1. Navigate to **Configuration** > **Wi-Fi Profiles** > **WLAN** tab,or WLAN page in the Wireless LAN View.
2. In **WLAN** tab select **New**.

As with AP Groups, WLANs are separated into cnPilot Home and Enterprise Wi-Fi. Enterprise Wi-Fi WLANs are able to configure WLAN, RADIUS, Guest Access, Usage Limits, Scheduled Access, and Access parameters. cnPilot Home WLANs can configure SSID, Scheduled Access, and Access parameters.

	Note: The special characters can be used to create AP Group and WLAN names (Eg: a-zA-Z_-*&%#@!<>.() []^~`$1234567890). The user can also rename them if required.

To create a WLAN, perform the following steps:

1. Navigate to **Configuration > Wi-Fi Profiles** in the left-side menu.
2. Select **WLANs** tab and then click New.
3. Enter **Type, Name**, and WLAN parameters.
4. Ensure **WPA2 PSK** is enabled in **Security** drop-down.



5. Click **Save**.

	Note: In 6 GHz Band, **Open** option is not supported in **Security**.

Creating an ePSK WLAN

To create an ePSK WLAN, perform the following steps:

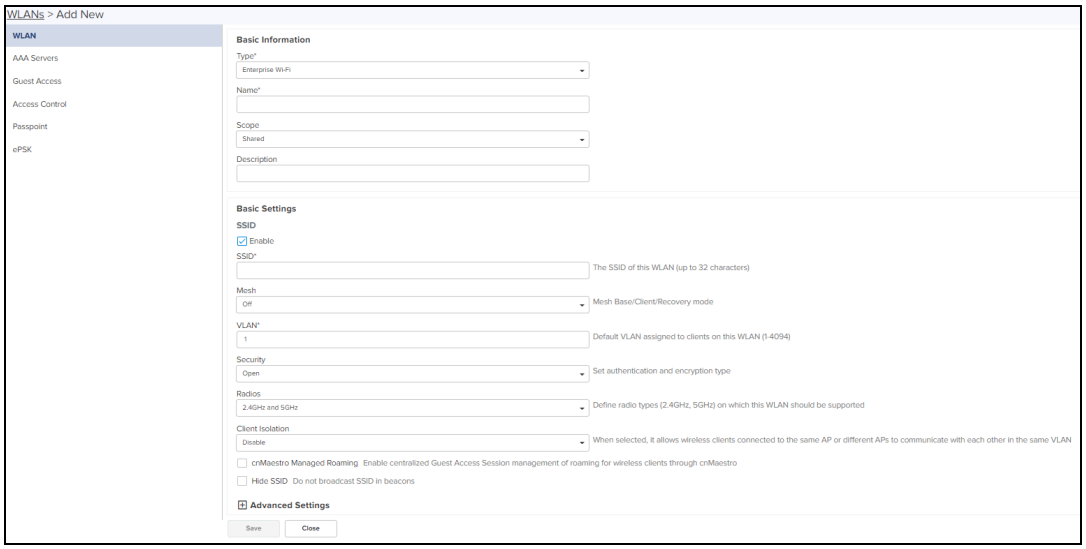
1. Navigate to **Configuration > Wi-Fi Profiles** or WLAN page in the Wireless LAN View.
2. Select **WLANs** tab and click **Add**.

As with AP Groups, WLANs are separated into cnPilot Home and Enterprise Wi-Fi types. Enterprise Wi-Fi WLANs are able to configure WLAN, RADIUS, Guest Access, Usage Limits, Scheduled Access, and Access parameters. cnPilot Home WLANs can configure SSID, Scheduled Access, and Access parameters.

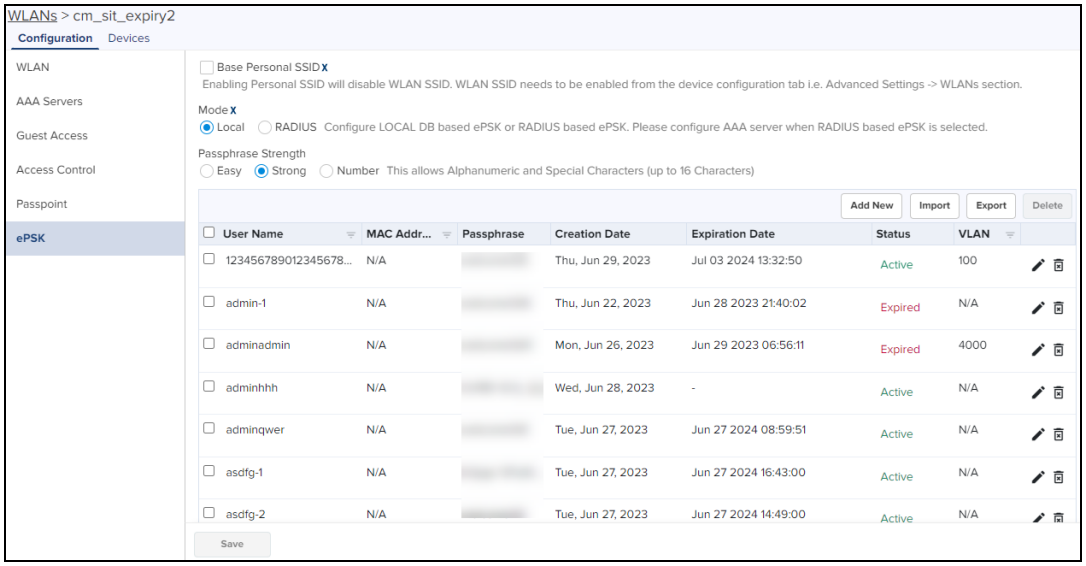
	Note: • The special characters can be used to create AP Group and WLAN names (Eg: a-zA-Z_-*&%#@!<>.() []^~`$1234567890). The user can also rename them if required. • By default, password will not be configured. User has to configure the password for WLAN.

To create WLAN policy, perform the following steps:

1. Navigate to **Configuration** > **Wi-Fi Profiles**.
2. Select **WLAN** tab and click **Add**.
3. Select **Enterprise Wi-Fi** from the **Type** drop-down list and enter details in the **Basic Information** section.
4. In the **Basic Settings** section, ensure the **WPA2 Pre-Shared Keys** option is selected in the **Security** drop-down list.



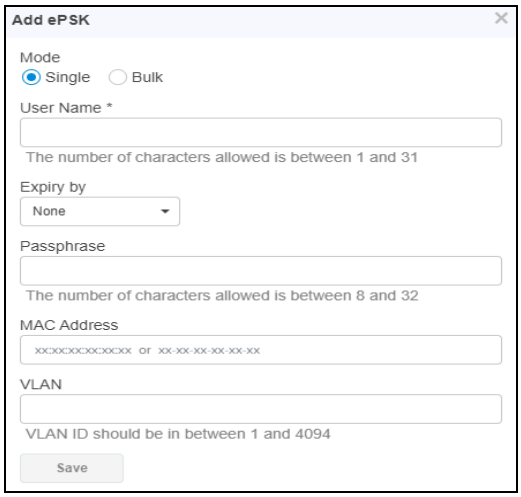
5. Click **Save**.
6. In **ePSK** > select type of **Passphrase Strength** (Easy, Strong, or Number).



7. Click **Add New**.

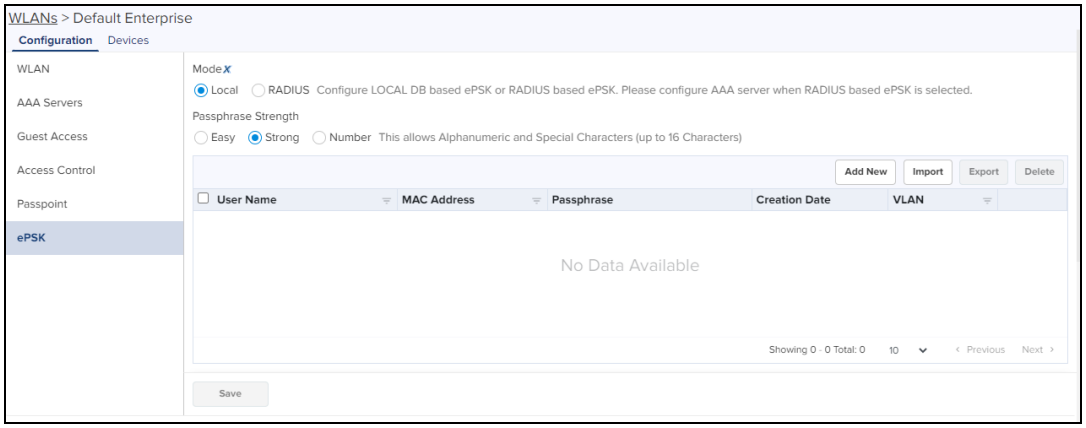
The **Add ePSK** window is displayed.

8. Select **Mode** type as one of the following:
   - **Single**: In the Single mode, only the **User Name** is mandatory and rest of the entries are optional. There is only one entry in this mode.

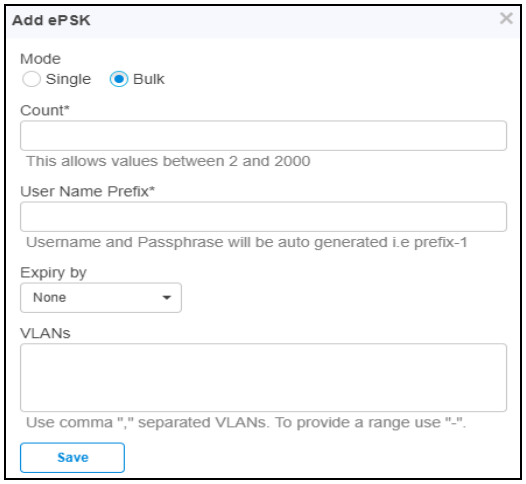


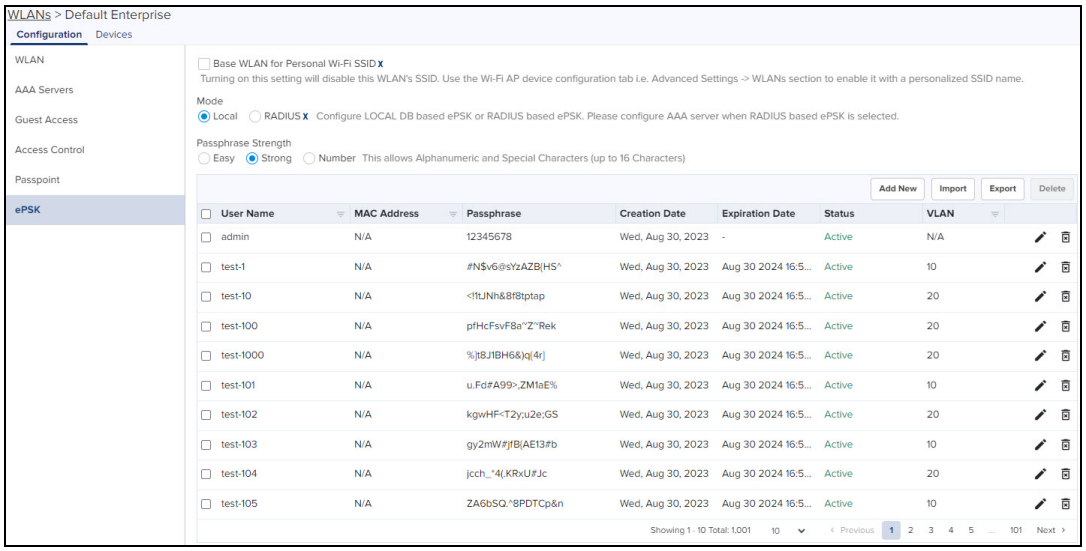
NOTE:

Passphrase is optional and it will be automatically generated based on the selected **Passphrase Strength**.



- In the **Bulk** mode, the **Count** and **User Name Prefix** are mandatory. There are multiple entries in this mode.





9. To automatically expire ePSK details after a specific duration. The following options are available:

   - **None**—ePSK details never expire. Select **None** to never expire the ePSK credentials.
   - **Date and Time**— ePSK expires after the specified date and time (in dd/mm/yyyy hh:mm AM/PM format)

     Supported minimum time is 12 A.M. on the next day and the maximum is five years.
   - **Duration**— ePSK expires after the specified (in hours, days, months, or years) in the **Expiry by** drop-down.

     Supported minimum duration is one hour and the maximum is five years. No decimal values are supported, for example, 1.5 hours.

	NOTE: • The configured expiry time appears in the **Expiration Date** column on the **WLANs** > <WLAN name> page. • The **Status** column on the **WLANs** > <WLAN name> page displays the status of the ePSK details—**Active**, **Expired**, or **None**. **None** is displayed only when older ePSK keys are imported to cnMaestro. • Expired ePSK details are deleted from the AP only when the next configuration sync functionality is initiated or when there is a configuration change in the AP.

Creating a Personal Wi-Fi ePSK X

In Multiple Dwelling Units (MDU), personal Wi-Fi allows a user to connect all the personal devices to a unique SSID associated with a VLAN. For example, a user can connect multiple devices to a single personal Wi-Fi

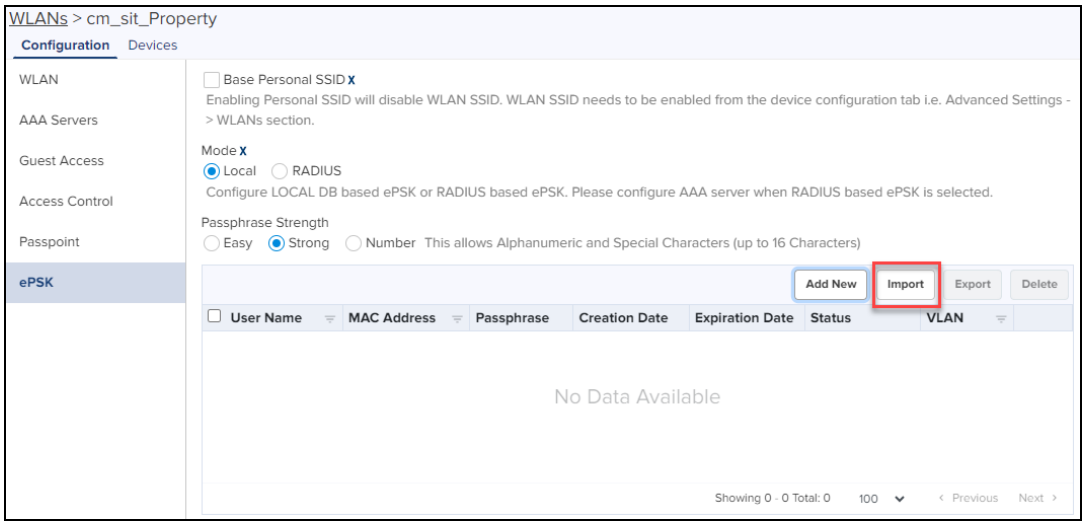
To configure personal Wi-Fi on the AP, complete the following steps:

1. Add and enable the SSID details (to be used as personal Wi-Fi) in the **WLANs** tab, under **Manage and Operation > Networks >** <network name> **> Configuration > Device Configuration > Advanced Settings** section.
   a. Select the **Enable SSID** checkbox.
   b. In the **Passphrase** field, configure the passphrase.
   c. Configure the VLAN with which the SSID must be associated.
2. Enable personal Wi-Fi on the ePSK page for the WLAN profile by selecting the **Base Personal SSID** checkbox.

By default, this feature is disabled. Once enabled, the **Enable** checkbox (under **WLANs > WLAN > Basic Settings > SSID**) is cleared. Also, the local and RADIUS ePSKs are disabled.

Import ePSK

1. Click **Import**.



2. Select **Import.csv** file.

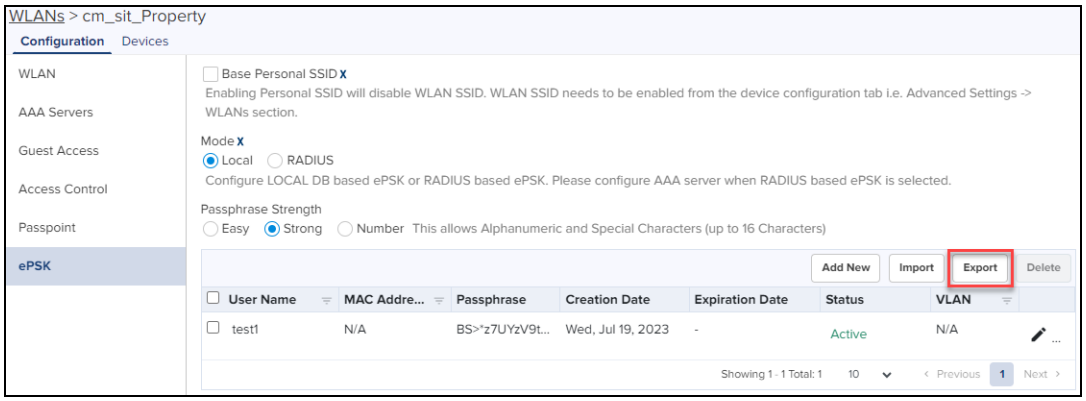
Alternatively, one can import a CSV file containing a list of ePSK entries. A sample file format is available from the Import dialog.

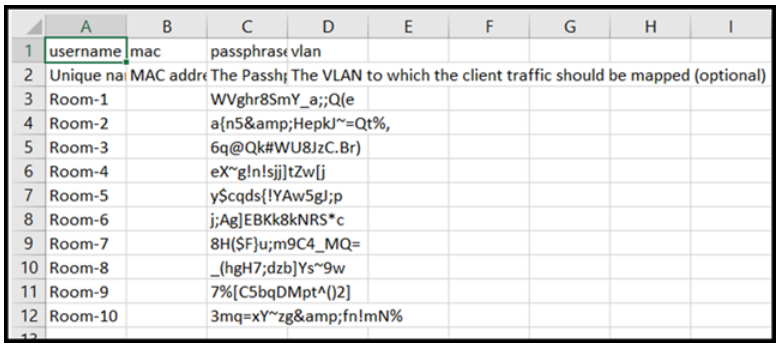
3. Click **Download Sample File**, to view sample ePSK Excel sheet.

	A	B	C	D	E
1	username	mac	passphrase	vlan	expiration_time
2	Unique name of this entry	MAC address of the client,if any (optional)	The Passphrase (Pre Shared Key) to be used in the WPA2 handshake	The VLAN to which the client traffic should be mapped (optional)	Expiration time should be either none or Jun 22 2024 09:07:28 format only
3	Lounge-1	11:11:11:11:11:11	646}hj6ab;^B((;	9	Jun 22 2024 08:34:28
4	Lounge-2	22:22:22:22:22:22	9jdf};qJ*38GU53%	10	Aug 22 2024 05:07:28
5	Lounge-3		*{{;nQgUdeM2ErR	1	Jul 27 2024 19:07:28
6	Lounge-4		]jJzam4F1]x}Zgg%	2	May 22 2024 12:07:28

Export ePSK

1. Click **Export**.
2. Select **export.csv** file.





	A	B	C	D	E	F	G	H	I
1	username	mac	passphrase	vlan					
2	Unique na	MAC addre	The Passh	The VLAN to which the client traffic should be mapped (optional)					
3	Room-1		WVghr8SmY_a;;Q(e						
4	Room-2		a{n5&HepkJ~=Qt%,						
5	Room-3		6q@Qk#WU8JzC.Br)						
6	Room-4		eX~g!n!sjj]tZw[j						
7	Room-5		y$cqds{!YAw5gJ;p						
8	Room-6		j;Ag]EBKk8kNRS*c						
9	Room-7		8H($F}u;m9C4_MQ=						
10	Room-8		_(hgH7;dzb]Ys~9w						
11	Room-9		7%[C5bqDMpt^()2]						
12	Room-10		3mq=xY~zg&fn!mN%						

Editing ePSK

To edit an ePSK, select the required ePSK and click the edit ( ) icon in the row.

You can edit only the passphrase and the expiry duration information.

Deleting ePSK

To delete an ePSK, select the required ePSK and click **Delete**. You can also click the delete ( ) icon in the row.

To delete multiple ePSK entries, select the checkboxes corresponding to the ePSK entries and click **Delete**.

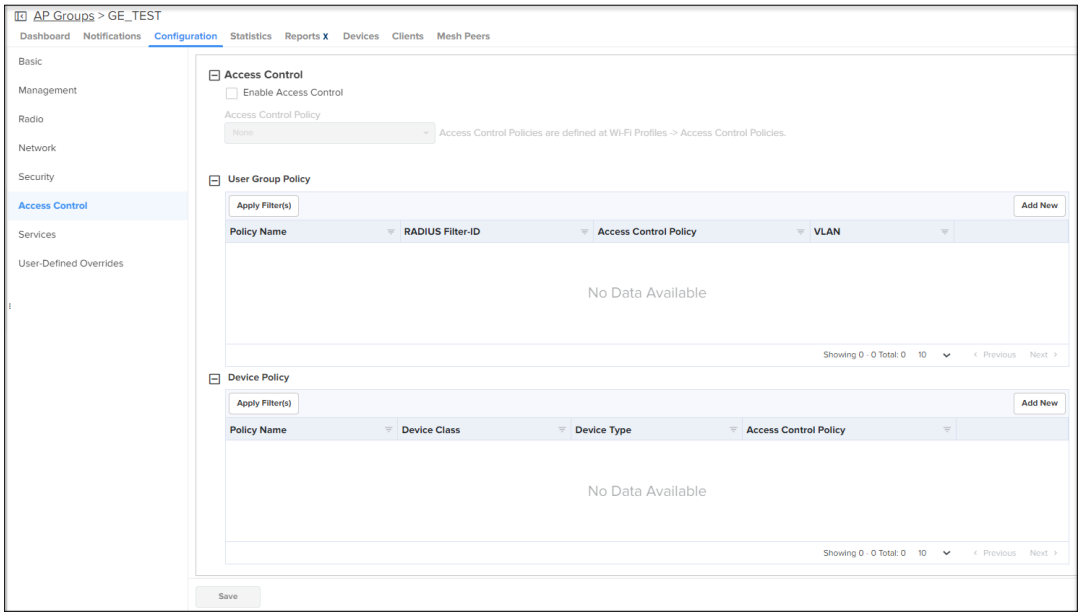
NOTE:

- ePSK feature is supported on cnPilot from System Release 3.11.1 onwards.

Access Control

The Access Control page allows user to enable or assign access control policies and configure **User Group Policy** and **Device Policy**. It offers visibility into the configured rules, ensuring efficient and secure network management.

Figure 258 Access Control page

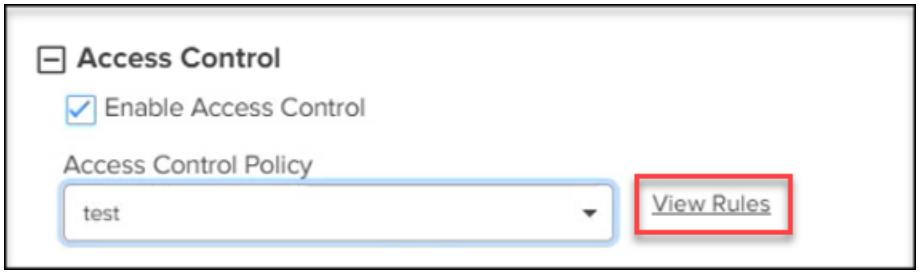


	NOTE: If an Access Control Policy is assigned at the AP group level, it does not appear under User Group or Device Group policies.

Enable Access Control Policy

Users have the provision to enable or disable access control policies under **Access Control** tab as shown in Figure 259.

Figure 259 Enabling Access Control Policy



Note:

	NOTE: User can select the available access control policies listed in Wi-Fi profiles in **Access Control Policy** drop-down list. User can review the configured rules associated with these policies by clicking **View Rule** icon as shown in Figure 259. This provides a comprehensive view of the policies and rules within the network.

User Group Policy

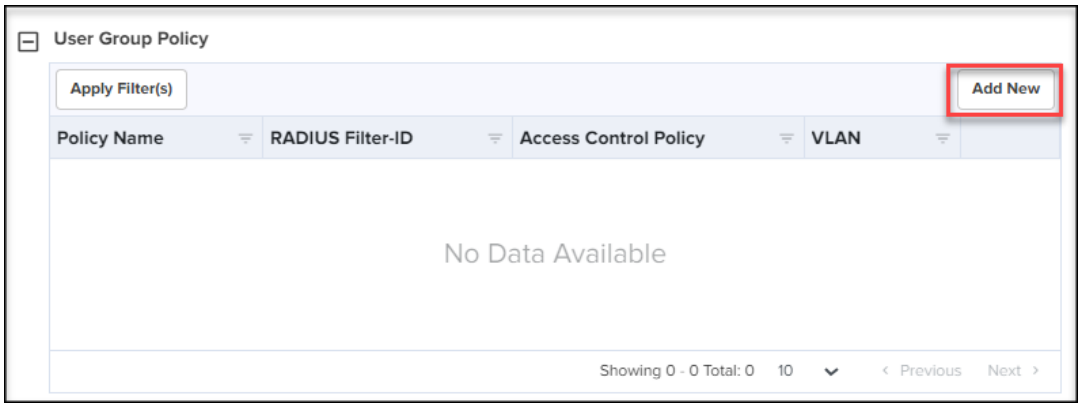
User Group Policy enables users to categorize into specific roles with customized access permissions and restrictions, facilitating fine-tuned control over network access.

Adding a new User Group Policy

To add a new User Group Policy, perform the following steps:

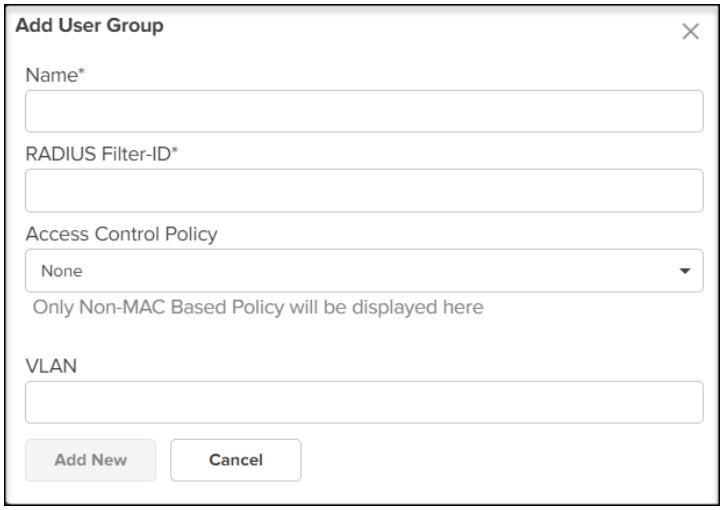
1. Navigate to **Configuration** > **Access Control** page.
2. Click **Add New** in the top right corner of the User Group Policy as shown in Figure 260.

Figure 260 User Group Policy



3. Complete the details in the **Add User Group** pop-up window as shown in Figure 261.

Figure 261 Add User Group



NOTE:

- The user needs to assign an Access Control Policy or VLAN to create a User Group.
- Users can add a maximum of 64 User Groups and Device Policies each.
- Users can only select Access Control Policies (ACPs) with NON-MAC filters from the **Access Control Policy** drop-down menu.
- Mapping an Access Control Policy (ACP) to a User Group Policy (UGP) enables its use for the AP group, and vice versa. However, the same ACP cannot be shared between UGP and AP group; you can apply it to only either UGP or AP group.

Device Policy

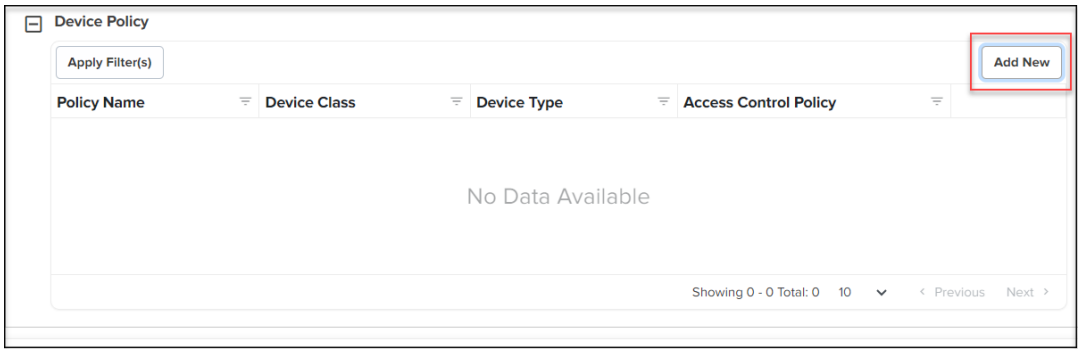
Device Policy allows users to apply specific rules and access control policies based on the type and characteristics of devices, offering customized control over device behavior within the network.

Adding a new Device Policy

To add a new Device Policy, perform the following steps:

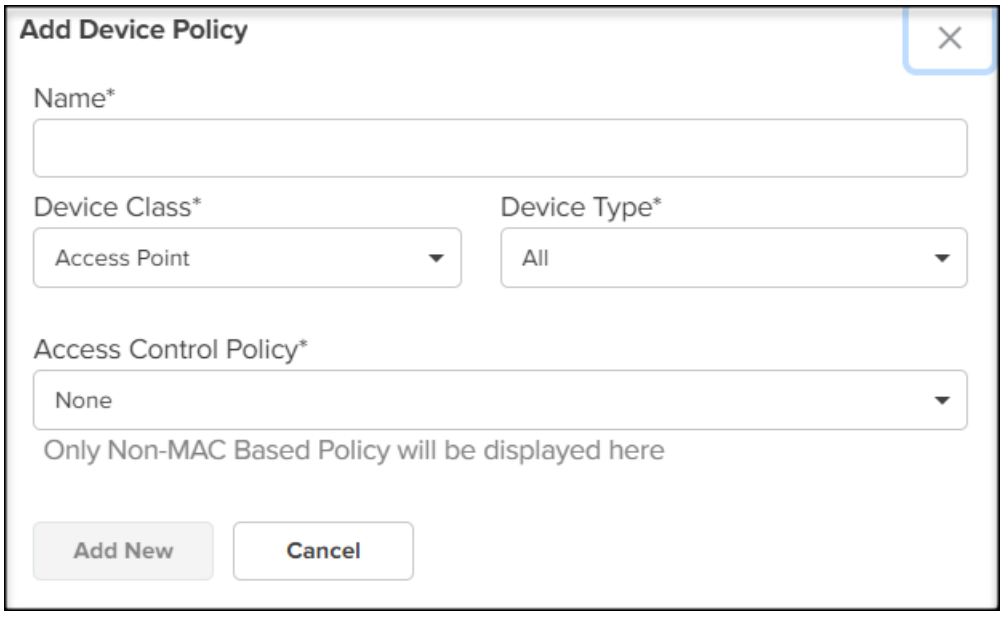
1. Navigate to **Configuration** > **Access Control** page.
2. Click **Add New** in the top right corner of the Device Policy as shown in Figure 262.

Figure 262 Device Policy



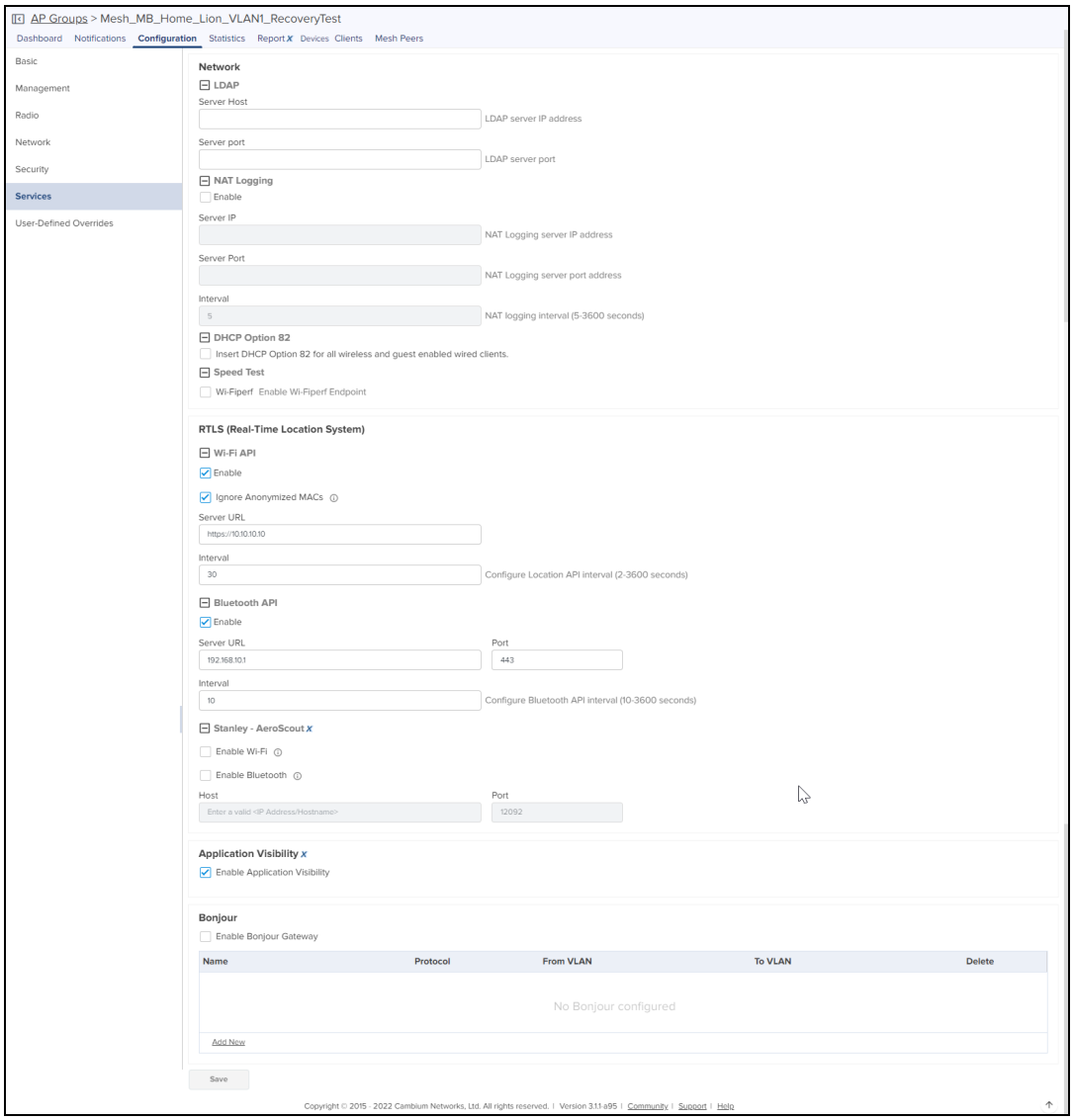
3. Complete the details in the **Add Device Policy** pop-up window as shown in Figure 263.

Figure 263 Add Device Policy



Services

The **Services** tab allows to configure the **LDAP, NAT Logging, DHCP Option 82, Speed Test, RTLS (Real-Time Location System)** such as **Wi-Fi API, Bluetooth API, Stanley-AeroScout,** and **Bonjour**.

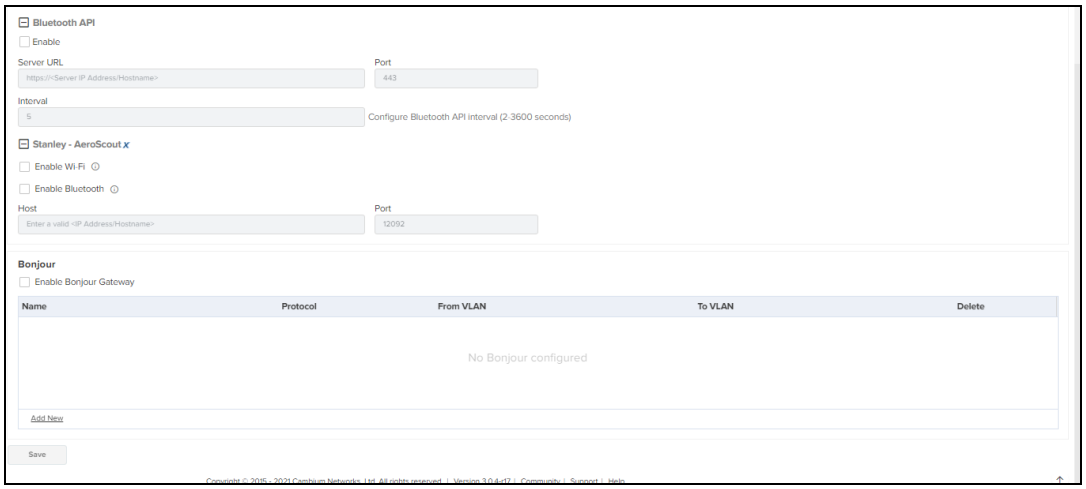


NOTE:

Stanley-AeroScout is supported only for cnMaestro X features.

Stanley-AeroScout

Stanley-AeroScout delivers an accurate and reliable location data for assets and customers with the STANLEY Healthcare Wi-Fi tags. It is an integral component of STANLEY Healthcare's Stanley-AeroScout RTLS solutions. The Stanley-AeroScout determines a location using signal strength measurements (RSSI) which are collected by the Cambium Wi-Fi Access Points. These Wi-Fi Access Points can simultaneously serve location sensors and provides network access. Stanley-AeroScout utilizes a location engine to determine the position of Wi-Fi tags.



Pre-Defined Overrides

Some device configuration is specific to an individual device and not easily shared through an AP Group. This includes IP Address, Radio Channel settings, and WLAN details such as Enabling/Disabling SSID and Passphrase. These items can be configured in the Device Configuration page, which can be selected by choosing **Manage > Configuration** in the menu, and then selecting the device in the tree to update.

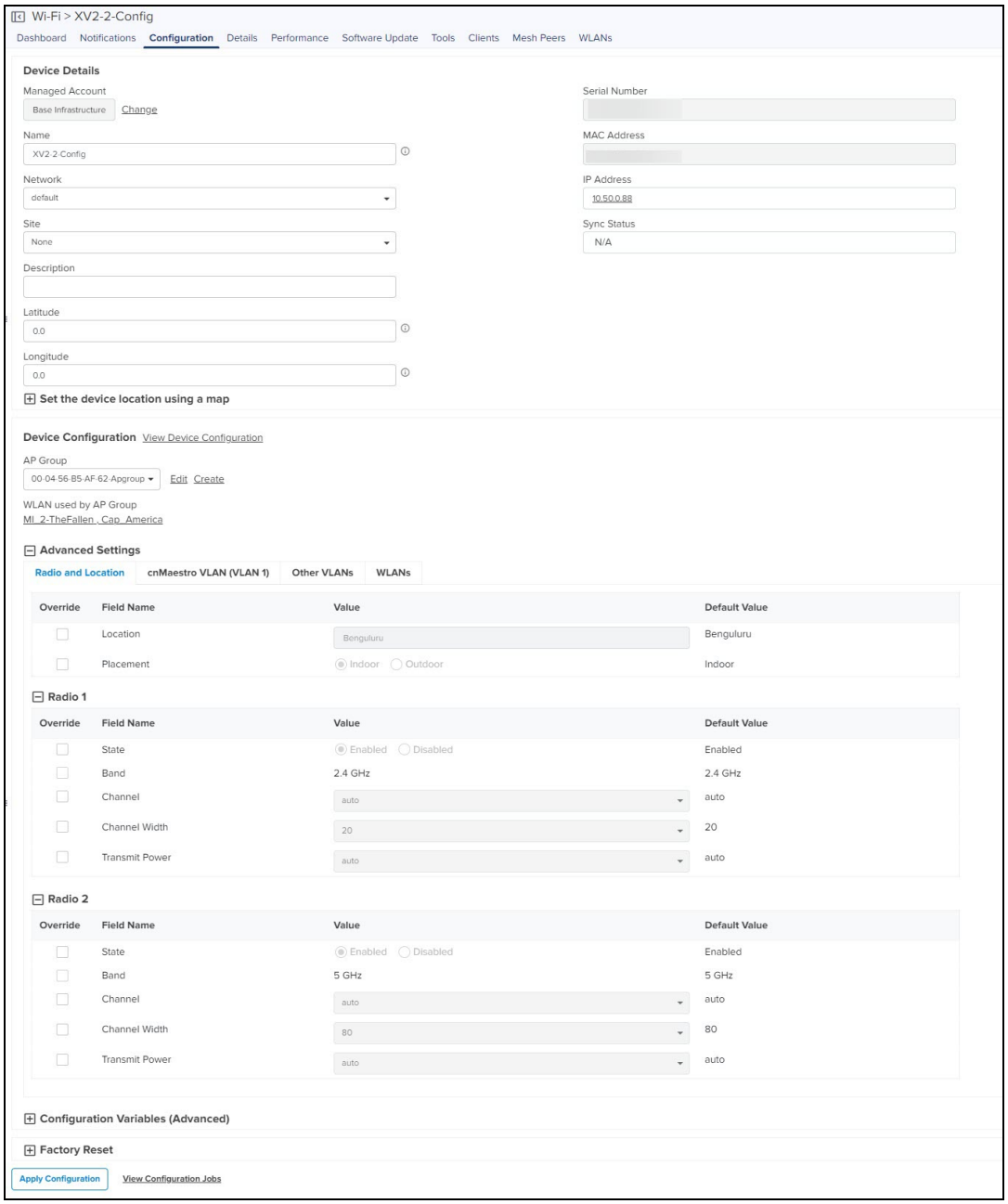
You can then choose/change different values from AP Group to be overridden. The icon to the left of a field must be selected first to override that parameter. After specifying override parameters, select **Apply Configuration** on the bottom right to save your changes to the server and create a job to push the new values to the device. This option is also applicable for Onboarding process queue.

Advanced Settings

By default, Enterprise Wi-Fi devices have **Auto-set from device** enabled. This option reads several network related configuration fields from the device and uses those as override values to prevent overwriting values that would disconnect the device.

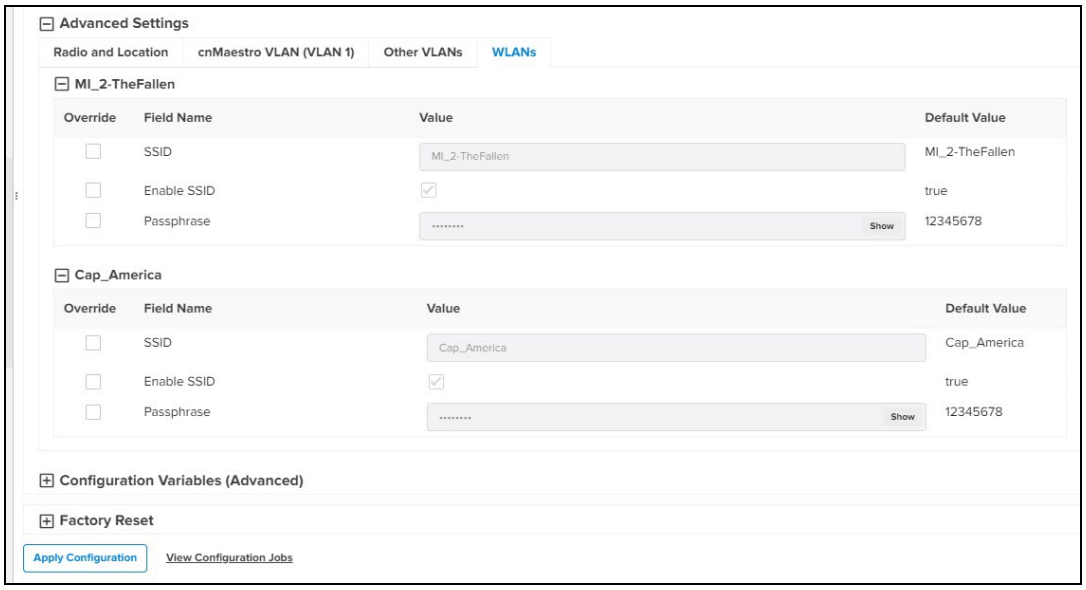
Modify the **Advanced Settings** section on the Access Point level configuration page as below:

- Add option to override Dual 5 GHz Radio setting for XV3-8 APs below the Placement field.
- If the Dual 5 GHz Radio feature is **Enabled**, then show the settings to override/configure the 3rd 5 GHz radio.
- If the Dual 5 GHz Radio option is enabled, then allow channel range > = 100 for Radio 2 and 36 – 64 for Radio 3.



NOTE:

XE3-4TN features a radio antenna override option.



User-Defined Overrides

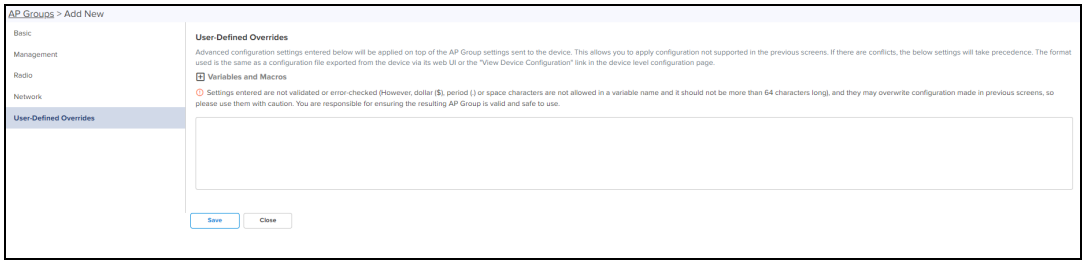
User-Defined Overrides can be entered into the end of an AP Group configuration. They will be appended to the AP Groups before the configuration is applied to the device. This allows setting configuration parameters which are not supported by GUI; this is an advanced operation that should rarely be used. The format of the commands is same as with the device CLI.

For example, if a new version of the software had a feature unsupported in cnMaestro, it could can be pushed to the device using CLI commands through the User-Defined Override mechanism.

This can be explained with the following example, in which country-code and hostname are appended to the end of the configuration and will override any settings in the UI.

```
country-code IN

hostname Wi-Fi_Device
```



User-Defined Variables

Override configuration also supports a programmatic concept called User-Defined Variables (which are also used with templates). User-Defined Variables can be embedded into the User-Defined Override text area. They require a value to be set for each device mapped to the AP Group before the configuration can be applied. This is either through a default value, or an explicit setting in the device configuration.

The syntax for User-Defined Variables is shown in the following example: the VariableName maps to an identifier set by each Device. If the value is not set, the optional DefaultValue will be used.

```
Parametername ${VariableName=DefaultValue}
```

	NOTE: You can also configure User-Defined Variables in the Onboarding process queue page. They are mapped individually to each device.

Other Examples

Enterprise Wi-Fi (E-Series and XV-Series) and cnPilot Enterprise (ePMP hotspot)

```
country-code ${countryname=US} // country name with US as default value

hostname ${hostname=ePMP_1000_Hostpot}
```

cnPilot Home R-Series

```
Parametername ${variableName=someDefaultValue}
```

Example

```
CountryCode=${countryName=IE}

RTDEV_CountryCode=${5GHz_CountryName=IE}

wan_ipaddr=${wan_ip=10.110.68.10}
```

Macros can be used in Advanced Configuration similar to User-Defined Overrides, except they automatically take values provided by the device itself.

- %{ESN} will be replaced with the MAC address of devices.
- %{MSN} will be replaced with the Serial Number of devices.

Bulk Overrides

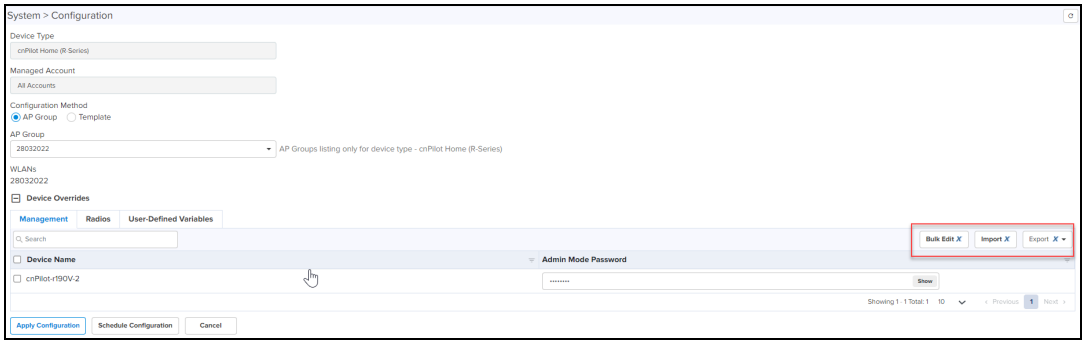
Bulk Overrides allow the user to edit the multiple configurations shared through an AP Group for one or more devices.

	NOTE: **Bulk Edit** option under **Configuration** > **Devices Overrides** is supported only for cnMaestro X.

The user can override for the following configurations in cnPilot (R-Series):

- Management
- Radios
- Wi-Fi Configuration

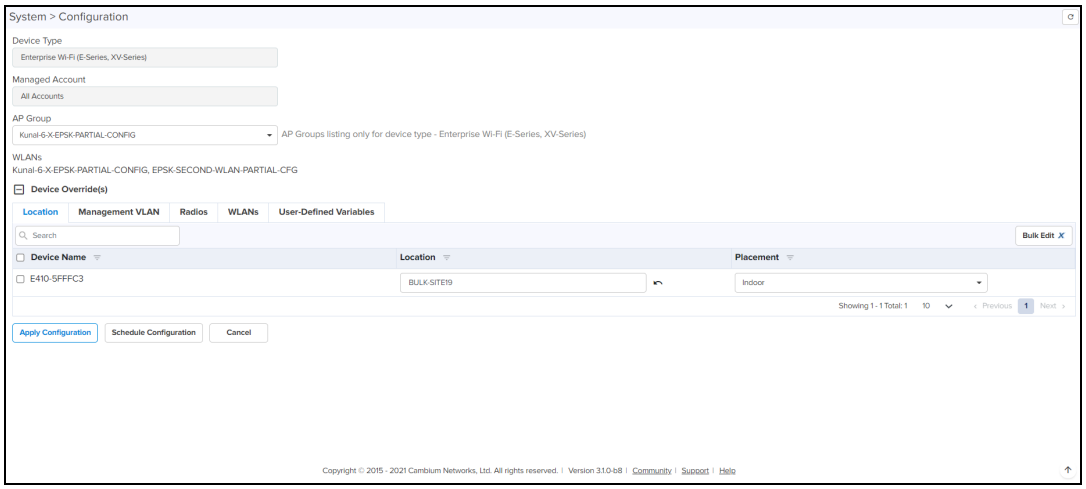
Figure 264 Bulk Override: cnPilot (R-Series)



The user can override for the following configurations in Enterprise Wi-Fi (E-Series, XV-Series):

- Location
- Management VLAN
- Radios
- WLANs
- User-Defined Variables

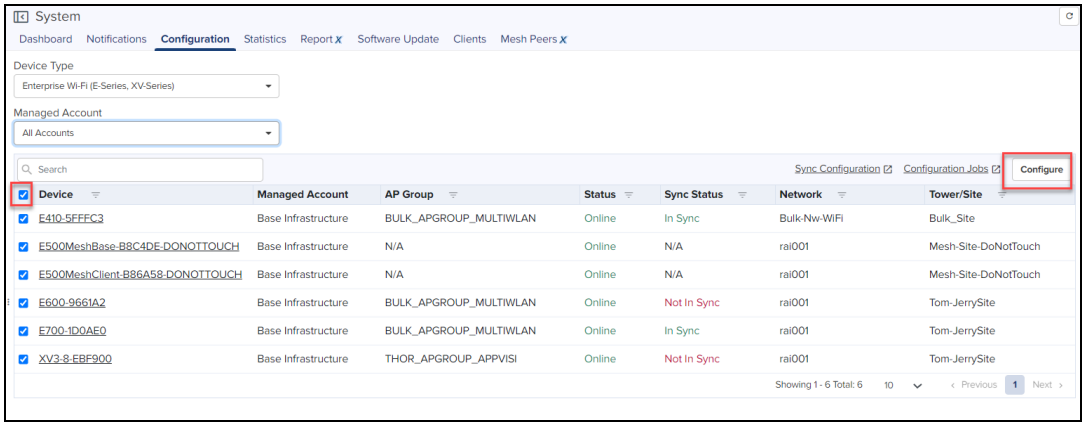
Figure 265 Bulk Override: Enterprise Wi-Fi (E-Series, XE-Series, XV-Series)



	NOTE: **Configuration** tab will be available from other container levels like Network/Site and also from AP group level.

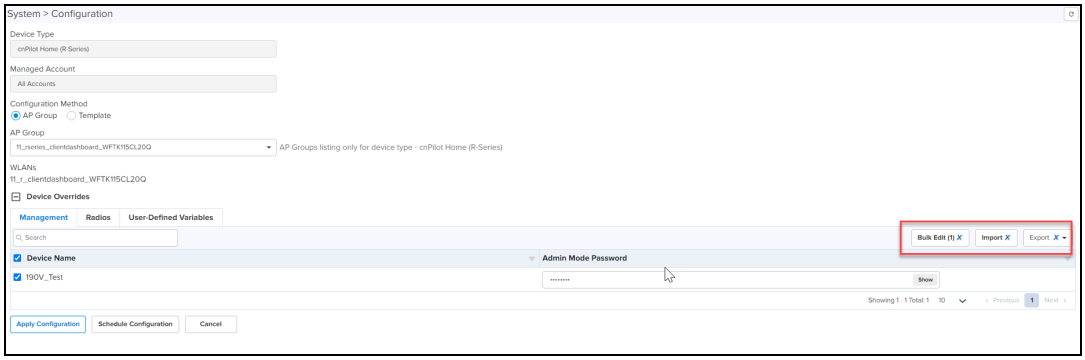
To configure Bulk Overrides for the devices, perform the following steps:

1. Navigate to **Manage > System > Configuration.**
2. Select the **Device Type** from the drop-down.
3. Select **Device** from the list and click **Configure**.



3. Click the plus (+) next to **Device Override(s)**, to override the list of devices.
4. In the Device Override table, reconfigure tabs and perform the following actions:
   - Bulk Edit
   - Export

- Import



5. Select the device(s) from the Device Override table to configure.
6. Click **Bulk Edit.**

A pop-up window appears for the fields to reconfigure.

7. Click **Save**.

You can export, as described:

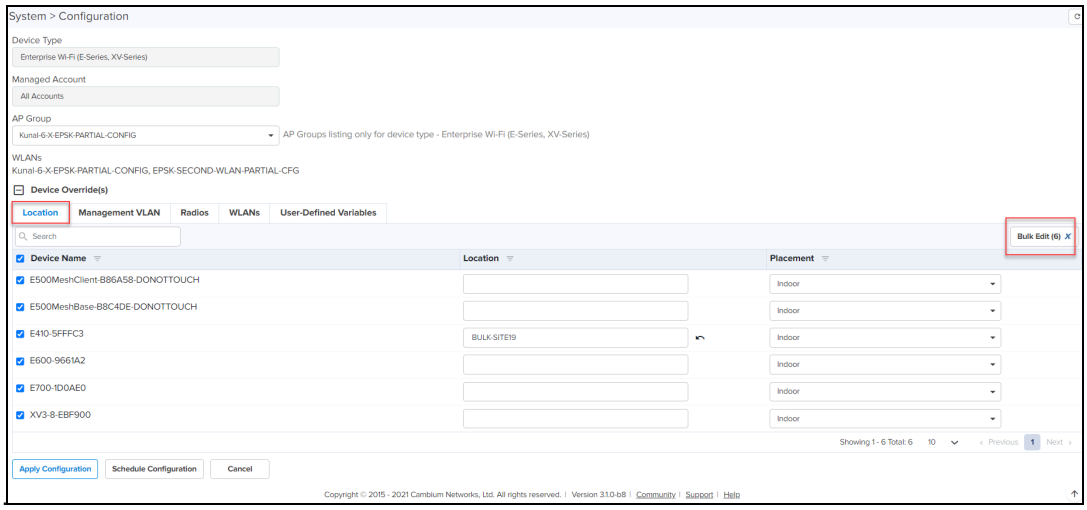
- Export page as CSV
- Export all as CSV

After modifying the field values, the CSV file can be imported.

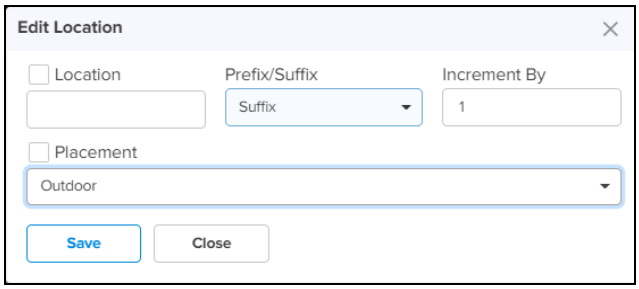
8. Click **Import**, to import the file.
9. Select the file to import in CSV file format.
10. Click **Apply**.

Location

1. In the **Location** tab, select the devices from the list.
2. Click **Bulk Edit.**

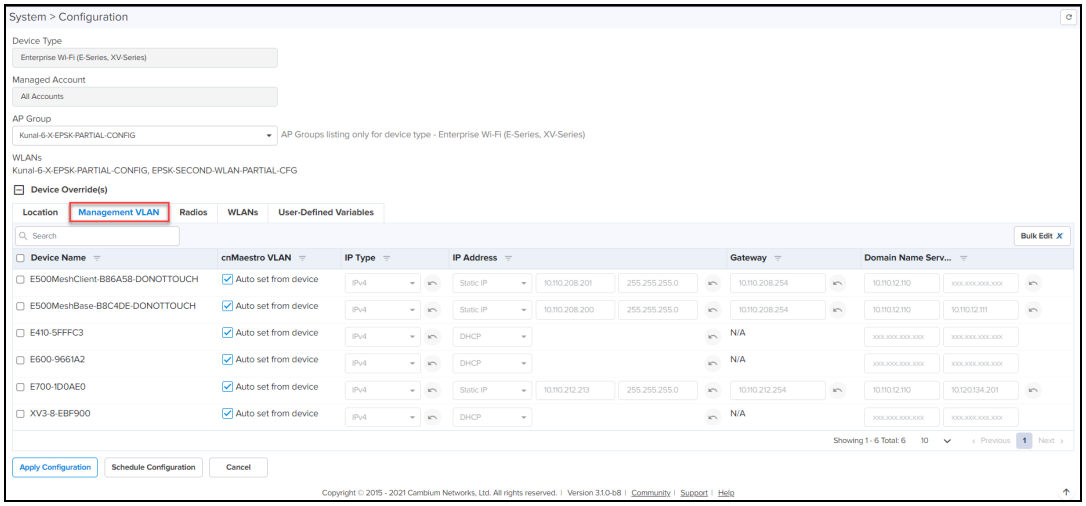


3. **Edit Location** window appears, edit the configuration details and click **Save**.

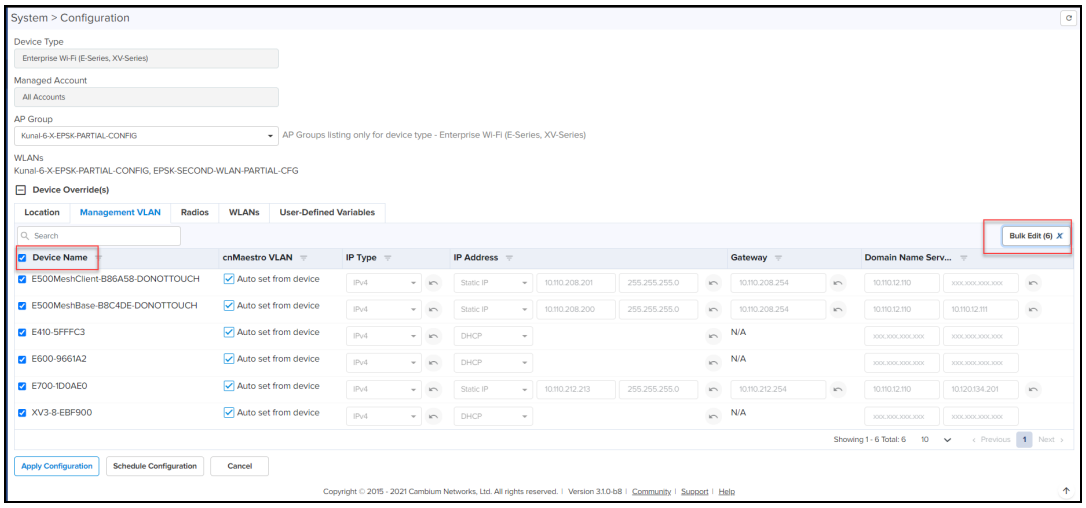


Management VLAN

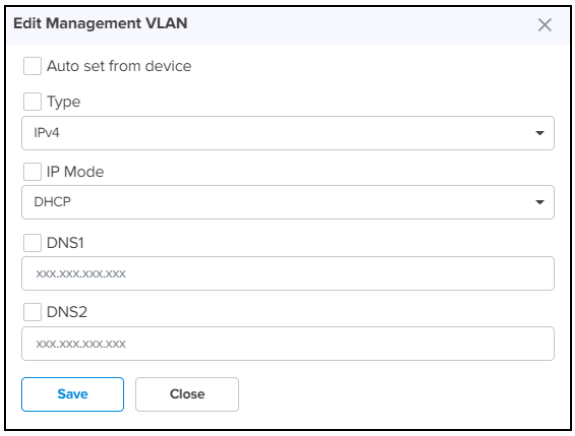
1. In the **Management VLAN** tab, select the **VLAN** of the device from the list.



2. Click **Bulk Edit**.

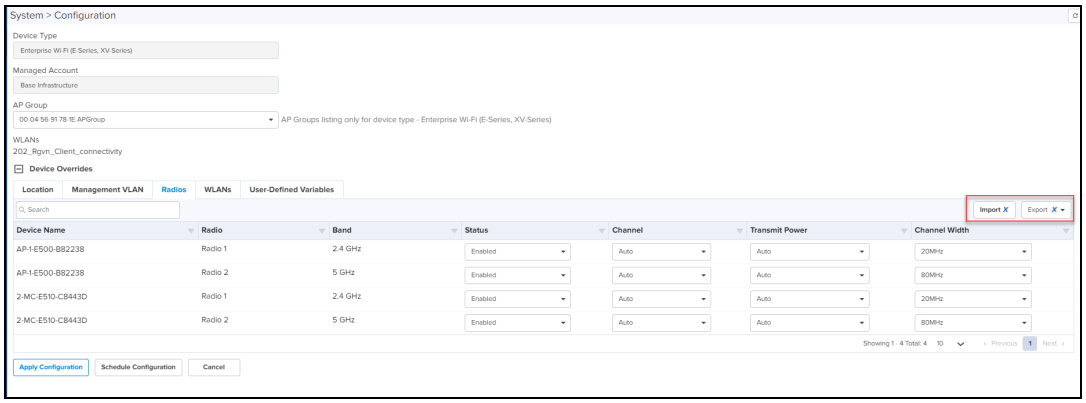


3. **Edit Management VLAN** window appears, edit the changes and click **Save**.



Radios

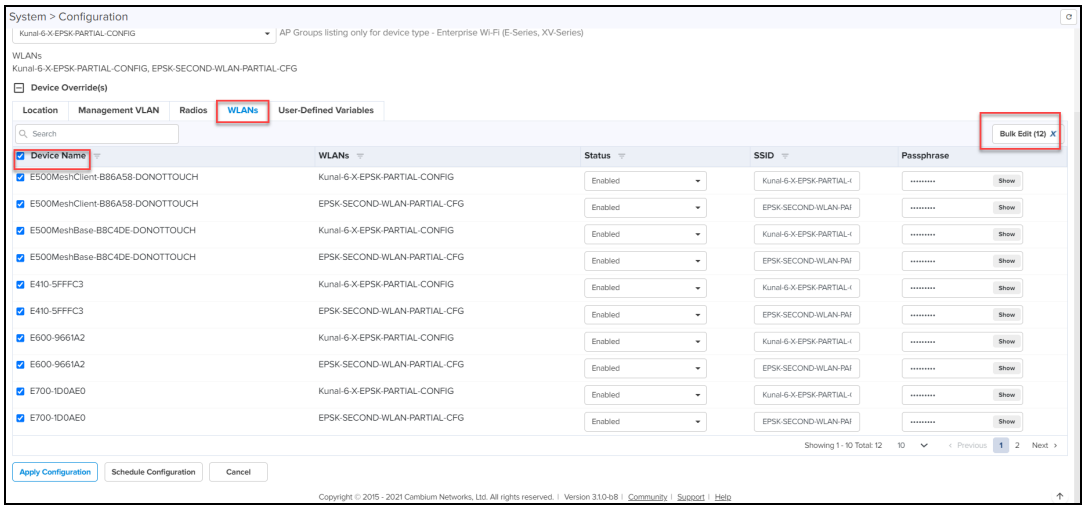
In the **Radio** tab, select the radios from the device list, to perform **Import** and **Export** actions.



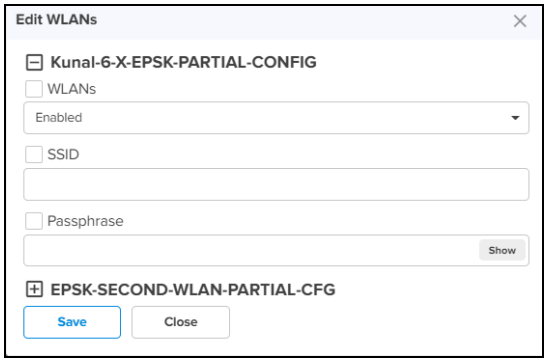
	NOTE: **Bulk Edit** tab is removed from Radio configuration from 3.1.1 release.

WLANs

1. In the **WLANs** tab, select the WLAN of the devices from the list.

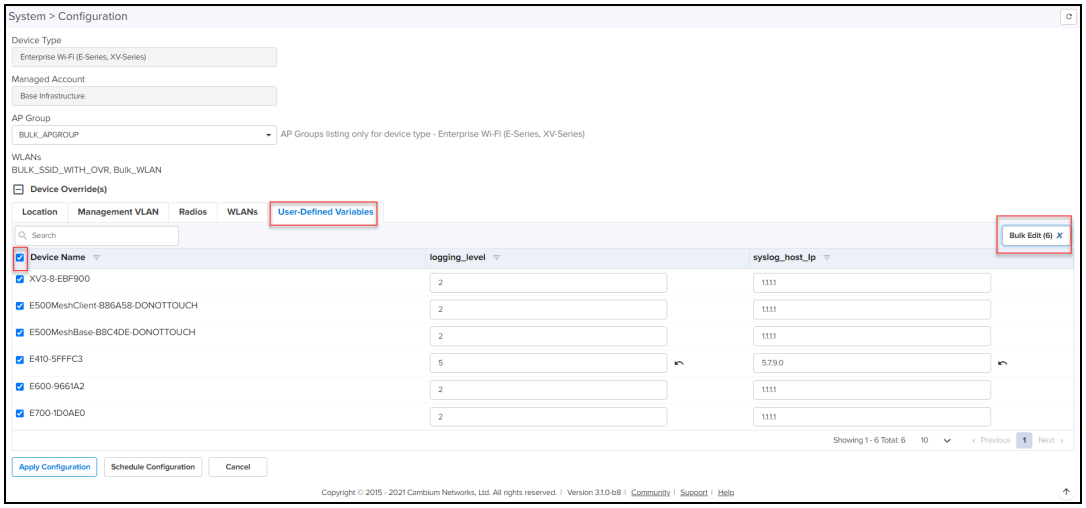


2. Click **Bulk Edit**.
3. **Edit WLANs** window appears, edit the configuration details and click **Save**.



User-Defined Variables

1. In the **User-Defined Variables** tab, select the devices from the list.



2. Click **Bulk Edit**. Edit WLANs window appears, edit the configuration details and click **Save**.

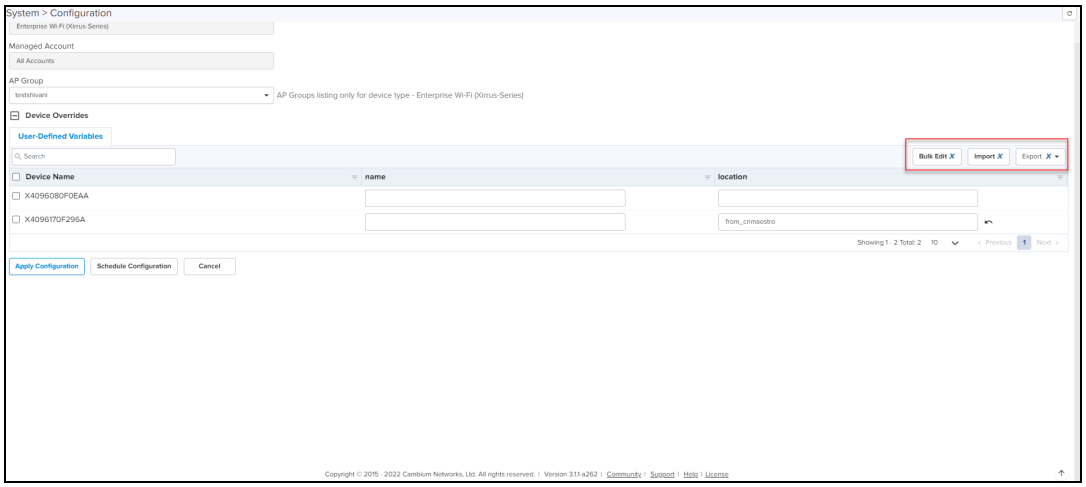
	NOTE: For Bulk overrides to enable in **User-Defined Overrides** tab, user has to define overrides in User-Defined Overrides section of AP groups. For more details, refer to User-Defined Overrides

3. Click **Apply Configuration** to start immediately, or click **Schedule Configuration** to schedule later.

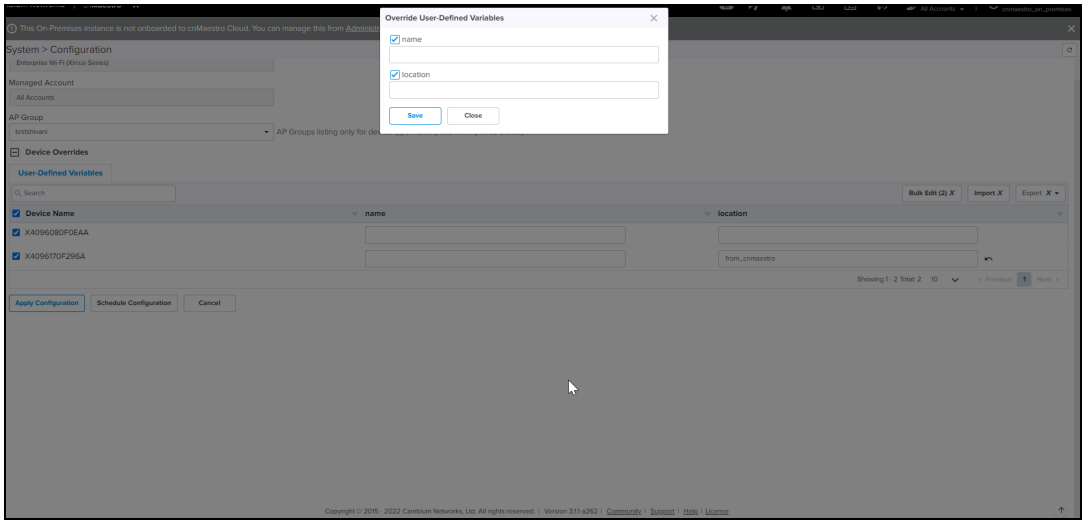
The user can override for the following configurations in Enterprises Wi-Fi (Xirrus-Series):

- User-Defined Variables

Figure 266 Bulk Override: Enterprises Wi-Fi (Xirrus-Series)



1. In the **User-Defined Variables** tab, select the devices from the list.



2. Click **Bulk Edit**. Edit WLANs window appears, edit the configuration details and click **Save**.

3. Click **Apply Configuration** to start immediately, or click **Schedule Configuration** to schedule later.

Synchronize (Sync) Configuration

AP Groups can be configured to synchronize automatically or manually when they are updated. The setting is available in the AP Group configuration page.

1. **Enterprise Wi-Fi AP Groups** by default synchronize automatically (so any change of AP Group or WLAN, followed by a **Save**, will immediately push configuration to the devices without manual intervention).
2. **cnPilot Home AP Groups** by default synchronize manually. Updates to them (or the WLANs to which they map) need manual synchronization to push configuration to the devices.

Manual Synchronization

Manual configuration synchronization allows the user to synchronize any devices with a single action rather than updating each device separately.

Navigate to **Administration > Sync Configuration**.

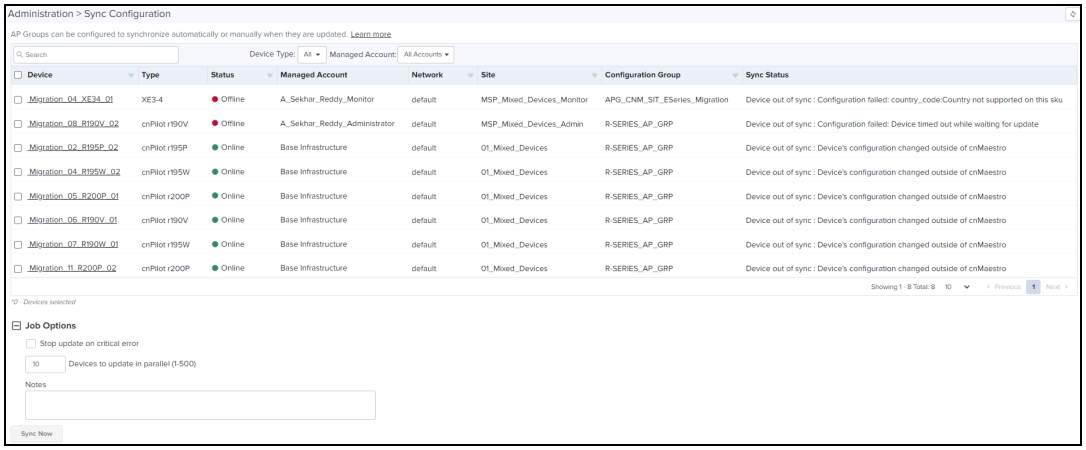
Sync Configuration only displays devices currently **Out-of-Sync** with a mapped AP Group.

Sync Configuration has the following fields:

- AP Group (AP Group to which device is mapped)
- Device (Hostname)
- Device Type
- Network (Network in which device is present)
- Status (Up/Down)
- Site (Site under which device is present)
- Sync Status (Sync status will tell whether job is completed or failed)

Steps to Sync Configuration:

1. Click the **Sync Configuration** inthe top right of the **Configuration > WLAN and AP Groups** or **Manage > Configuration > Device Details** or **Jobs** tab.
2. Select devices to synchronize.



3. Click **Sync Now**.

NOTE:

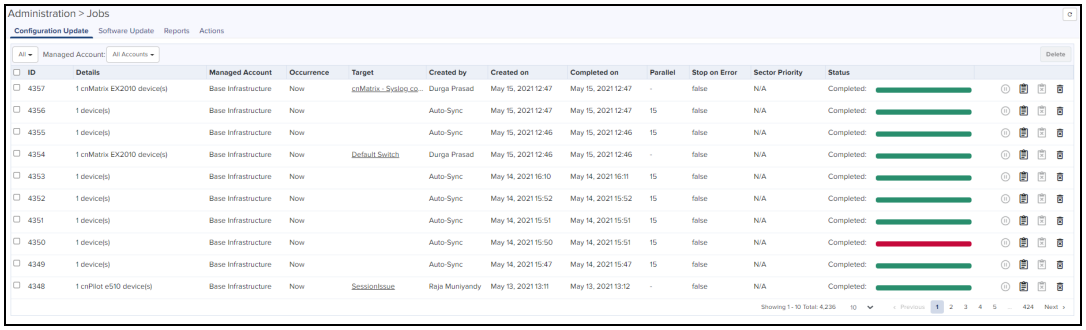
- Sync Configuration can only be used if an AP Group is already mapped to the device.
- Software Update Jobs can be scheduled in parallel irrespective of other running Jobs in cnMaestro X. Configuration and Software Update jobs execute sequentially if mapped to the same device.

Configuration Job Status

After applying the configuration, the Configuration Job status is viewed at:

- Navigate to **Monitor and Manage > Configuration > View Update Jobs** (for Access and Backhaul devices) or
- **Administration > Jobs** (for Wireless LAN devices).

When the configuration is pushed from the Sync Configuration page, a Configuration job will be created in the background.



NOTE:

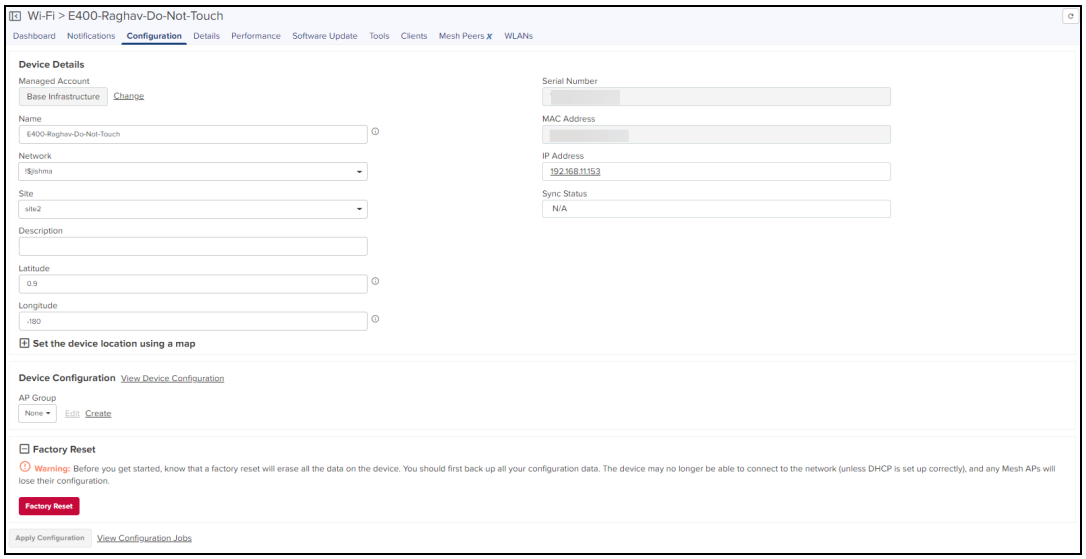
- Configuration jobs skip offline devices. With manual synchronization, they need to be synchronized by the administrator.
- For more information on Wi-Fi AP configuration, refer to the following URLs:
  - Unique per-Device values in Profiles Using User-Defined Overrides
  - AP Groups and Overrides for Wi-Fi Devices.
  - Migrating from Templates to Profiles
- cnMaestro X can run any number of Jobs in parallel.

Factory Reset

A factory reset erases all the data on the device. Factory reset is supported for two device models: Enterprise Wi-Fi higher than 3.10-R6 version and cnMatrix higher than 4.0 version.

To factory reset the device perform as follows:

1. Navigate to the **Configuration** page of the device.
2. Select **Factory Reset.**



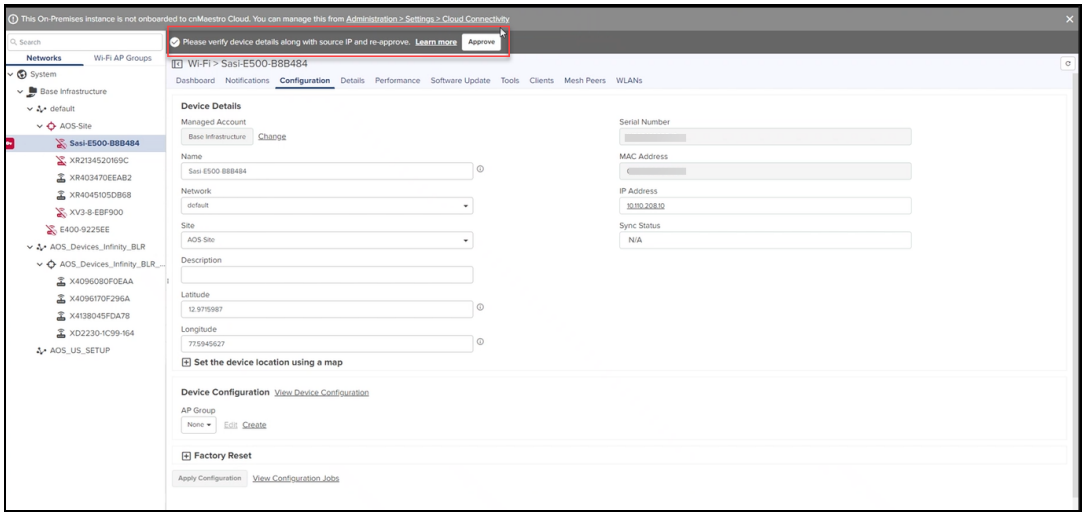
3. Click **Factory Reset**.

It displays **Please confirm factory reset** message as shown below:

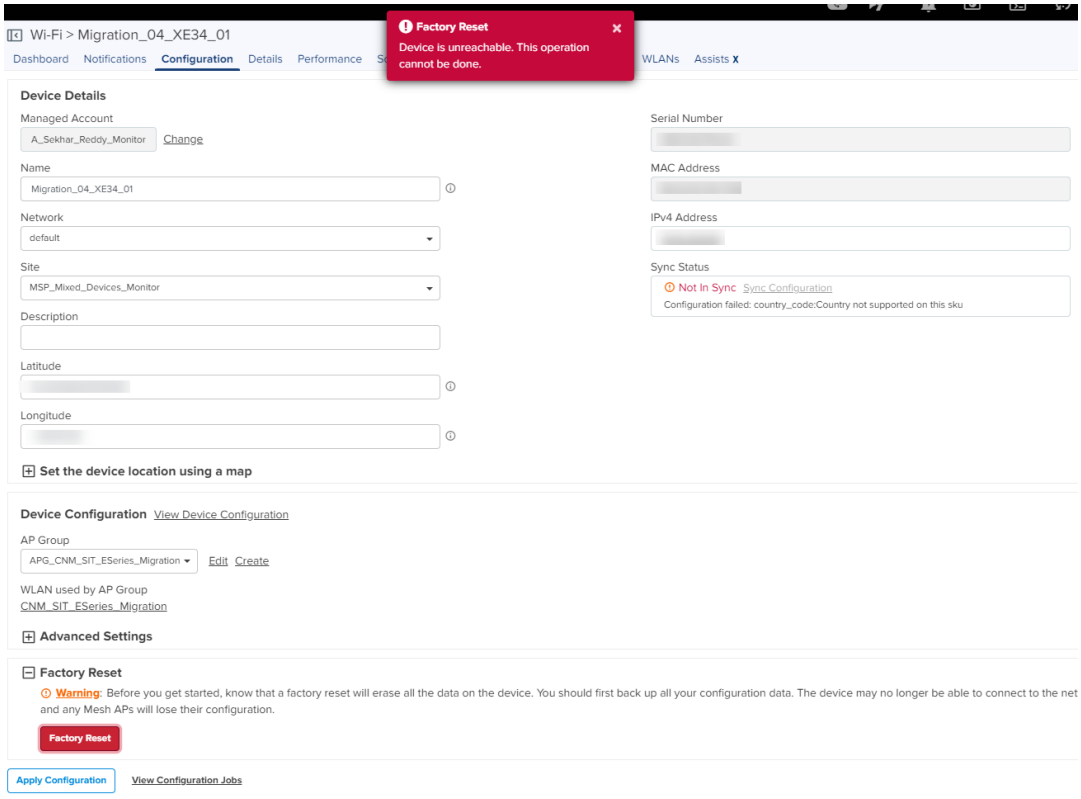
4. Click **Yes, Factory reset** option.

If the Factory Reset is successful, the following message is displayed on the **Notifications** tab.

When Factory Reset is performed, cnMaestro deletes the existing device cookie and displays message to **Approve** in the homepage. When the device connects back you have to re-approve the device as shown below:



When Factory Reset is applied to an offline device, it displays an error as shown below:



Association ACL

This section describes how cnMaestro replies to AP's request to allow or disallow client associations. This feature allows you to configure a MAC Association list that is used to allow/deny client associations.

Overview

When a client tries to connect to an AP, the following occurs:

1. The AP sends MAC authentication request along with the MAC Address of client and the Customer ID (CID) to the Controller. This is optional and occurs only if MAC ACL is configured for the WLAN on the AP and the policy for the MAC ACL is cnMaestro.

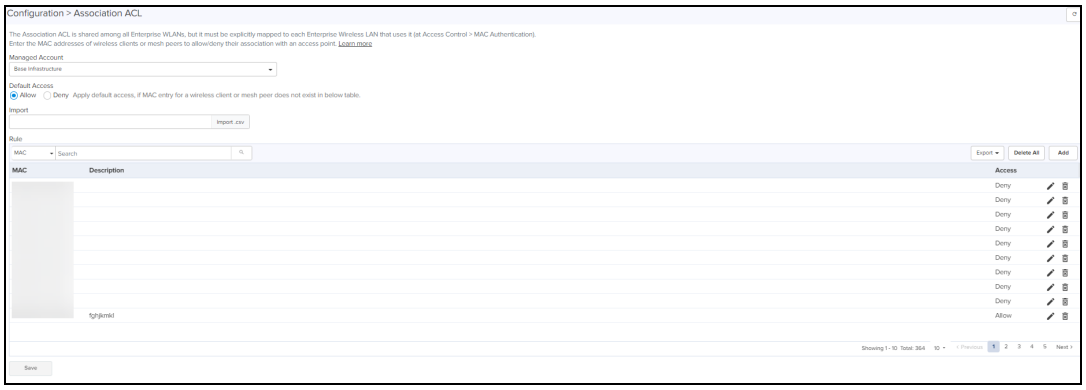
2. Controller checks and responds with an action to Allow or Deny the request.

3. AP allows or denies the client's request based on the response of the Controller.

Configuring Association ACL

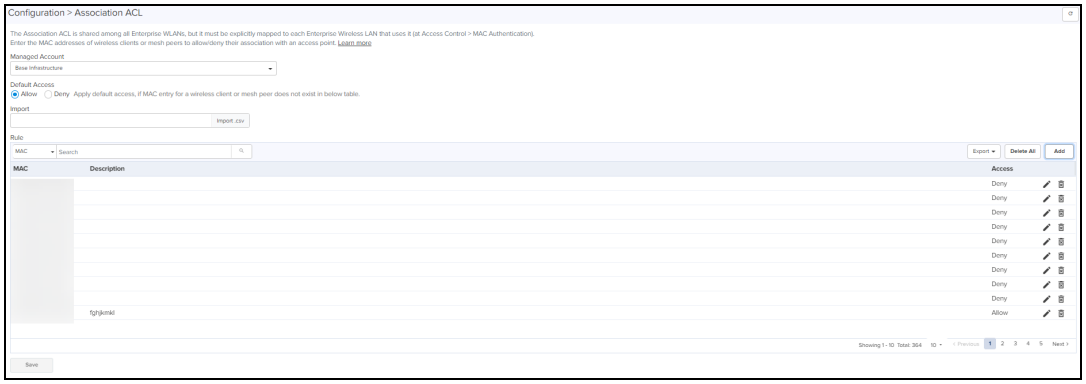
To configure the Access Control List (ACL) in cnMaestro:

1. Navigate to **Configuration > Wi-Fi Profiles > Association ACL** tab.
2. Click **Add.**



3. Select **Allow.**
4. Enter the **MAC** and **Description**.
5. Click **Save**.

It displays the **Success** message.



5. To configure MAC authentication as cnMaestro:

The Association ACL is shared among all Enterprise WLANs, but it must be explicitly mapped to each Enterprise Wireless LAN that uses it (at **Access Control > MAC Authentication**).

NOTE:

- If MAC is not configured under the policy (to Allow or Deny), the default action will be applied.
- You can perform the following actions by selecting the respective icons in the table:
  - Edit
  - Delete
  - Export
  - Import Association ACL, by selecting **Import.csv** file.

Access Control Policies

This feature allows you to configure policies that define who can connect to the network, and how or when they are allowed to connect and access a specific device. The policies are a set of conditions, constraints, and settings.

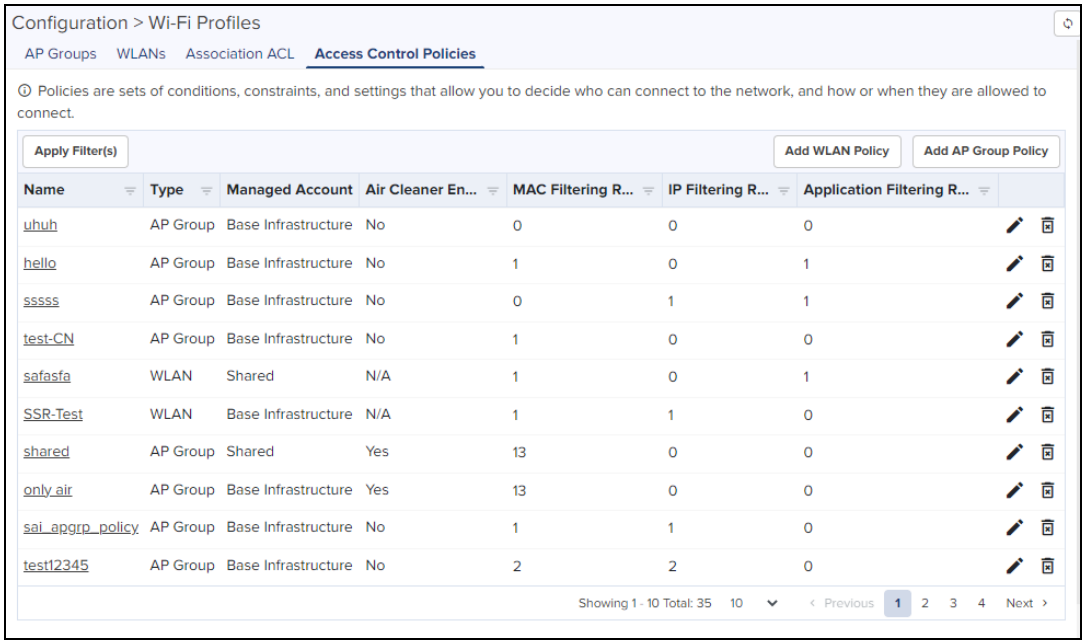
The policies can be configured on both AP Group level and WLAN level, AP Group policies have more priority than WLAN Access Control policies.

On both AP group policy and WLAN policy, we can have L2, L3 and L3 Rules. The configuration rules are processed in following priority: MAC Filters followed by IP and Application Filters.

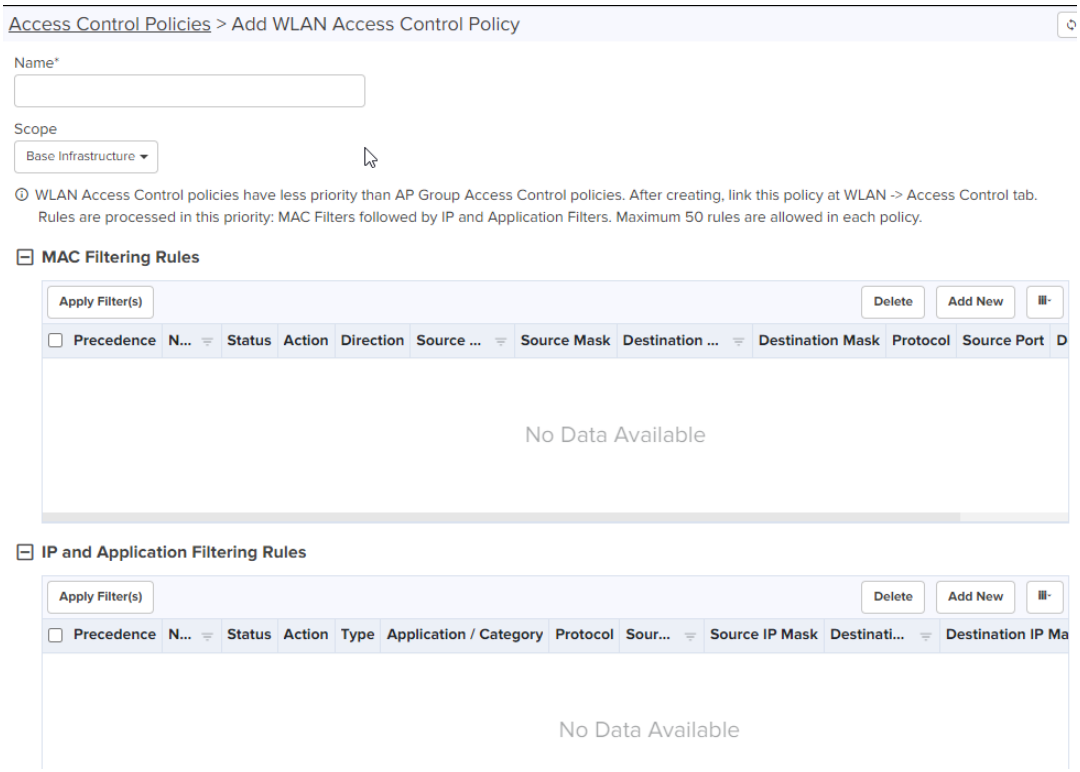
Configuring Access Control Policies for AP Groups and WLANs

To configure the Access Control Policies:

1. Navigate to **Configuration > Wi-Fi Profiles > Access Control Policies** tab.



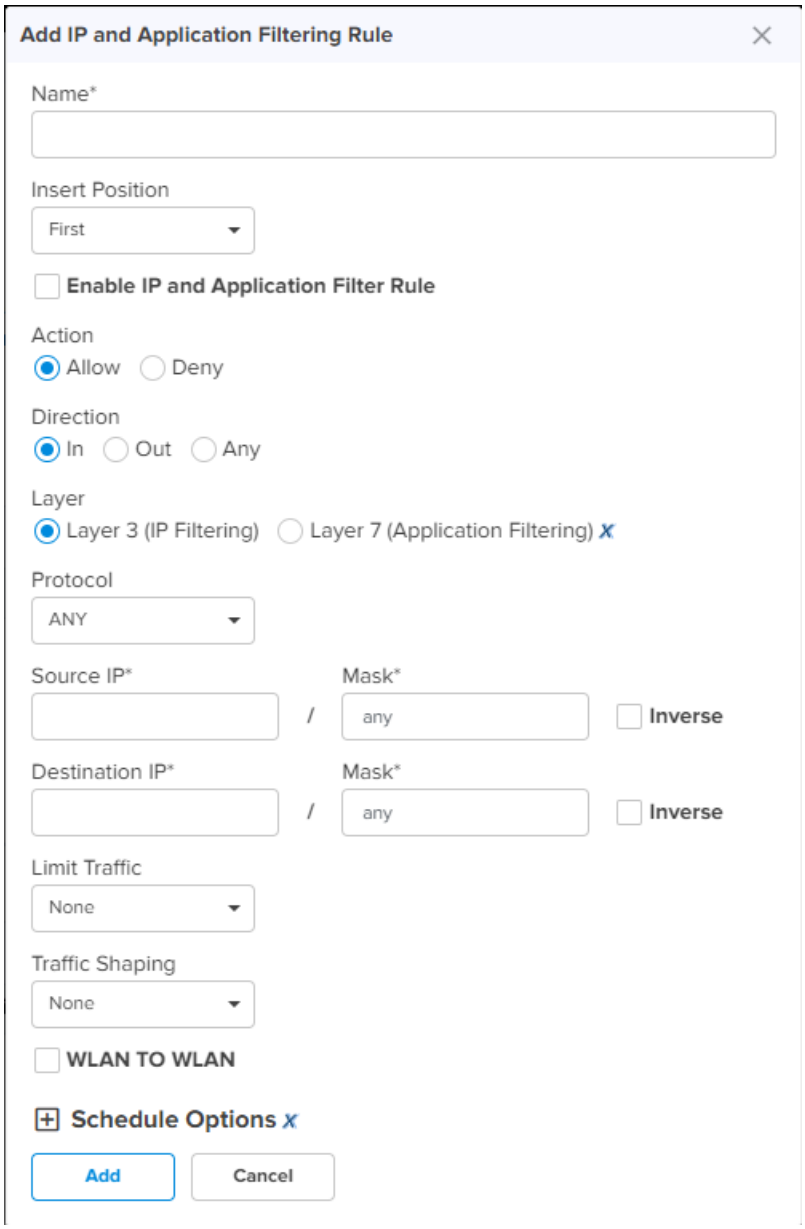
2. Click **Add. WLAN Policy** or **Add. AP Group Policy** in the top right corner of the corresponding lists.



3. Enter a **Name** for the policy.
4. Select the **Scope** from the drop-down list.
5. For AP Groups, **Enable Air Cleaner**.
6. Click **Add New** in the top right corner of the **MAC Filtering Rules** list and complete the details in the **Add MAC Filtering Rule** pop-up window.

7. Click **Add New** in the top right corner of the **IP and Applications Filtering Rules** list and complete the details in the **Add IP and Application Filtering Rule** pop-up window.

	NOTE: Application Filtering Rule is an X Feature.



8. After adding all the required rules, Click **Add** in the bottom left corner of the window.
9. Navigate to **WLAN > Access Control** or **AP Group > Access Control** tab and link this policy.

	NOTE: • AP Group Access Control Policies are applied at the device level. • WLAN Access Control policies have less priority than AP Group Access Control policies.

Custom Applications[X]

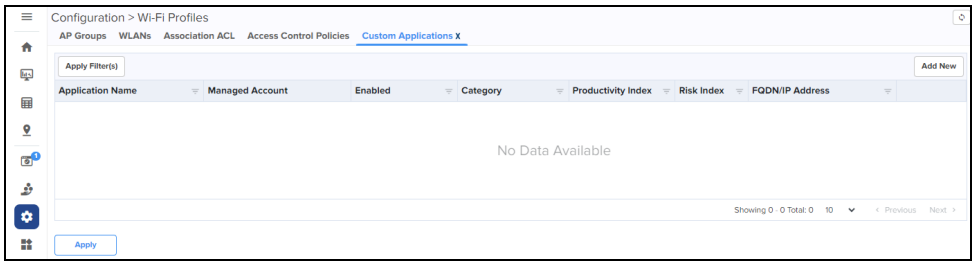
Custom applications allow you to configure applications with a specific IP address or a domain name, and apply filter rules, such as enable or disable traffic from these applications. By default, these applications are applied on the devices along with the AP group configuration.

After creating the custom application, when you click **Apply**, cnMaestro creates a job for devices in the AP group that has auto sync enabled. Devices in AP groups that do not have auto sync enabled, are marked as **Not in Sync**, and users must manually apply the configuration on to the devices.

To disable cnMaestro from applying the custom application configuration on the devices, clear the **Enable Custom Application** check box from the **AP Groups** > **Services** tab > **Application Visibility**X section.

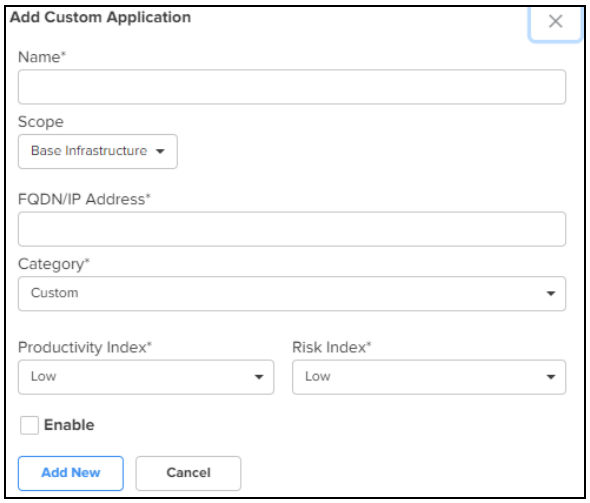
To add a new custom application, complete the following steps:

1. Navigate to **Configuration** > **Wi-Fi Profiles** > **Custom Applications**X.



2. Click **Add New** on the **Custom Applications**X page.

   The **Add Custom Application** window is displayed.



   Configure the following parameters:

Table 66: Custom Application Parameters

Parameter	Description
Name	Specifies the name for the custom application. Supports a maximum of 20 characters.
Scope	Specifies the availability of the custom application across managed accounts. The following values are supported: • Base Infrastructure—Custom application is available only for the global account. It is not shared with other managed accounts. • Shared—Custom application is shared across all managed accounts. It can be mapped to devices in the managed account, but it cannot be modified. To modify the configuration, it must be copied into the managed account and then updated. • Managed Account—Custom application is available only for that specific managed account. **Note**: Once the scope has been configured on a custom application, it cannot be modified.
FQDN/IP Address	Specifies the IPv4 address or the domain name of the custom application.
Category	Specifies the category to which the application must belong. Select the appropriate category from the drop-down list.
Productivity Index	Indicates how appropriate an application is useful for business purposes. The higher the rating number, the more business-oriented an application is.
Risk Index	Indicates how likely an application is to pose a threat to the security of your network. The higher the rating number, the riskier of an application is.
Enable	Select the check box to enable this custom application.

3. Click **Add New**.
4. To apply this configuration on the AP, click **Apply**.

cnMatrix Switches

cnMatrix switches simplifies the network deployment and operation. cnMaestro provides management, configuration and control, and security services for cnMatrix with deployment options such as Policy-Based Automation (PBA) to simplify core operations and improve network security. Central to cnMaestro's orchestration of cnMatrix devices is the concept of Switch Groups.

Switch Group Configuration

A Switch Group represents a virtual stack of switches, independent of their locations or networks. The Switch Group functionality enables users to manage multiple switches with the same configuration.

Configuration is common to all switches belonging to a Switch Group:

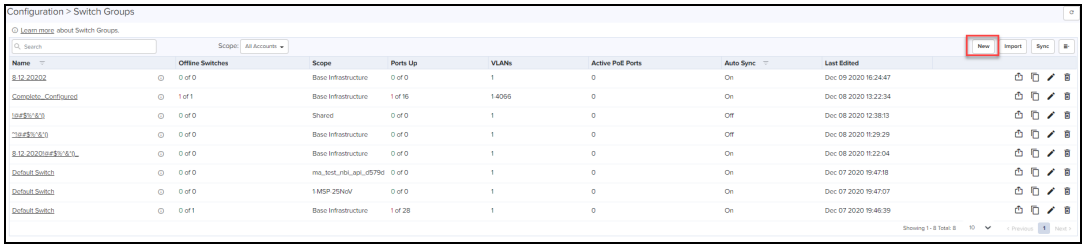
- Configuration changes are synchronized and applied for all the switches in a Switch Group.
- A subset of configuration attributes can be overruled for an individual switch.
- Switch Ports across all physical switches are associated with a Switch Group and can be simultaneously bulk edited.

From the **Switch Groups** tab, the administrator can navigate to the Switches and the Switch Ports tabs for configuration. The Dashboard tab is used to monitor the health condition of the virtual stack.

The process for creating a new switch group configuration is as follows:

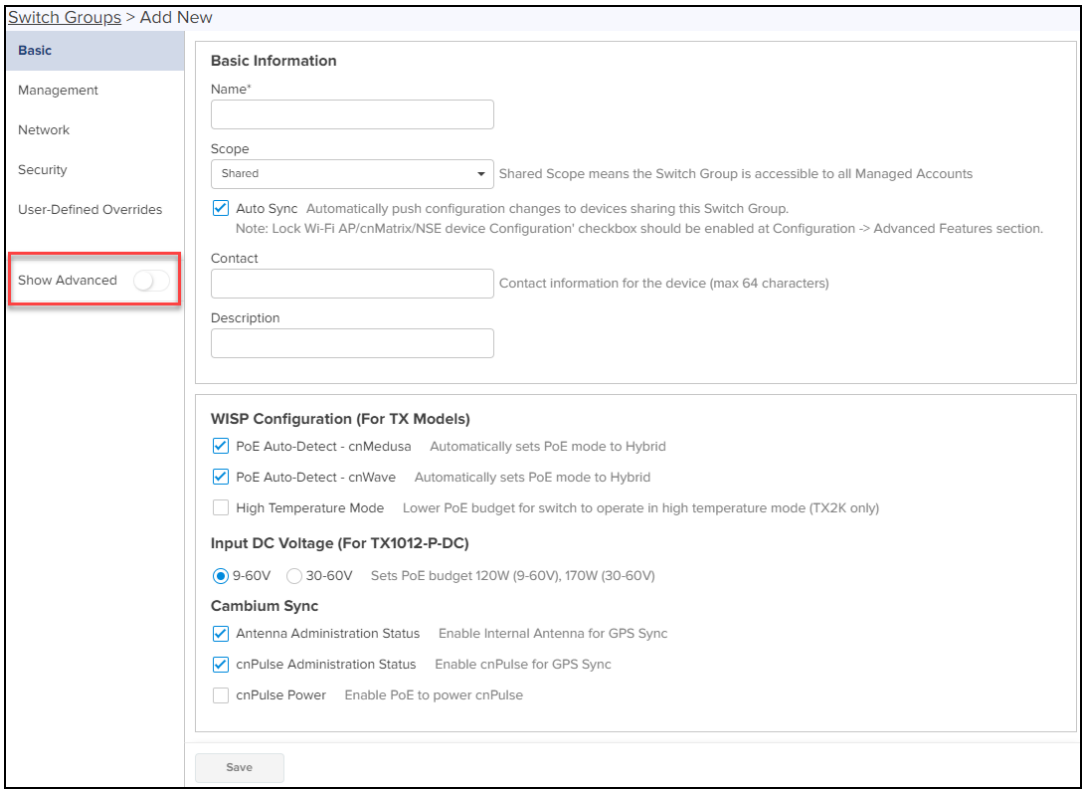
1. Navigate to **Configuration > Switch Groups.**

2. Click **New Switch Group**.



	NOTE: To Edit the Configuration of existing Switch group, click **Edit** icon, navigates to Switch Group Configuration page.

3. Configure the following tab parameters to create a Switch groups:
   - Basic
   - Management
   - Network
   - Security
   - User-Defined Overrides



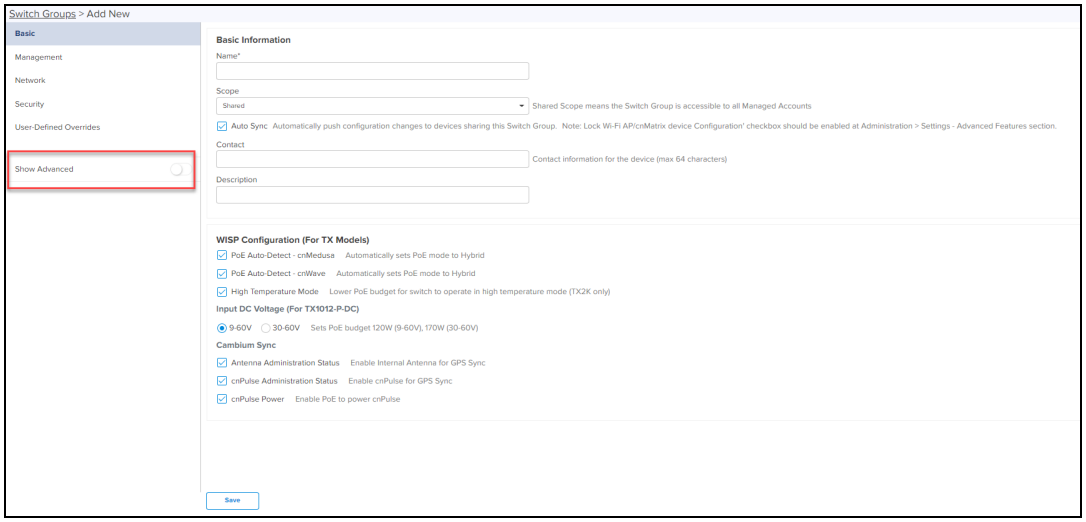
	NOTE: • Toggle the **Show Advanced** button to view the advanced options of the Switch Groups. • Click **Save** on individual tab parameters or click once after entering all the four tab parameters.

Basic

The Basic tab provides options to the user to configure the device name as well as other standard values used to identify a switch.

1. Navigate to **Configuration > Switch Groups > Basic.**
2. On the Basic page enter device identification data such as:
   - Name
   - Contact
   - Description

	Note: • The special characters should be used to create Switch Groups names (Eg: a-zA-Z_-*&%#@!<>.() []^~`$1234567890). The user can also rename them if required. • By default password will not be configured. User has to configure the password for Switch Group. • By default **Auto Sync** for automatically push configuration is enabled.

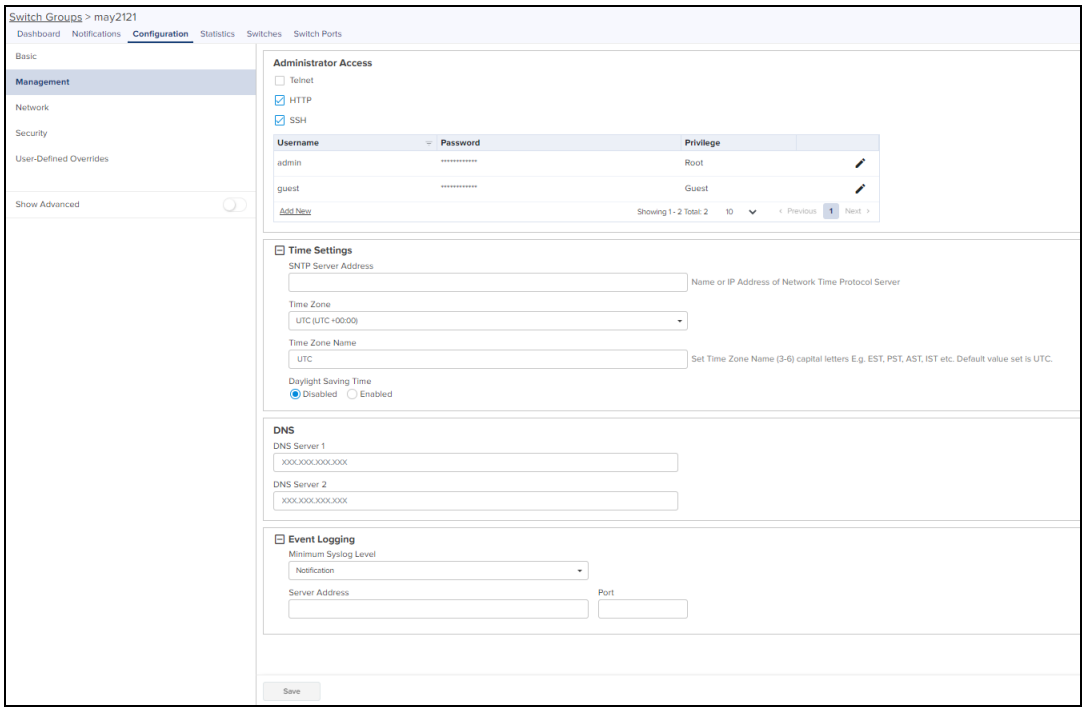


3. Click **Save**.

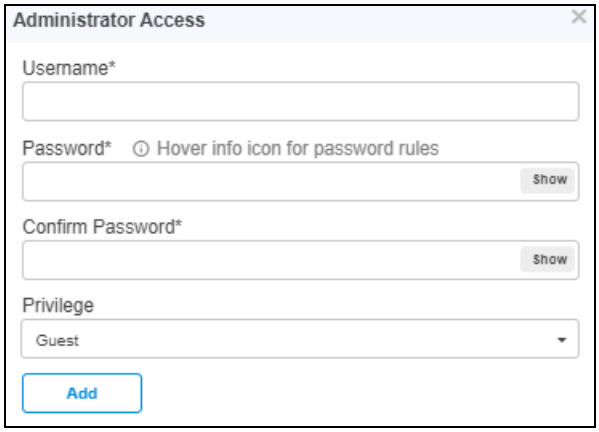
Management

1. Navigate to **Management** page.
2. Enable the **Daylight Saving Time** and enter the details.

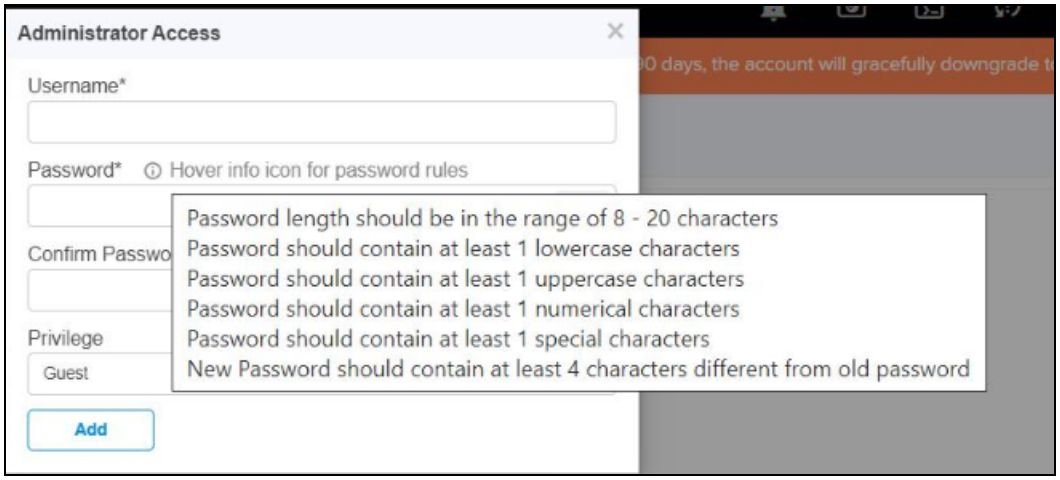
	Note: cnMatrix Switches supports SNMP configuration from release 3.0.4.



3. Click **Add New** to add **Administrator Access**, enter the details and click **Add.**



4. Password should match the special characters as shown below:



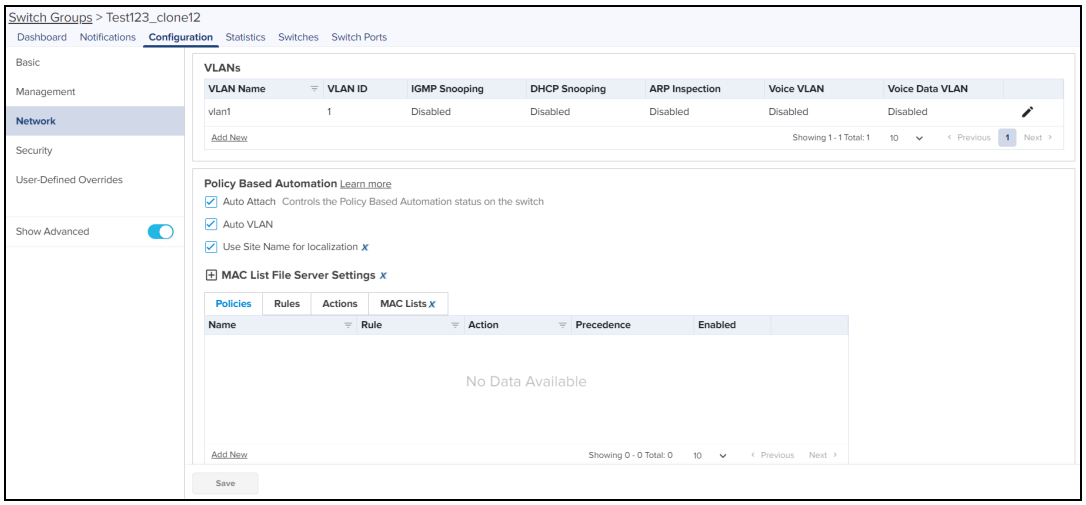
5. Click **Save.**

Network

The Network page allows the user to configure VLANs, PBA, IP Route, and Spanning Tree details.

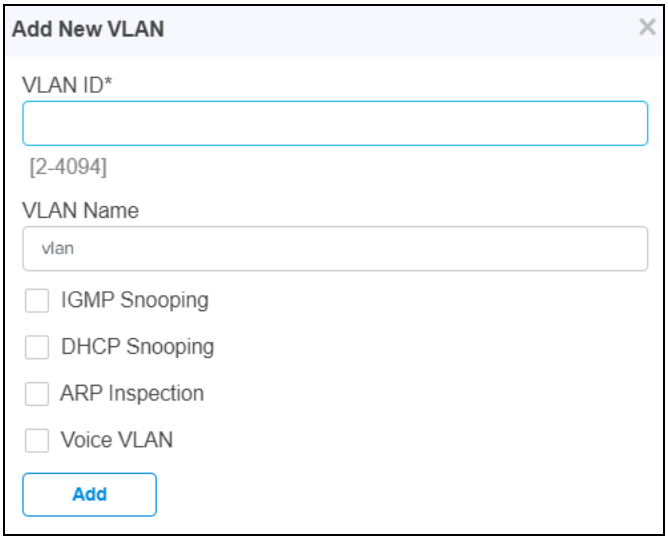
	Note: From release 3.0.4 cnMatrix Switches supports MSTP Mode and Path Cost Method in Spanning Tree.

1. Navigate to **Switch Groups > Network,** enter the details of **VLANs**, **Policy Based Automation**, **MAC List File Server Settings**, **IP route**, and **Spanning Tree**.



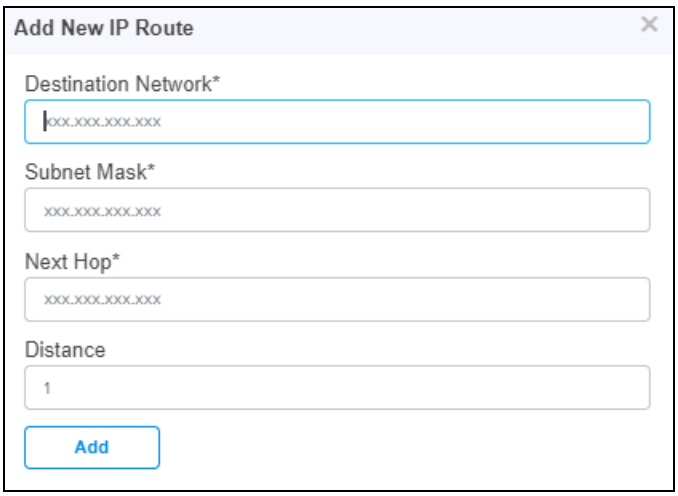
Note: Use Site Name for localization, MAC List File Server Settings, and MAC Lists are cnMaestro X features.

2. To Add a new VLANs click **Add New.**
   a. Enter the **VLAN ID**.
   b. Enter the **VLAN Name**.



   c. Enable the **IGMP Snooping.**
   d. Enable the **DHCP Snooping.**
   e. Enable the **ARP Inspection.**
   f. Enable the **Voice VLAN**.
   g. Click **Add.**

3. To Add a new IP Route click **Add New.**
   a. Enter the **Destination Network**.
   b. Enter the **Subnet Mask**.

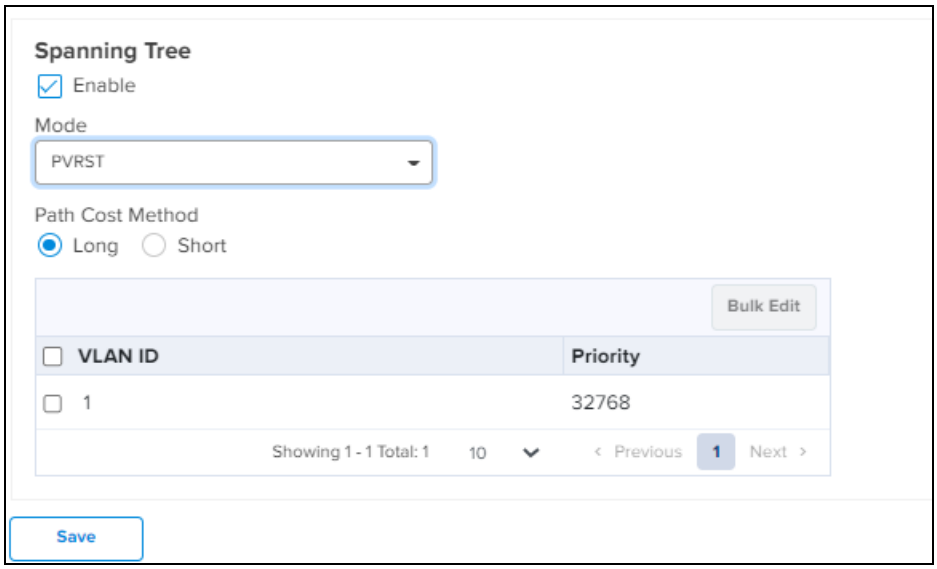


   c. Enable the **Next Hop.**
   d. Enable the **Distance.**
   e. Click **Add.**
4. Enable **Spanning Tree**.
   a. Select the Mode **RSTP** from the drop-down.

   - Select Path Cost Method **Long** or **Short.**
   - Select **Priority**.

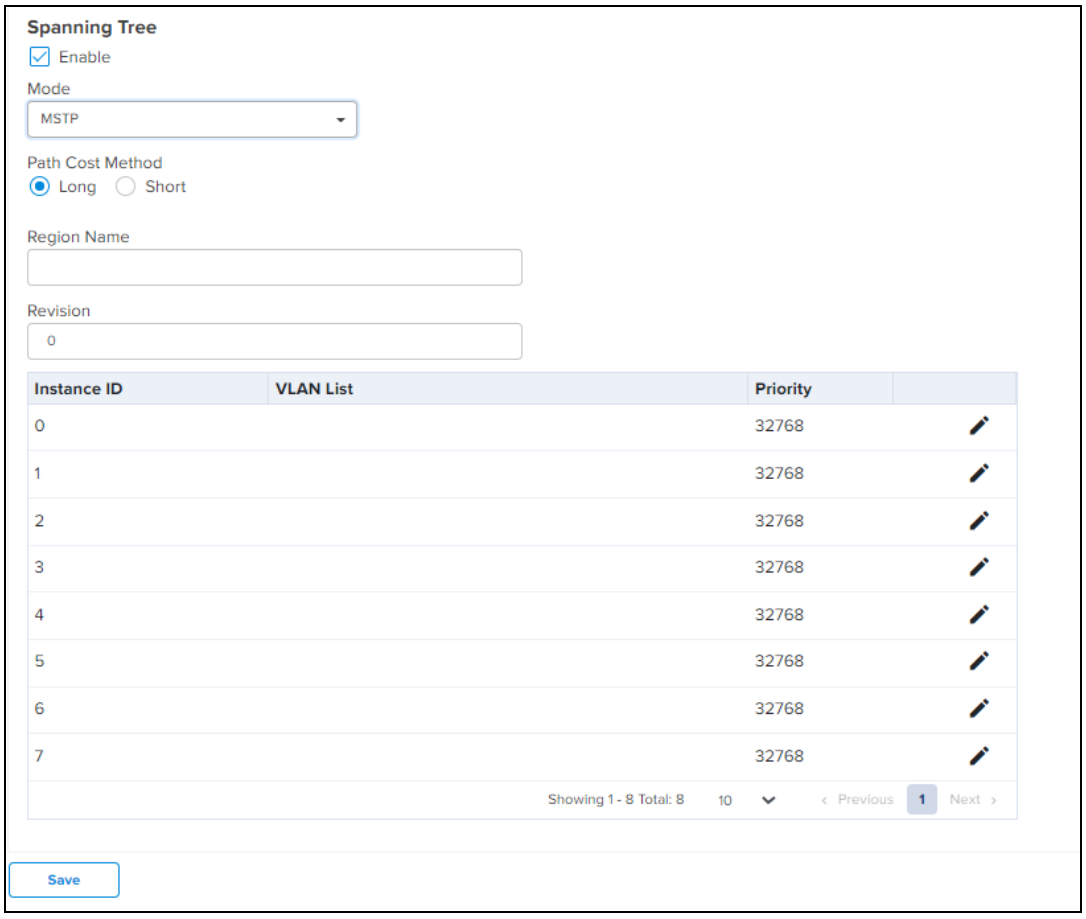
   b. Select the Mode **PVRST** from the drop-down.

   - Select Path Cost Method **Long** or **Short.**
   - Select **Priority**.

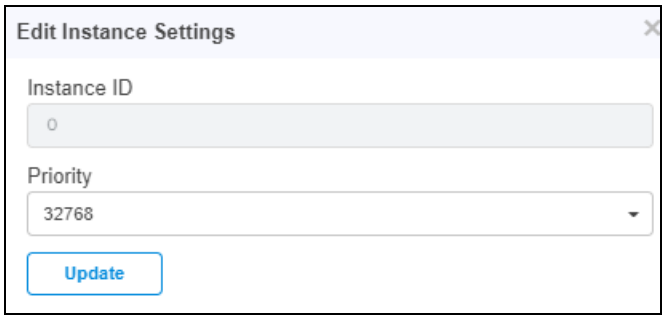


c. Select the Mode **MSTP** from the drop-down.

- Select Path Cost Method **Long** or **Short.**
- Enter the **Region Name** and **Revision.**



- User can edit **Priority** by clicking edit icon.
- Select the Priority and click **Update.**



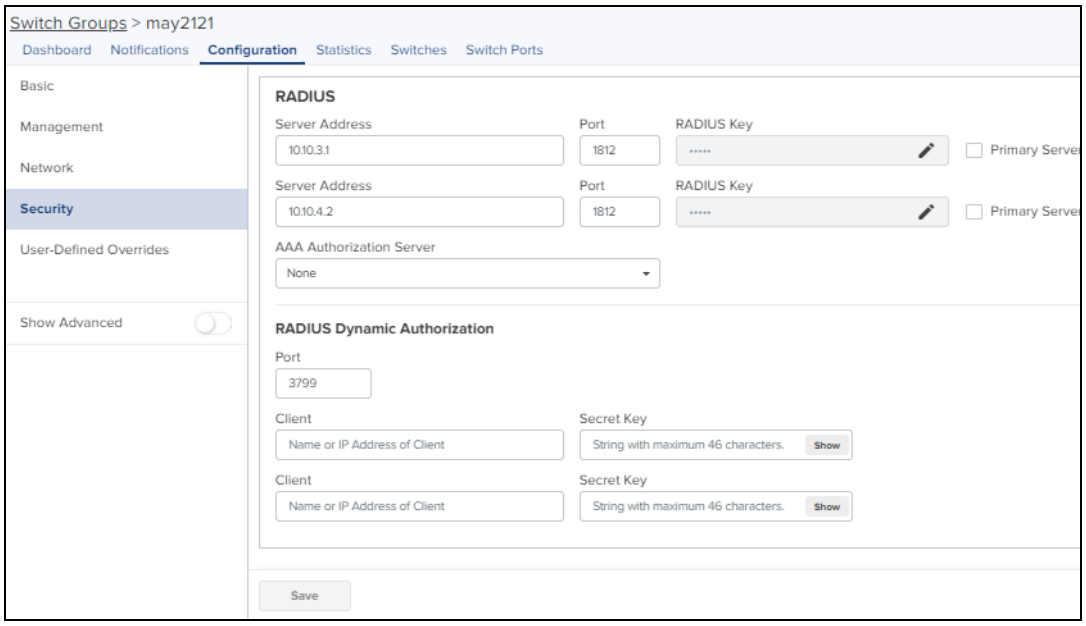
5. Click **Save.**

Security

In **Security** page user can configure **RADIUS** and **Access Control List (ACL)** details.

To configure Security:

1. Navigate to **Switch Groups** > **Configuration** > **Security** tab
2. Enter **Server Address**.
3. Enter **RADIUS Key**.
4. In **AAA Authorization Server** select **None** or **RADIUS** from the drop-down.
5. Enter **RADIUS Dynamic Authorization**.



6. In **IP ACL**, click **Add New**.

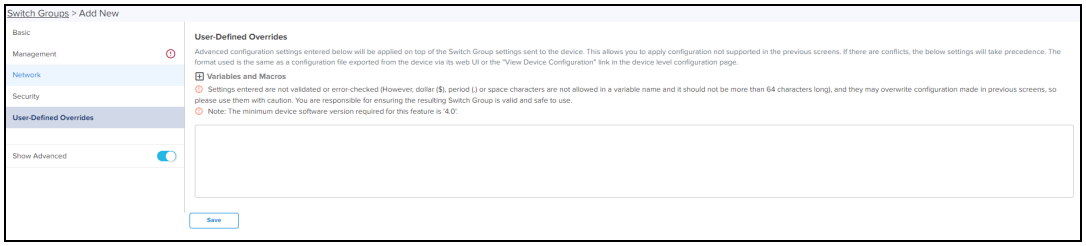
- Enter **ACL Name**.
- Select the appropriate **Protocol** from the drop-down.
- Enter **Source IP/Mask**.
- Enter **Destination IP/Mask**.
- Click **Add**.

7. Click **Save**.

User-Defined Overrides

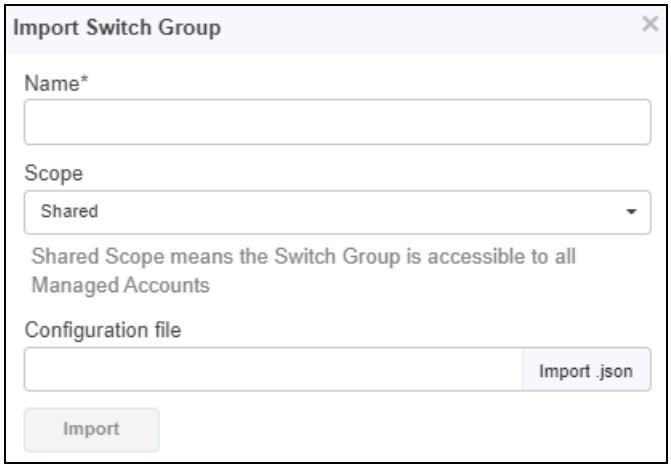
	Note: The minimum device software version supported for this feature is 4.0.

User-Defined Overrides allows you to apply configuration in cnMatrix switches. If there are conflicts, the below settings will take precedence. The format used is the same as a configuration file exported from the device via its web UI or the "View Device Configuration" link in the device level configuration page.



Import Switch Group

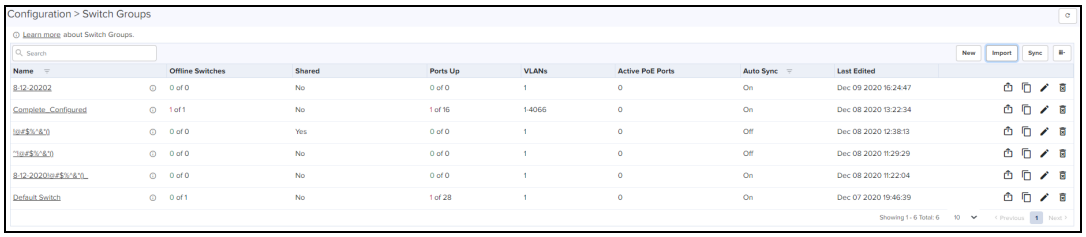
1. Click **Import Switch Group**. A dialogue box appears.
2. Select the **Scope** from drop-down.
3. Select **import.json** and import the file.



4. Click **Import.**

Delete Switch Group

To delete Switch Group from the list click **Delete** icon of the specific device row.



Retry Configure

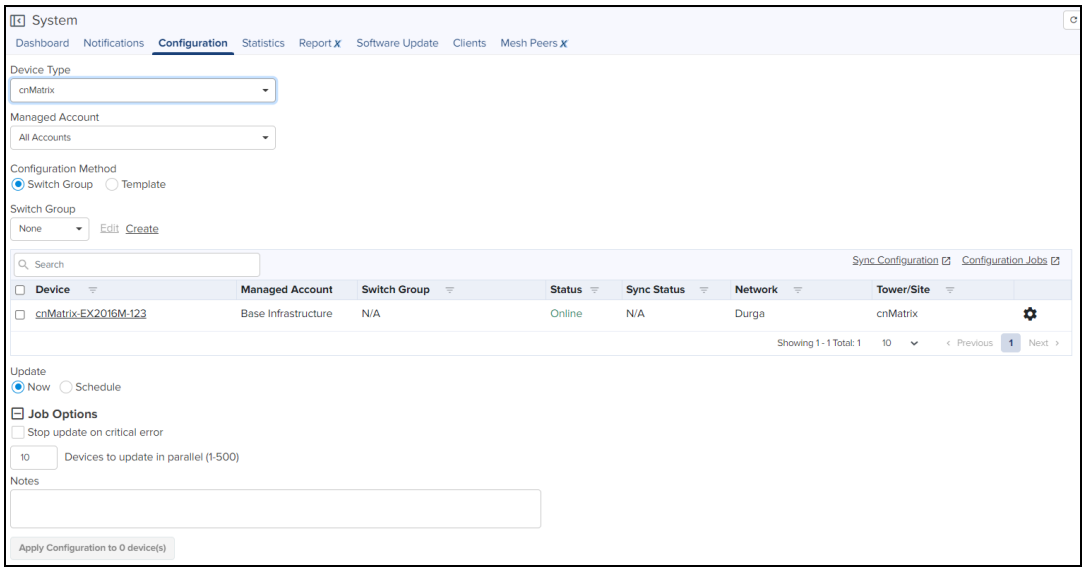
When the user tries to apply any Switch Group on the device and if the job was skipped for the device as it was offline, the reason for the skip will be displayed as " Device was offline", in the Jobs page. In this case, when device comes Up and connects to cnMaestro, then cnMaestro will create an Auto-sync job for that device and pushes the Switch Group. (It will not apply to the switch group if the "Auto-Sync" was disabled in the switch group).

	NOTE: The config update (auto-sync) will happen only when the **Auto-Sync** option was enabled in the Switch Groups page. If the device was skipped/failed because of any other reason other than the "Device was offline", then the device will not be updated.

Create a Configuration Job

Configuration job can be created from **System/Network/Tower/Site/Device Configuration** page. Select a device type and a set of devices along with switch groups to which they will be mapped. This can be done in three steps:

1. Select the Switch Group that needs to be pushed from drop-down.
2. Select the list of Switch Group **Device**.
3. Click **Apply Configuration**



Synchronize (Sync) Configuration

Switch Groups can be configured to synchronize automatically or manually when they are updated. The setting is found in the Switch Group configuration.

Switches by default synchronize automatically (so any change of switch group, followed by a Save, will immediately push configuration to the devices without manual intervention).

Manual Synchronization

Manual configuration synchronization allows the user to synchronize any devices with a single action rather than updating each device separately. The page is located at **Administration > Sync Configuration**.

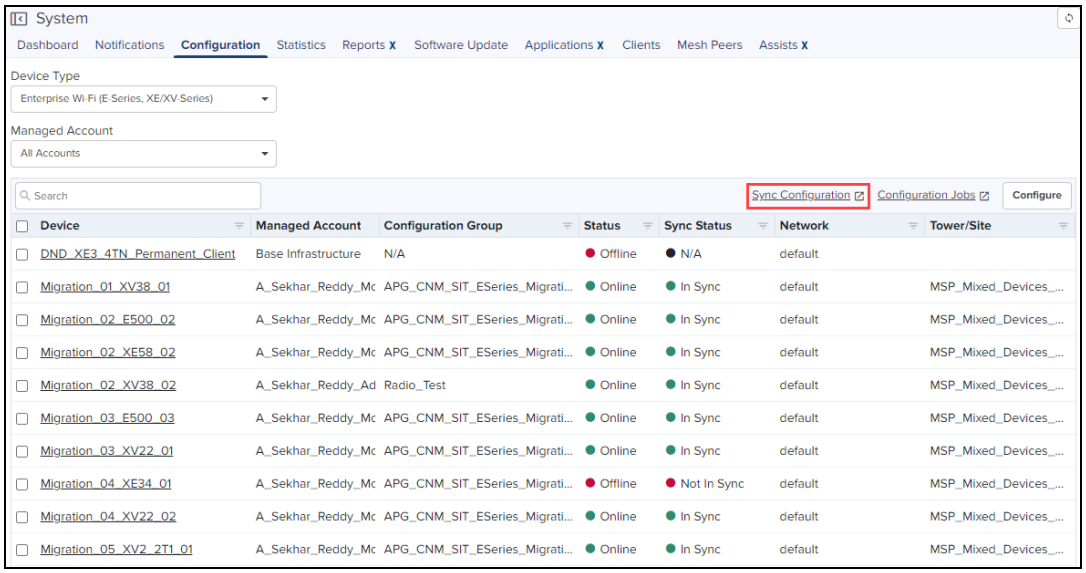
Sync Configuration has the following fields:

- Device (Hostname)
- Type
- Status (Online/Offline)
- Network (Network in which device is present)
- Site (Site under which device is present)
- AP Group/Switch Group (AP Group/Switch Group to which device is mapped)
- Sync Status (Sync status will tell whether job is completed or failed)

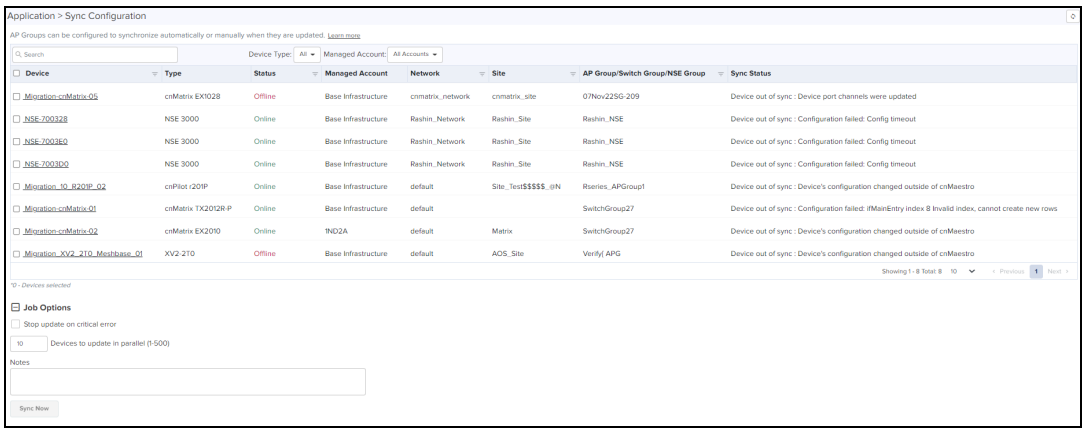
Steps to Sync Configuration:

Perform the following steps for Sync Configuration:

1. Navigate to **System** > **Configuration** > **Sync Configuration.**
2. Select the devices to synchronize and click **Sync Configuration.**



3. Click the **Sync Now**.



User can also synchronize devices from **Application** >**Sync Configuration**.

	NOTE: Sync configuration can only be used if a Switch Group is already mapped to the device.

Policy Based Automation (PBA)

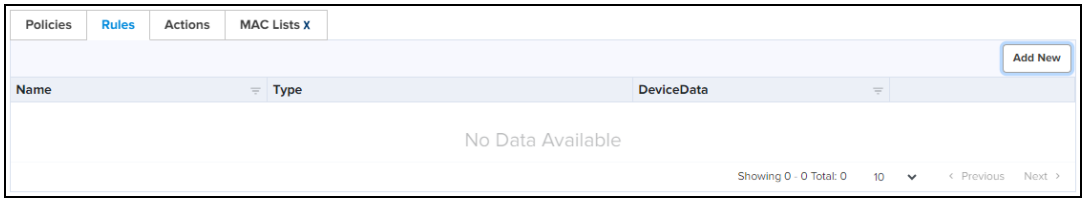
Cambium Networks PBA feature fully automates commonly performed operations, improving network security while eliminating potential configuration errors. It allows the user to automatically configure switch port settings based on the device connected to the port. These dynamic PBA settings remain in-use for the duration of the device connection and are automatically cleared when the device disconnects from the switch.

PBA configuration is common to all switches within a Switch Group.

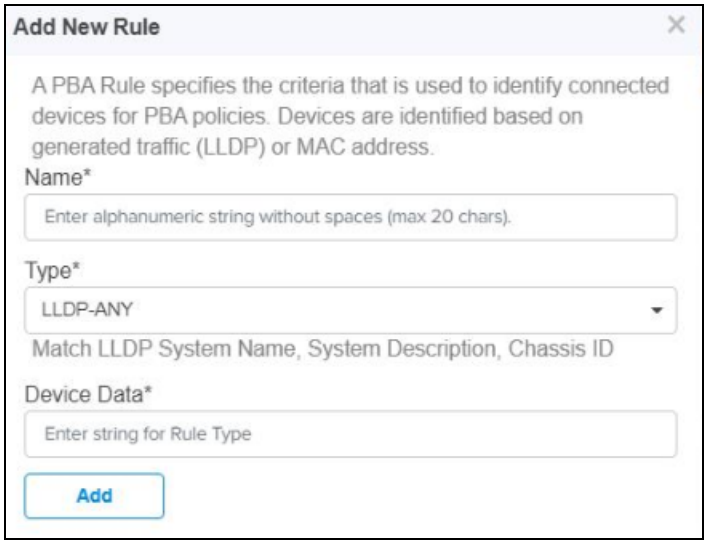
	NOTE: Dynamic PBA updates are indicated by asterisk * on the Switch Dashboard and on the Switch Ports pages.

Configure the PBA as follows:

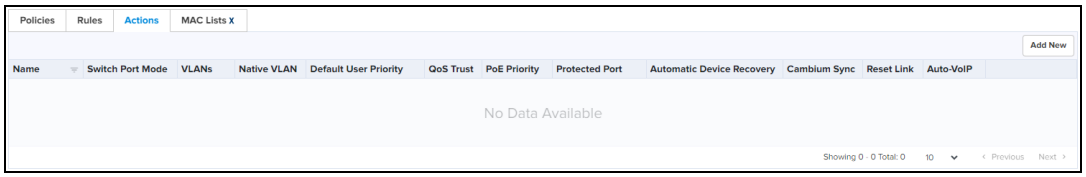
1. Navigate to **Switch Groups > Configuration > Network > Policy Based Automation.**
2. Navigate to **Rules** tab.



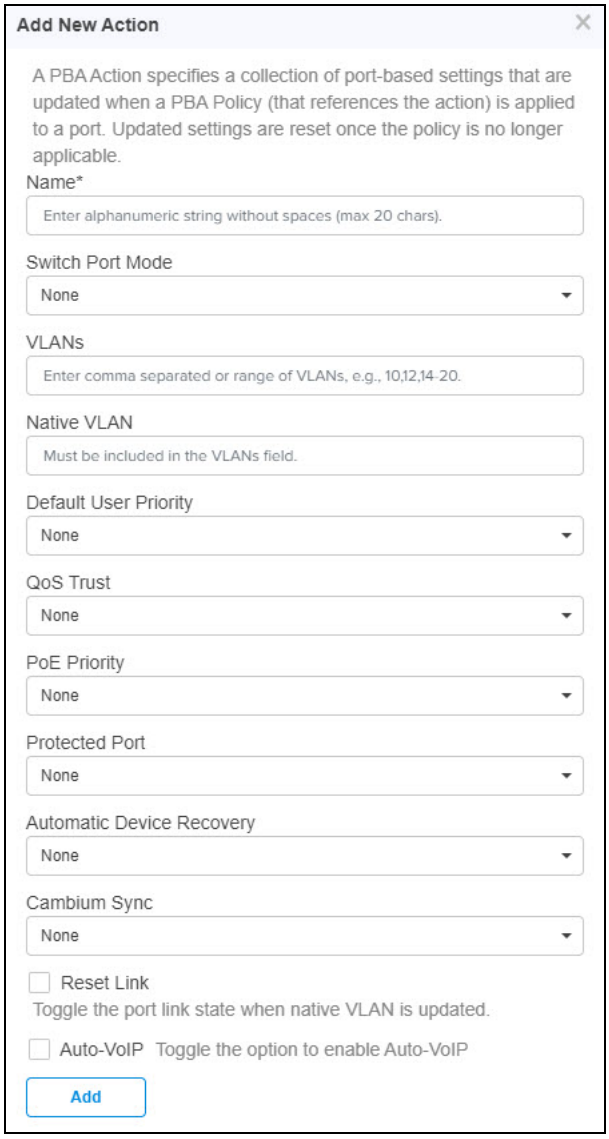
3. Click **Add New** to set the rules.



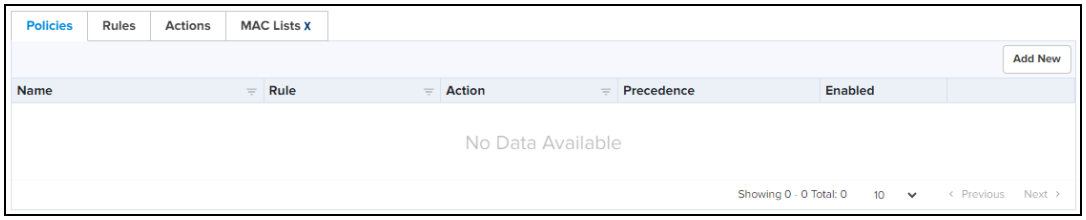
4. Click **Add**.
5. Navigate to **Actions** tab.



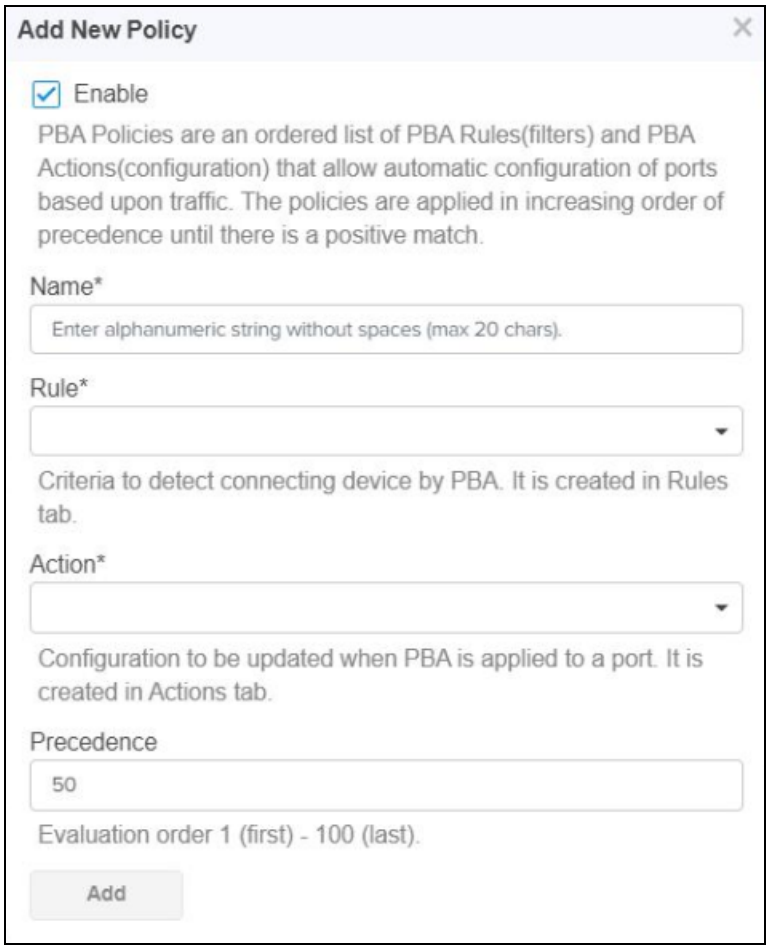
6. Click **Add New** to set the actions.

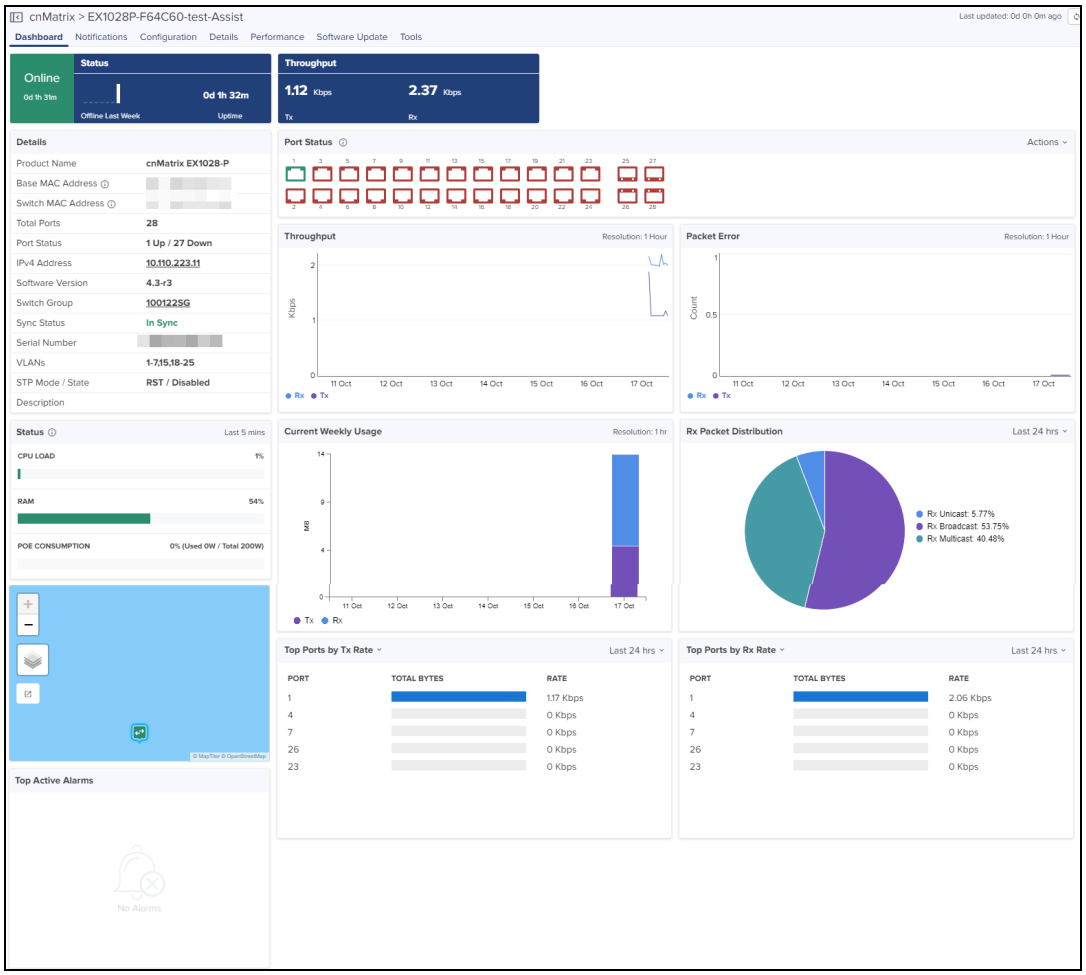


7. Click **Add**.
8. Navigate to **Policies.**



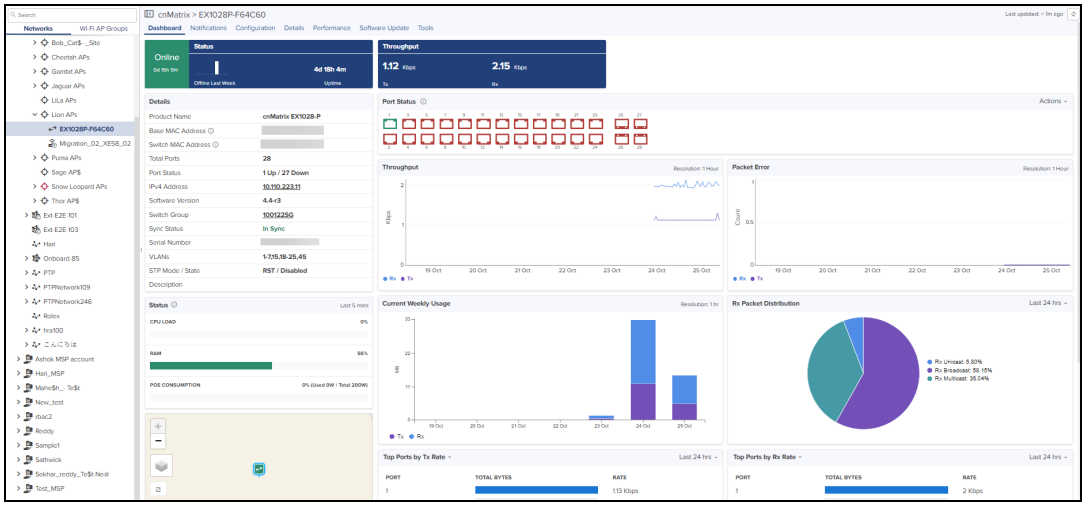
9. Click **Add New** to set the policies.


Add New Policy
Enable
PBA Policies are an ordered list of PBA Rules(filters) and PBA Actions(configuration) that allow automatic configuration of ports based upon traffic. The policies are applied in increasing order of precedence until there is a positive match.
Name*
Enter alphanumeric string without spaces (max 20 chars).
Rule*
Criteria to detect connecting device by PBA. It is created in Rules tab.
Action*
Configuration to be updated when PBA is applied to a port. It is created in Actions tab.
Precedence
50
Evaluation order 1 (first) - 100 (last).
Add



In cnMatrix dashboard page, user can navigate to the following pages using **Action** drop-down menu in Port Status

- Port Configuration
- Port Statistics
- Topology
- Remote CLI
- Port Operations



Switches

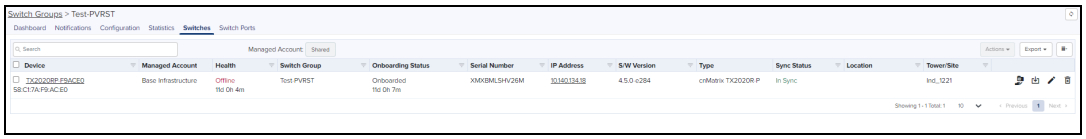
The Switches page is accessed by selecting the **Switch Groups > Switches** tab lists all of the physical switches assigned to the Switch Group. The Switch Dashboard and switch override configurations settings are accessible through this page.

Switch overrides allows certain attributes for each switch to be configured individually.

	NOTE: For configuration, a switch must belong to a Switch Group.

Configure the Switch Group as follows:

- Navigate to **Switch Groups >** select the switch from the list **and** click **Switches** page to view and edit the onboarded switches.

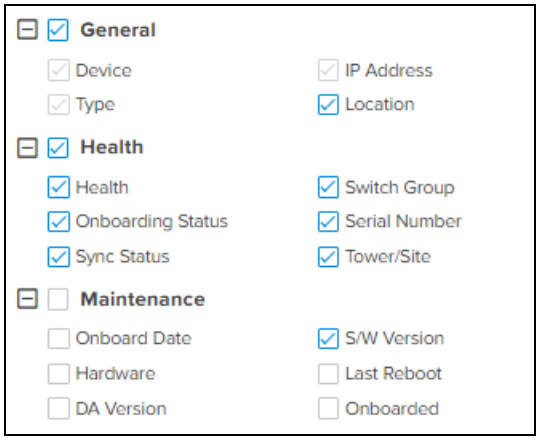


The Switches details view displays following fields by default:

- Device, Health, Onboarding Status, Serial Number, IP Address, Switch Group, Type, Site, and Action tab.

Action column can be used to edit or delete any device of the Switches.

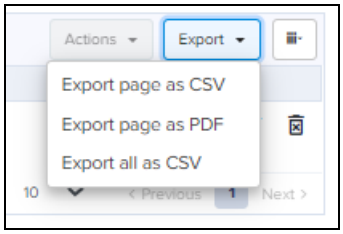
User can click on top bar to include additional fields in Switches Detail view.



Export Switches

Perform the following steps to export the Switch table:

1. Click **Export**. A dialogue box appears.

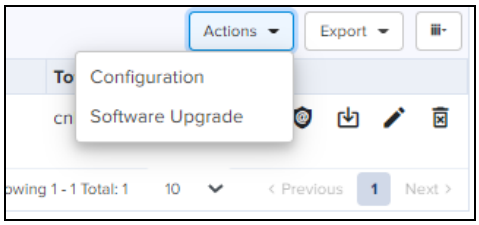


2. Select **Export page as CSV/PDF/all as CSV** and export the file.

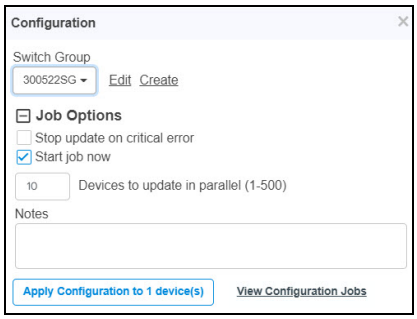
Action

Action column can be used to edit or delete any device of the Switches.

1. Click **Action**. A dialogue box appears.



2. Select Configuration to edit the device details or click Edit icon .



3. Select Software Upgrade to update the device software or click .

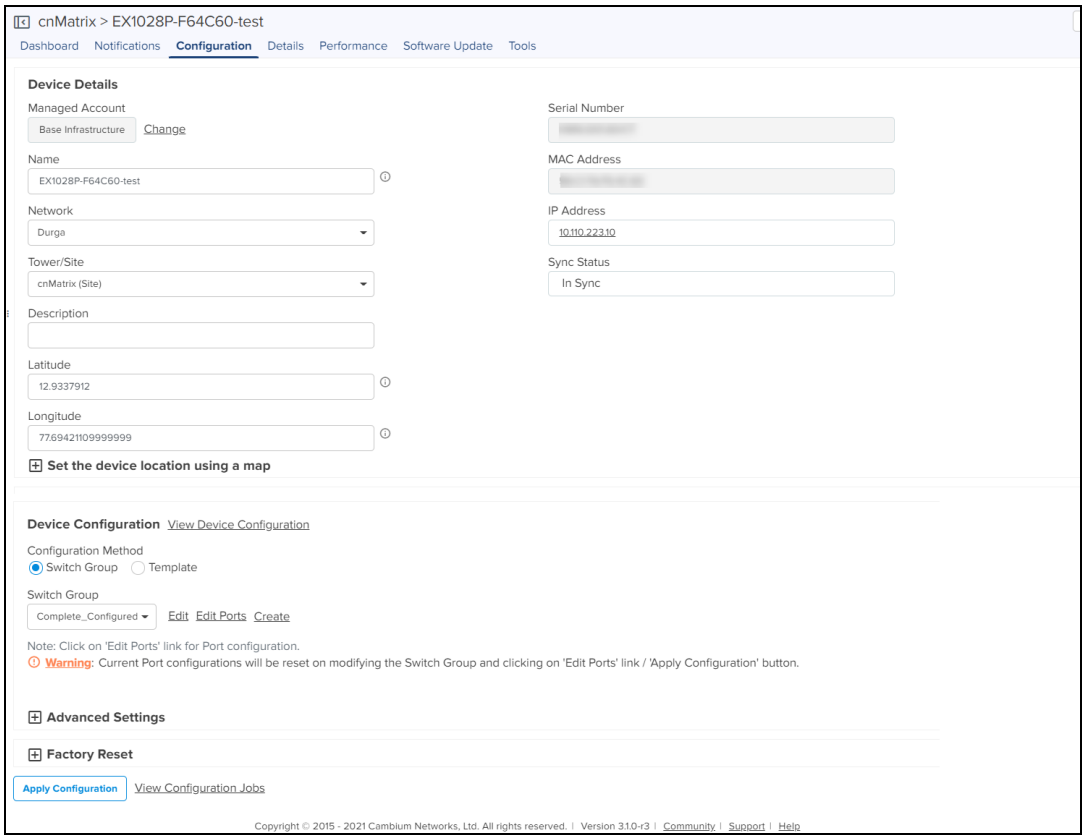
4. Click to delete the selected device from the list.

Switch Configuration

To edit or configure the switches, click the **Edit** or **Configuration** from the **Action** drop-down.

Navigates to the Device **Configuration** page.

1. Enter the **Device Details, Set the service location** and **Device Configuration.**



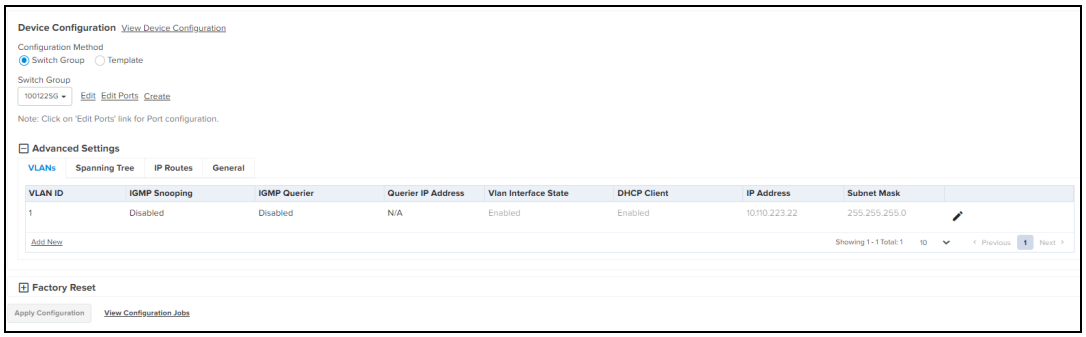
2. Click **Apply Configuration**.

Device Configuration

Device Configuration allows you to configure the Configuration Method as Switch Group/Template.

Switch Group Configuration Method

Enable the Switch Group and select a device from the Switch Group drop-down.



To Edit or Create a Switch Group. Refer to the Switch Groups Configuration.

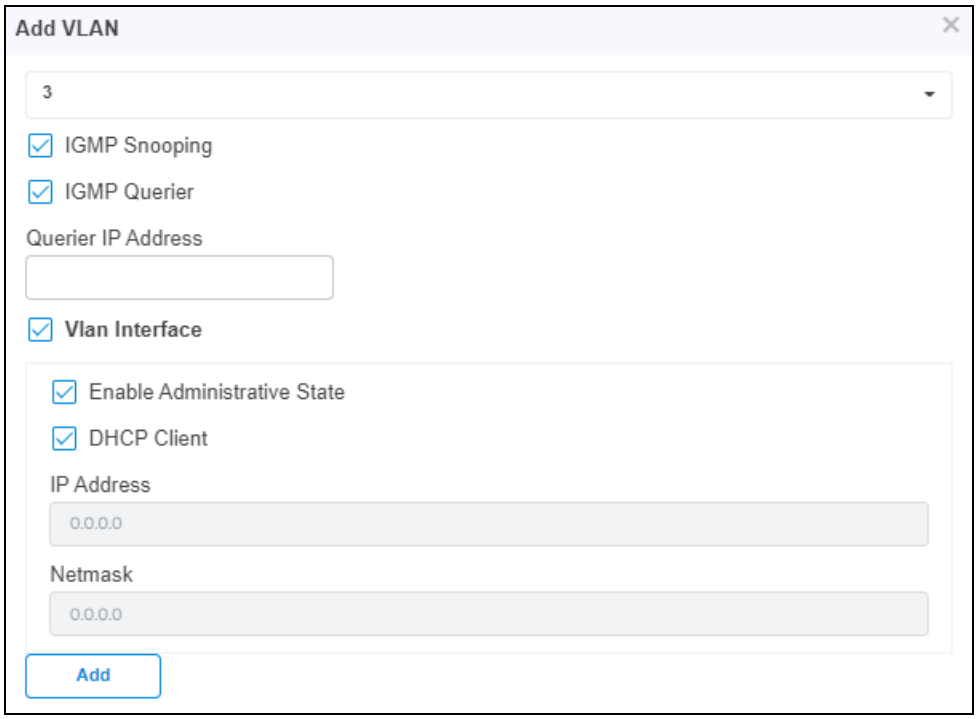
Navigate to the Advanced Settings and configure the following parameters:

VLAN Interface

VLAN Interface allows the user to edit/Add the VLAN details such as **VLAN ID, DHCP Client, IP Address**, and **Subnet Mask.**

- Click **Advanced Settings** in **Configuration** page and navigate to **VLAN Interface** tab.

- Click Edit Icon or Add New.
- Enter the required details and click **Add**



Switch Group Configuration Method

Spanning Tree

Certain configuration parameters are different for each Switch, and these are highlighted within cnMaestro as Overrides.

Configure the spanning tree to override as follows:

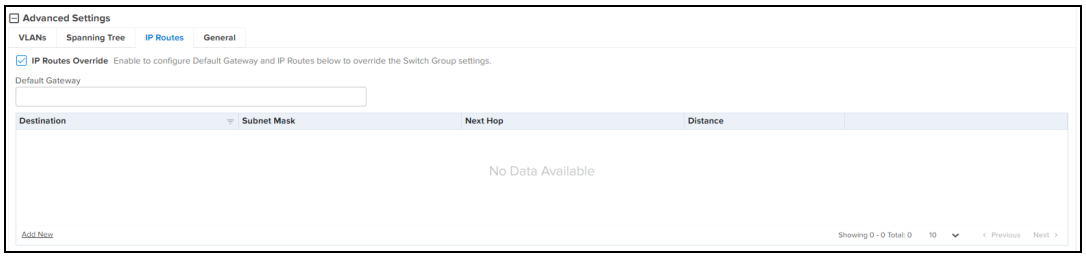
- Click **Advanced Settings** in **Configuration** page and navigate to **General** tab.
- Click **Enable Spanning Tree Overrides.**
- Select the **Spanning Tree** parameters.

	NOTE: If Spanning Tree is disabled the overrides feature will be disabled on the Switch configuration.

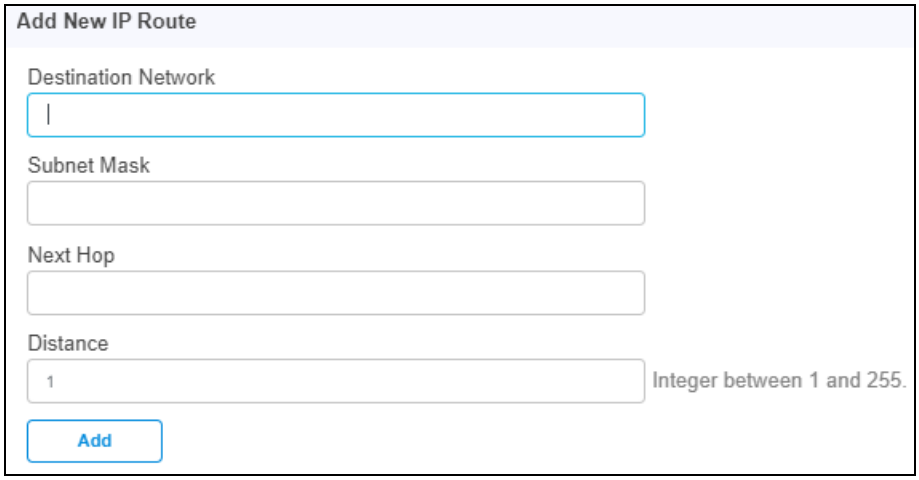
IP Routes

IP Routes allows the user to configure the Default Gateway and IP Routes to override the Switch Group.

- Configure the IP Route as follows:
- Enable the **IP Routes Override** and enter the **Default Gateway.**



- Click **Add New**.
- Enter the parameters such as Destination Network, Subnet Mask, Next Hop, and Distance.
- Click **Add.**



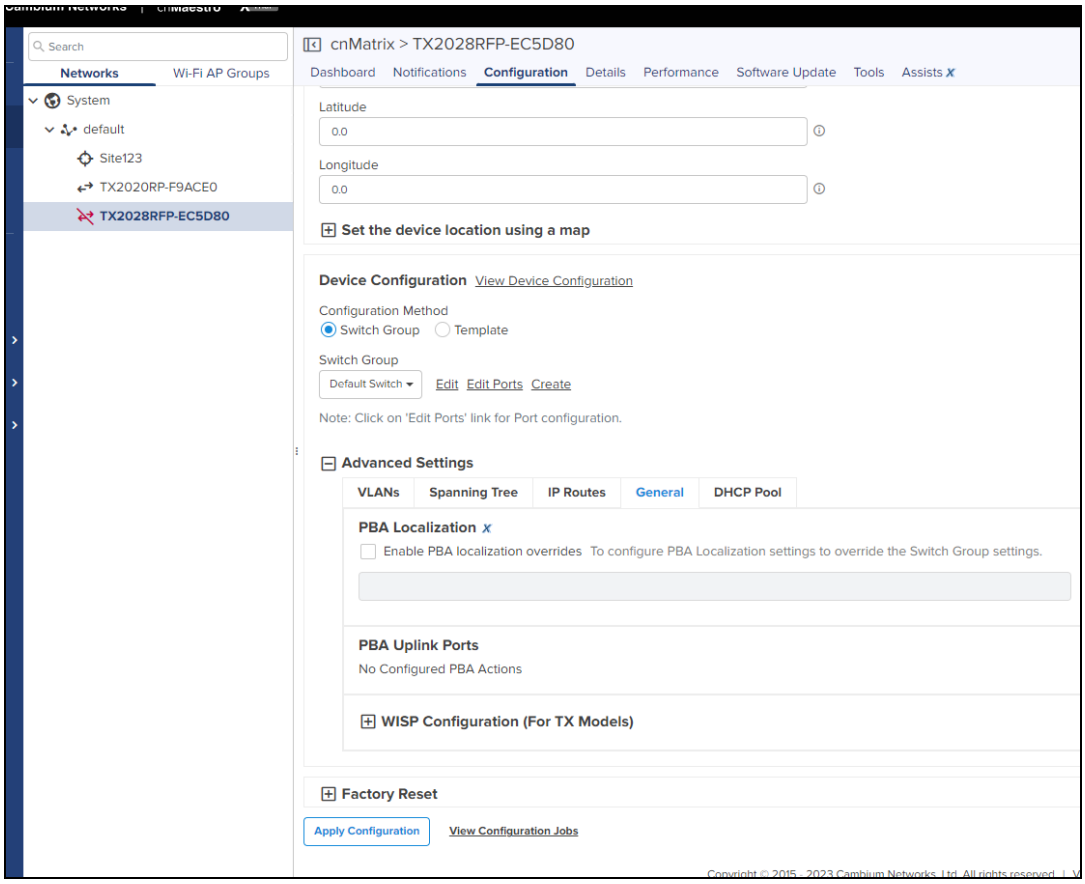
Default gateway IP will override the all IPs of the Switch Groups.

General

General tabs allows to configure PBA Localization settings to override the Switch Group settings.

To configure the PBA Localization perform as follows:

- Click**Advanced Settings** in **Configuration** page and navigate to **General** tab.



- Enable **PBA localization** overrides.
- Select **Use Site Name** or **Custom**.
- Enter **PBA Uplink Ports**.

Switch Ports

The **Switch Ports** table displays the list of Ports and the Port Channel assigned to the specific switch. The **Switch Ports** table allows administrators to configure the port settings by port ID for all ports within the **Switch Group**. By default, a port ID identifies the switch (by switch name) and port number.

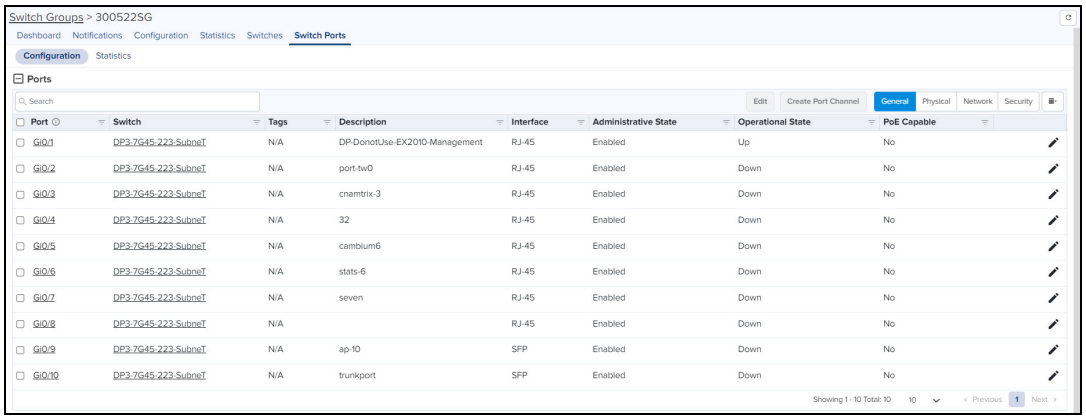
For example: Gi0/1

It supports bulk editing of Switch Port settings across all physical switches.

To view the **Switch Ports**, navigate to **Configuration** > **Switch Groups** > **Switch Ports**.

Ports

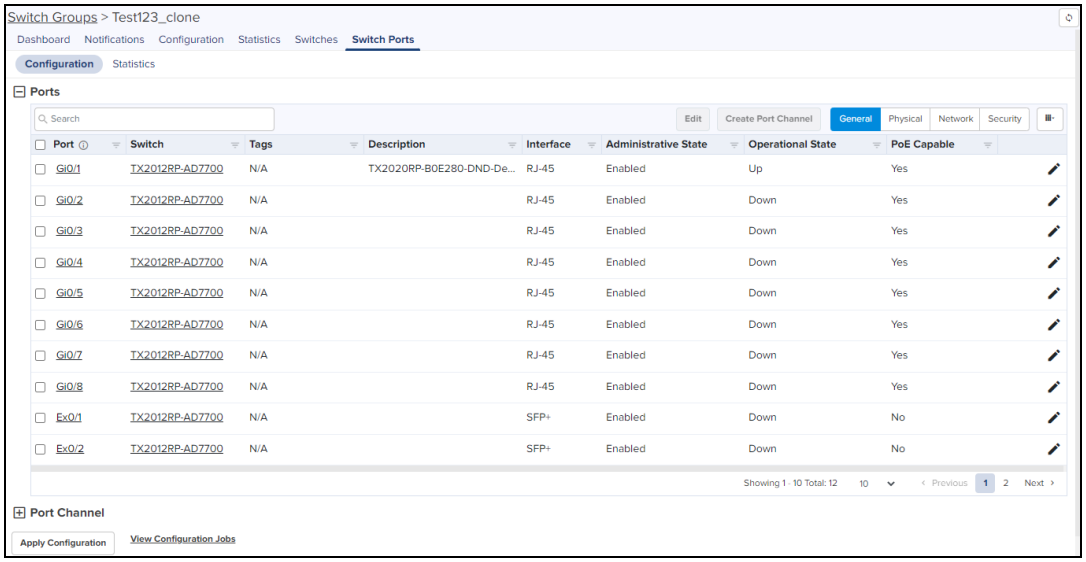
The **Ports** table supports creating port channels, editing port configuration and configuring port parameters.



Navigate to **Switch Ports** > **Configuration** tab, configure the following parameters:

- General
- Physical
- Network
- Security

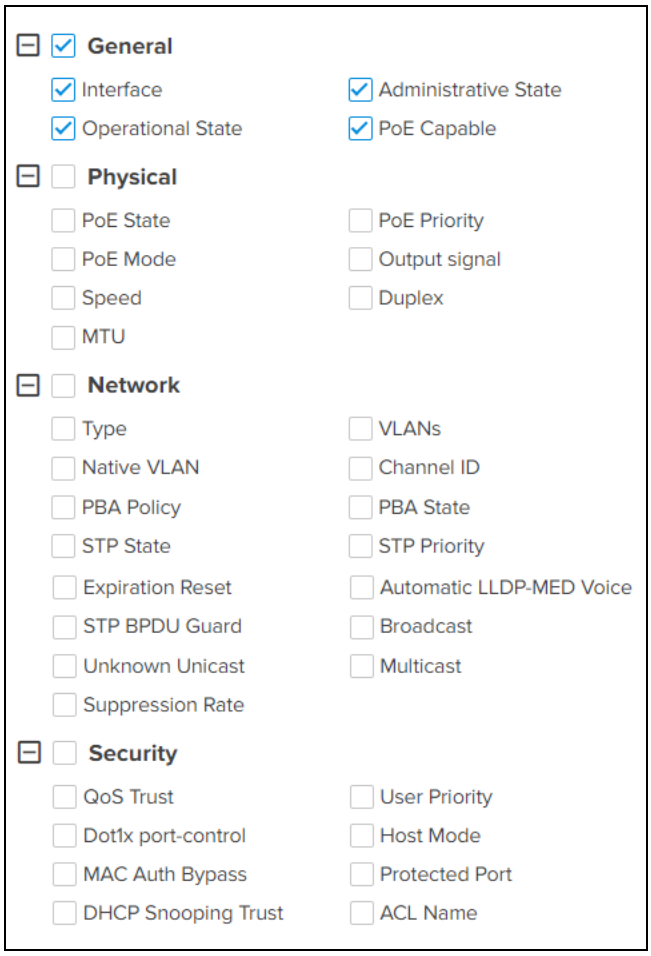
General Tab



The **Ports** General details view displays following fields by default:

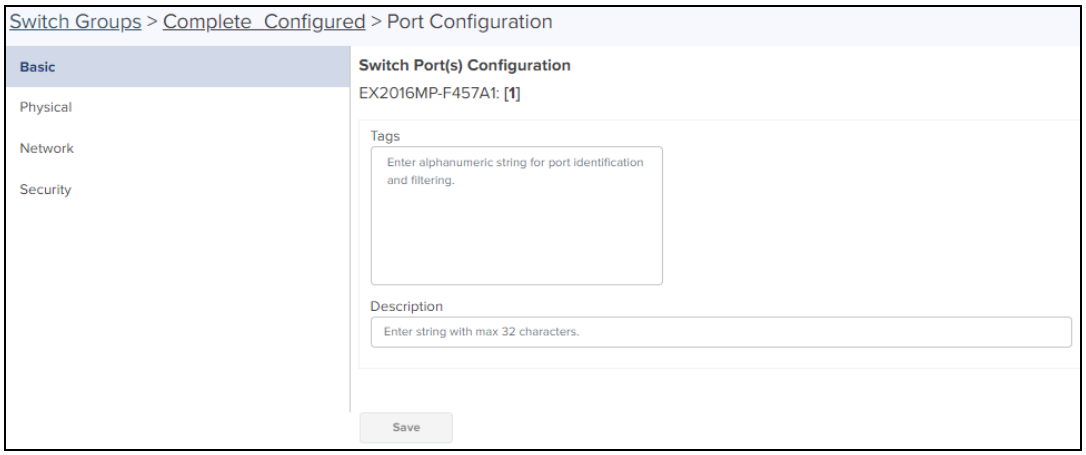
- Port, Tags, Description, Interface, Administrative State, Operational State, PoE Capable, and Edit.
- Click on **Apply Configuration** whenever you are sure to apply the modified configuration, preferably after all the port details are updated.

User can click on top bar to include additional fields in **Ports** General Detail view.



Click Edit icon or Port device in the list to edit the Ports Configuration General tab details.

Navigate to **Switch Groups > Switches > Port Configuration.**



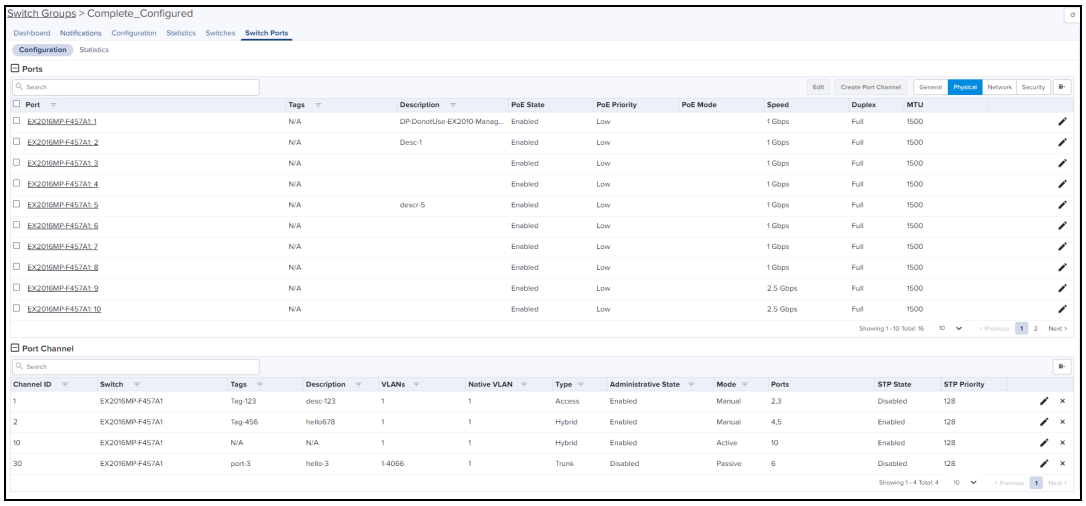
Enter the **Tags** and **Description** details and Click **Save**.

	NOTE: After modifying the port or channel details, you can apply the configuration to the device by clicking the **Apply Configuration** button at the bottom of the **Switch Ports** page.

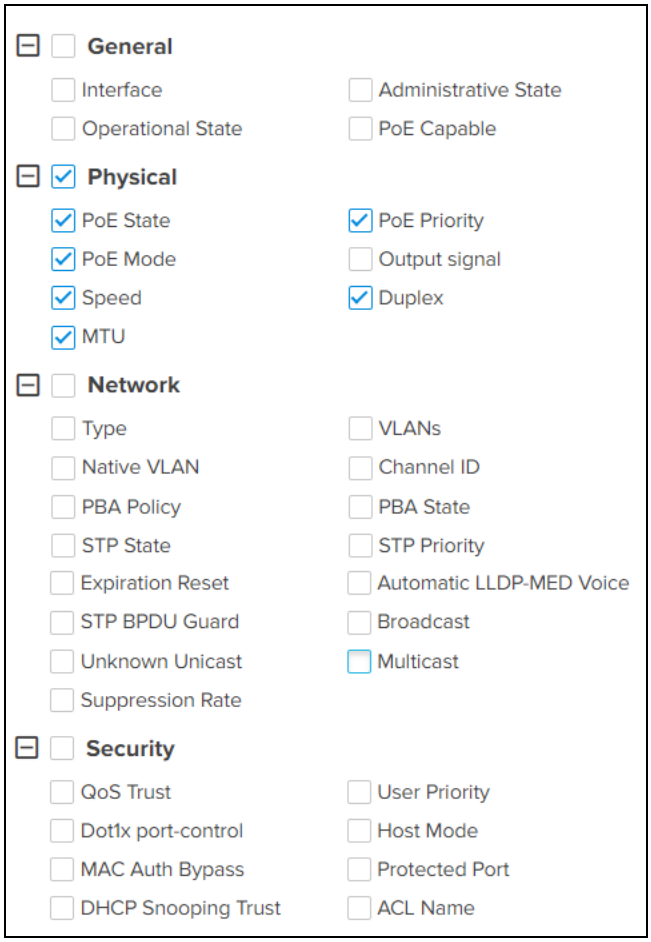
Physical Tab

The **Ports Physical** details view displays following fields by default:

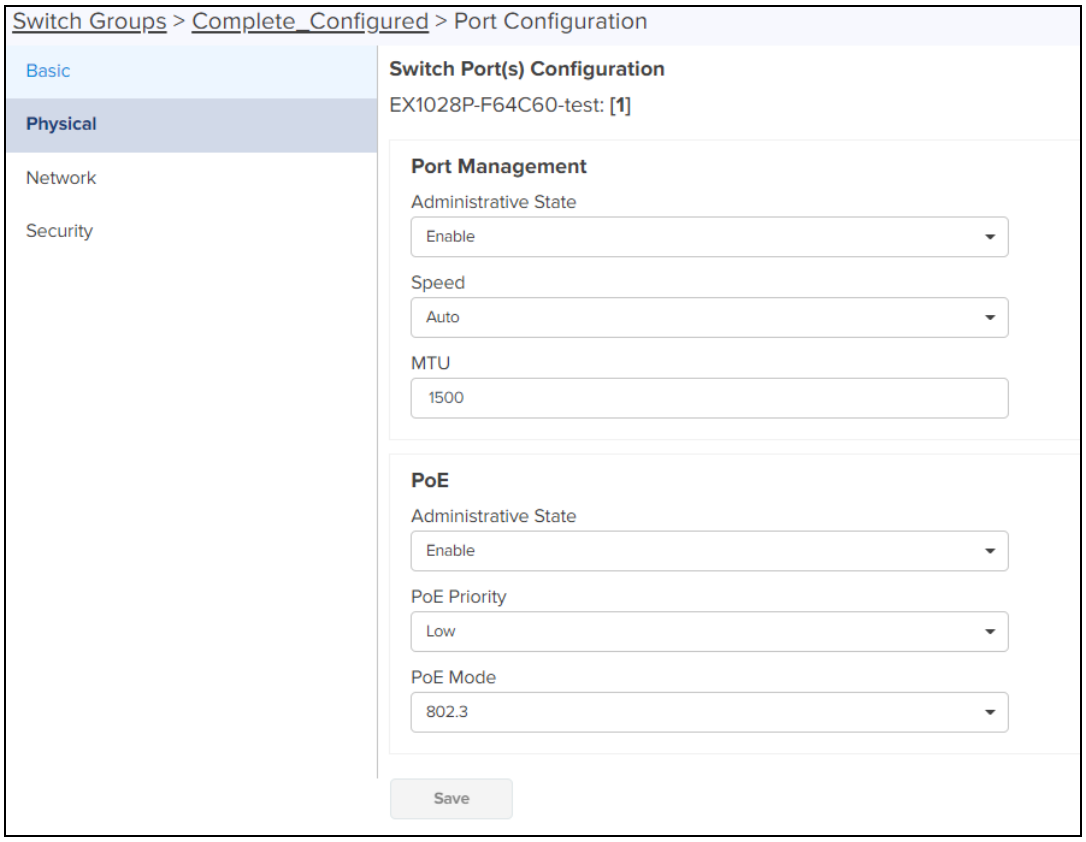
- Port, Tags, Operational State, PoE State, PoE Priority, Speed, Duplex, MTU, and Edit.



User can click on top bar to include additional fields in **Ports** Physical Detail view.



Click Edit icon or Port device in the list to edit the Ports Configuration **Physical** tab details.

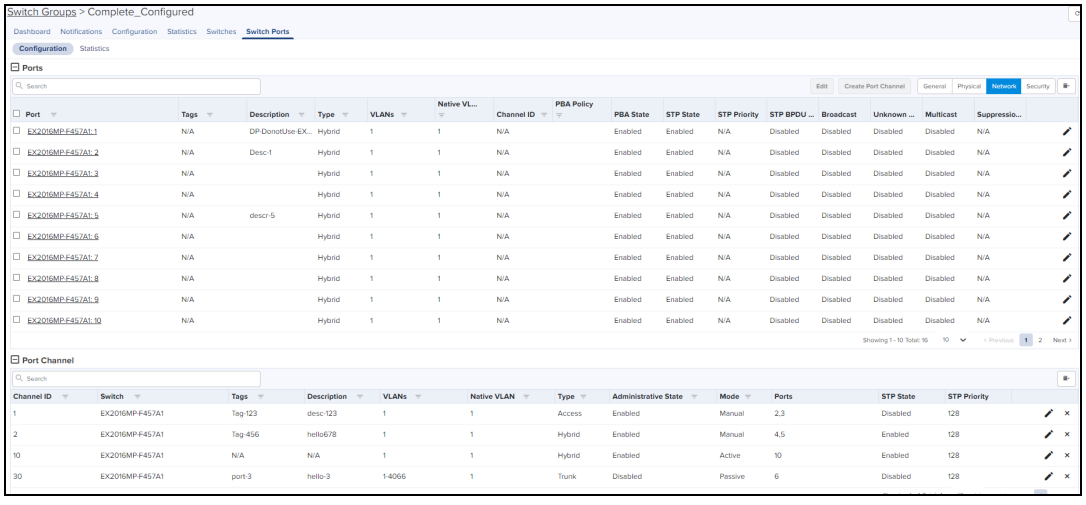


Enter the **Port Management** and **PoE details** and click **Save**.

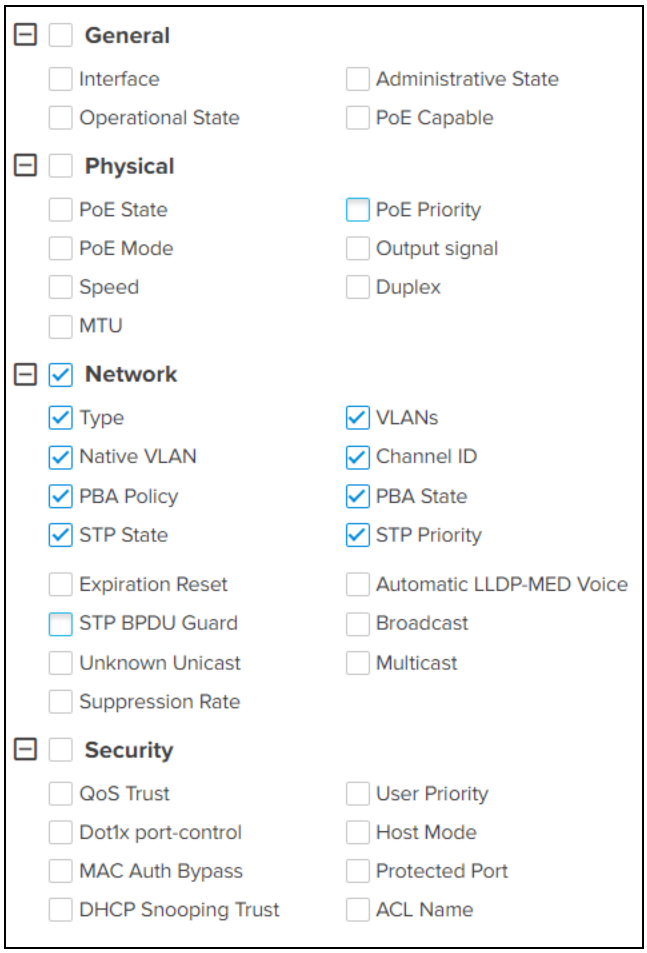
Network Tab

The **Ports Network** details view displays following fields by default:

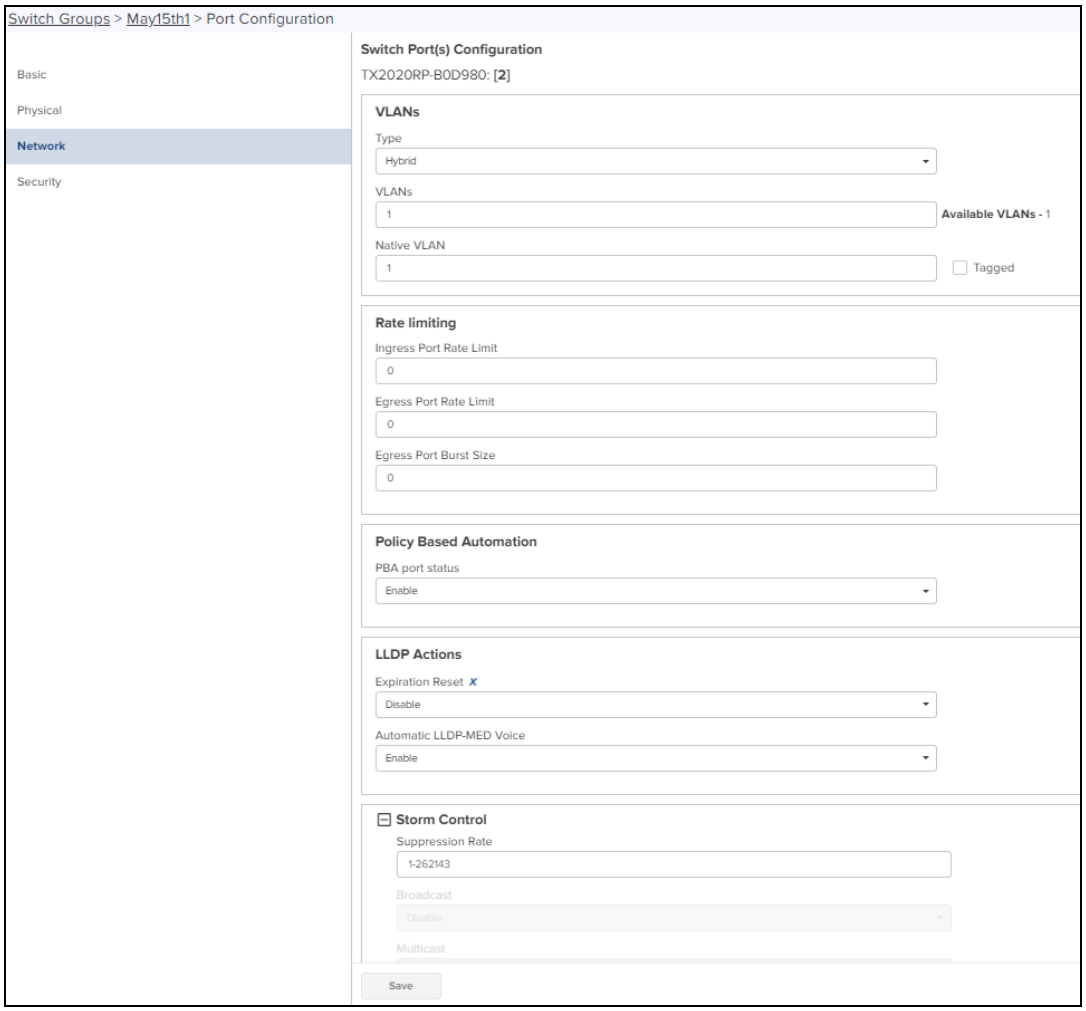
- Port, Tags, Type, VLANs, Native VLAN, Channel ID, PBA Policy, PBA State, STP State STP Priority, and Edit.



- User can click on top bar to include additional fields in **Ports** Network Detail view.



Click Edit icon or Port device in the list to edit the Ports Configuration Network tab details.



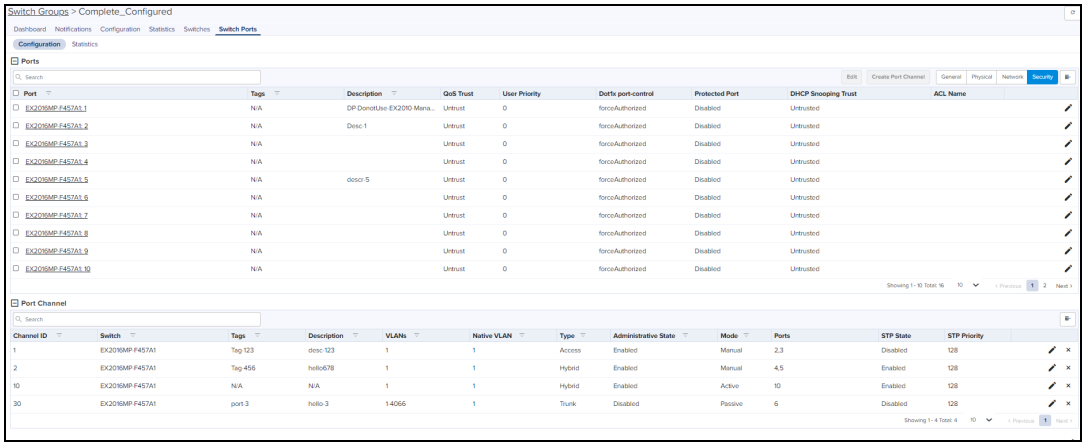
Note: LLDP Actions > Expiration Rest option is a Pro feature.

Enter **VLANs, STP, Policy Based Automation,** and **Storm Control** details and click **Save.**

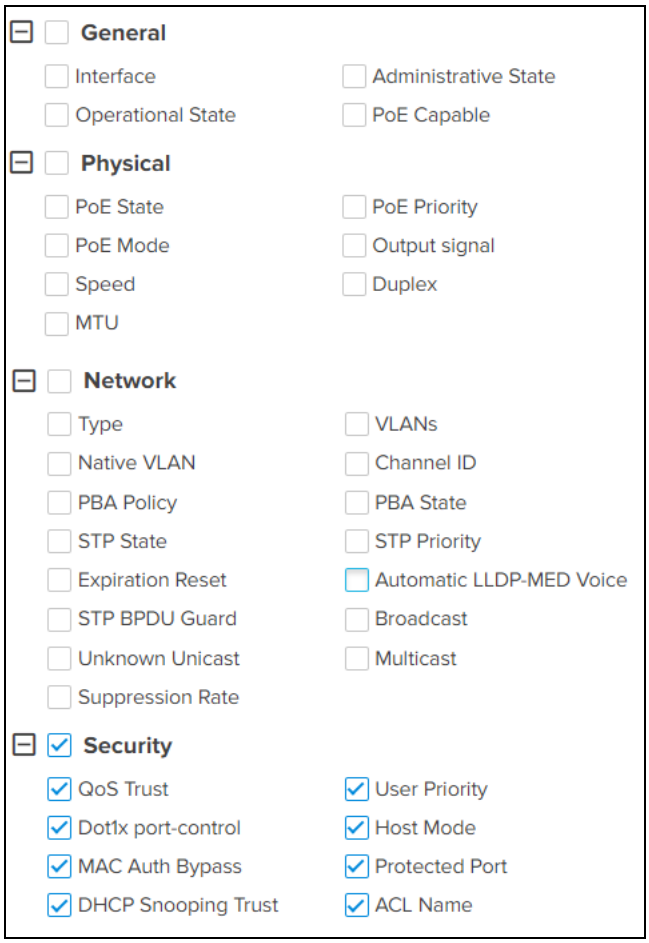
Security Tab

The **Ports Security** details view displays following fields by default:

- Port, Tags, QoS Trust, User Priority, Dot1x port-control, Protected Port, DHCP Snooping Trust, ACL Name, and Edit.



User can click ▾on top bar to include additional fields in **Ports** Security Detail view.

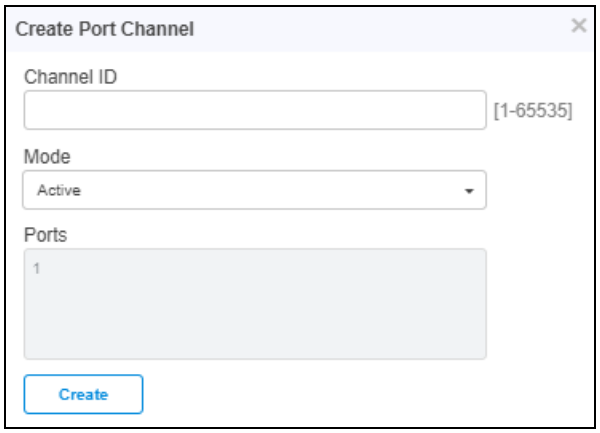


Click Edit icon or Port device in the list to edit the Ports Configuration Security tab details.

Enter **802.1xPort Control, DHCP Snooping Trusted State, QoS, Protected Port, Access Control List** details and click **Save.**

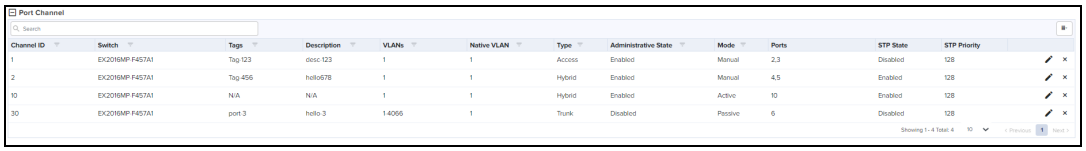
Port Channel

- To create a Port Channel, select a **Port** from the list under the specific parameters and click **Create Port Channel**.
- **Create Port Channel** window Pops-up, enter details.
- Click **Create**.

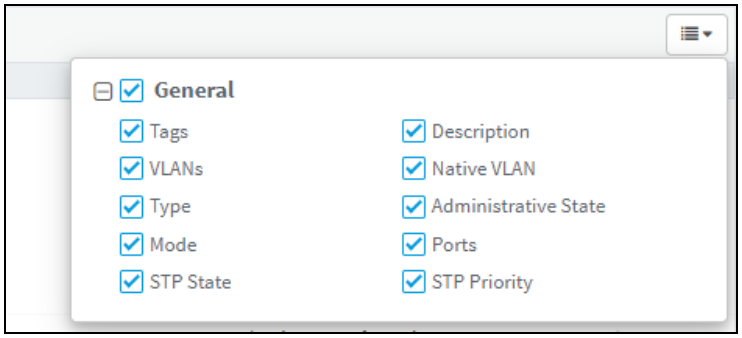


The **Port Channel** details view displays following fields by default:

- Channel ID, Switch, Tags, Description, VLANs, Native VLAN, Type, Administrative State, Mode, Ports, STP State, and STP Priority.



User can click on top bar to include additional fields in **Port Channel** Detail view.

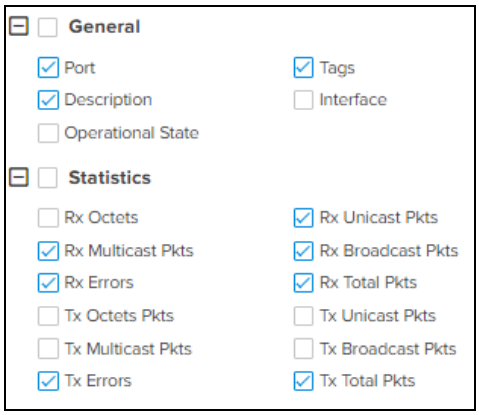


Statistics

The **Statistics** page displays the latest data and statistics of each Port. Port statistics match the Client statistics and generate the Client View.

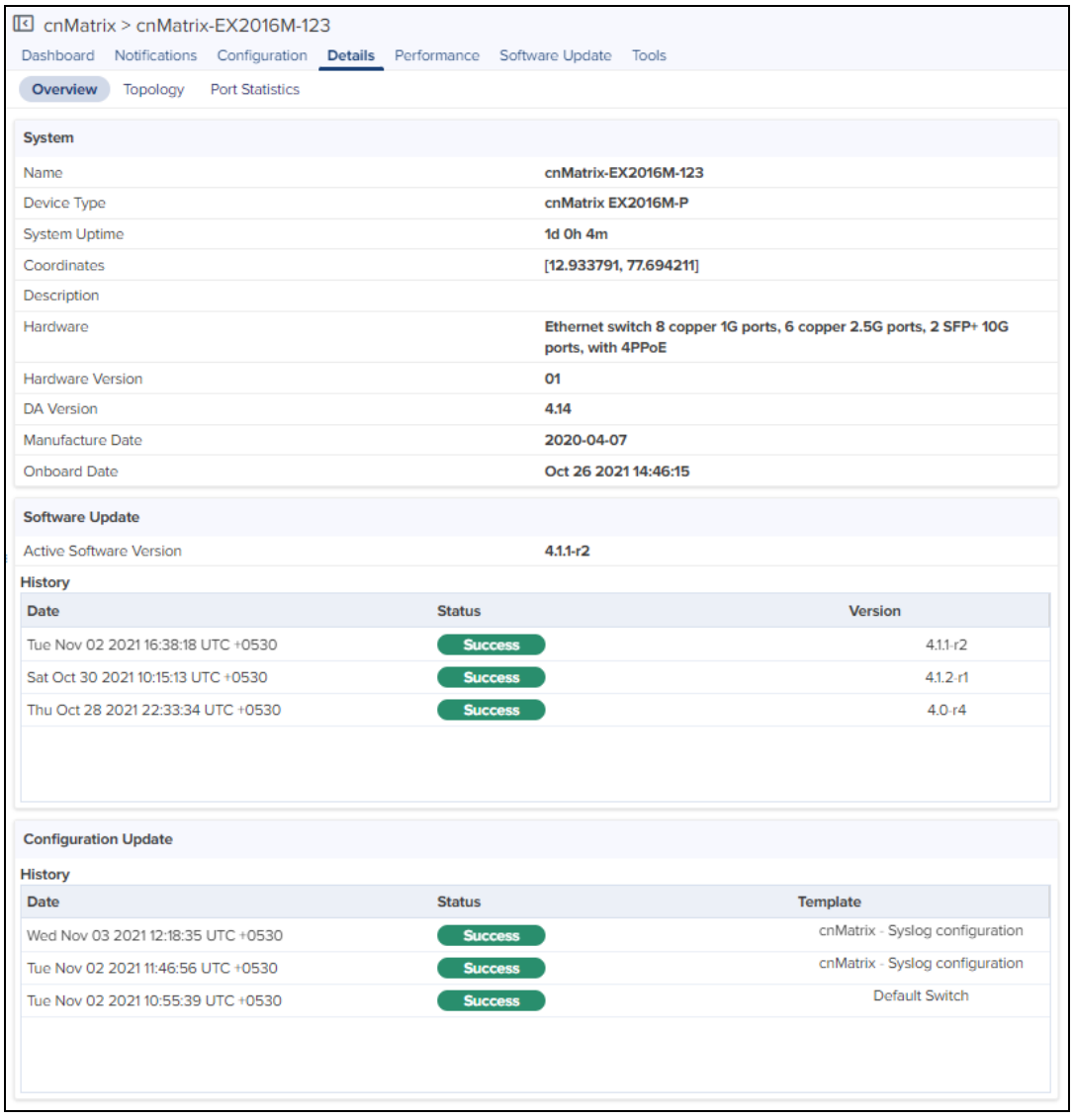
To view the Switch Ports Statics navigate to **Configuration > Switch Groups > Switch Ports > Statistics**.

User can click on top bar to include additional fields in **Statistics** Detail view.



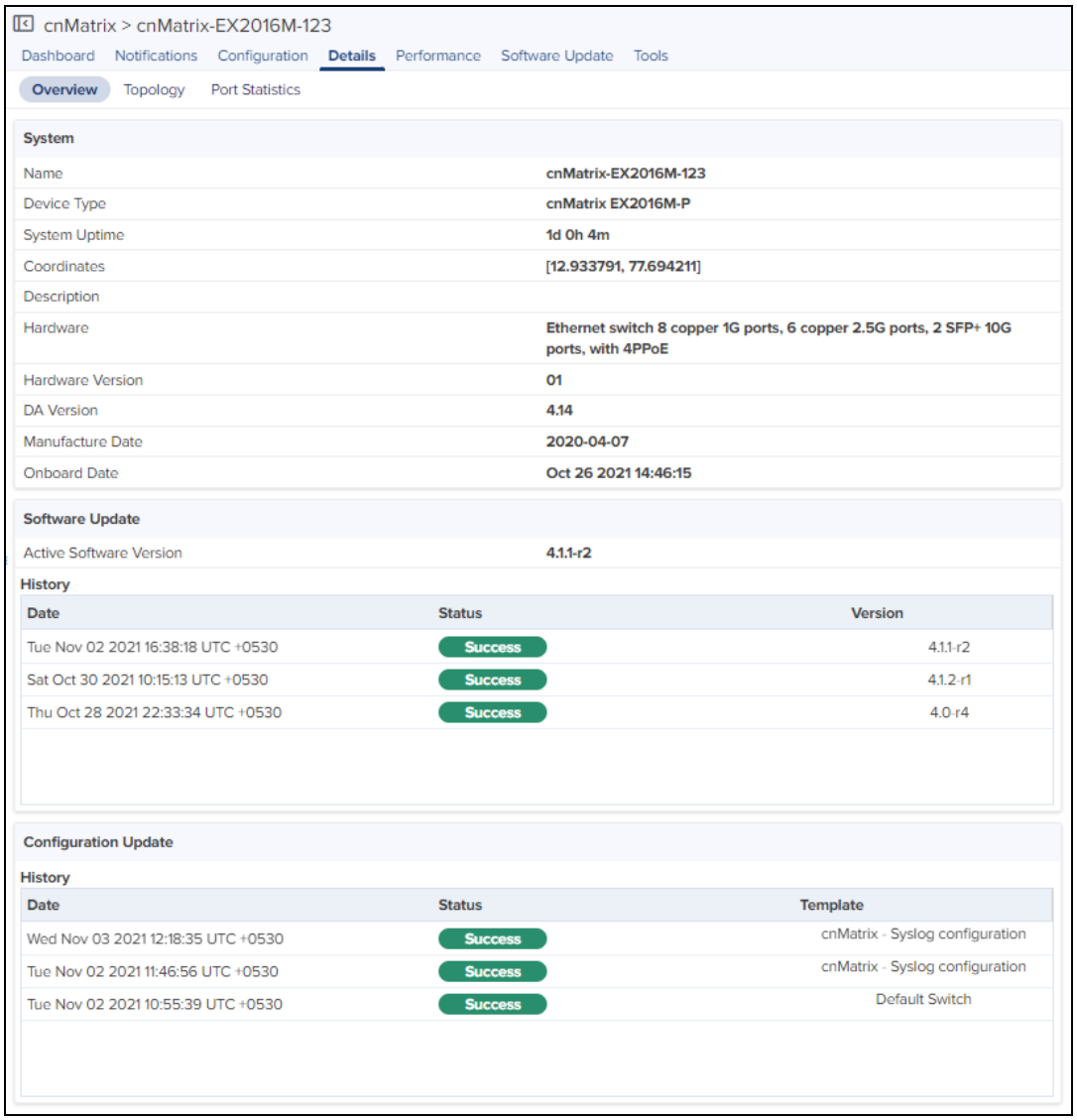
Device Details

Details page provide the information about the switches **Overview**, **Topology**, and **Port Statistics**.



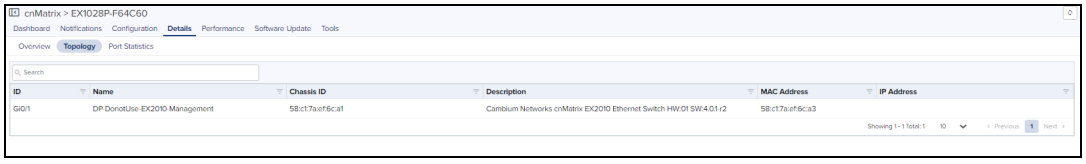
Details Overview

To view the details of the overview page, navigate to the **Details > Overview** tab.



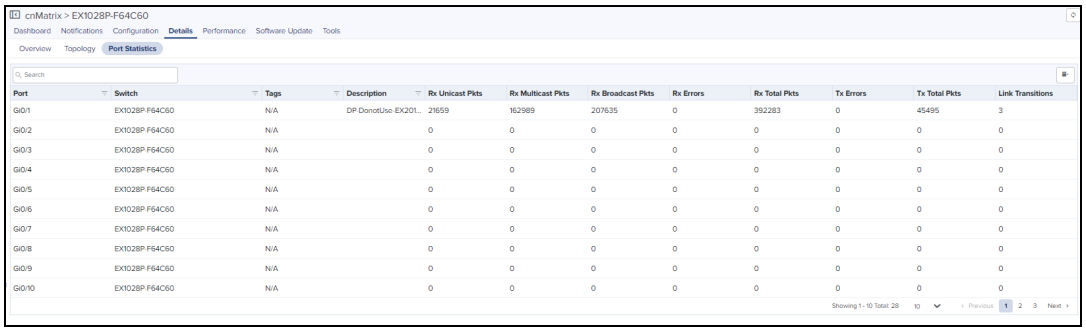
Topology

To view the details of the Topology page, navigate to the **Details > Topology** tab.



Port Statistics

To view the details of the Port Statistics page, navigate to the **Details > Port Statistics** tab.



60 GHz cnWave Network Configuration

cnWave 60 GHz operates with Cambium Networks cnMaestro management system. cnMaestro simplifies device management by offering full network visibility and zero-touch provisioning. Using cnMaestro, user can view network status and perform a full suite of wireless network management functions in real time including optimizing system availability, maximizing throughput, and meeting the emerging needs of business and residential customers.

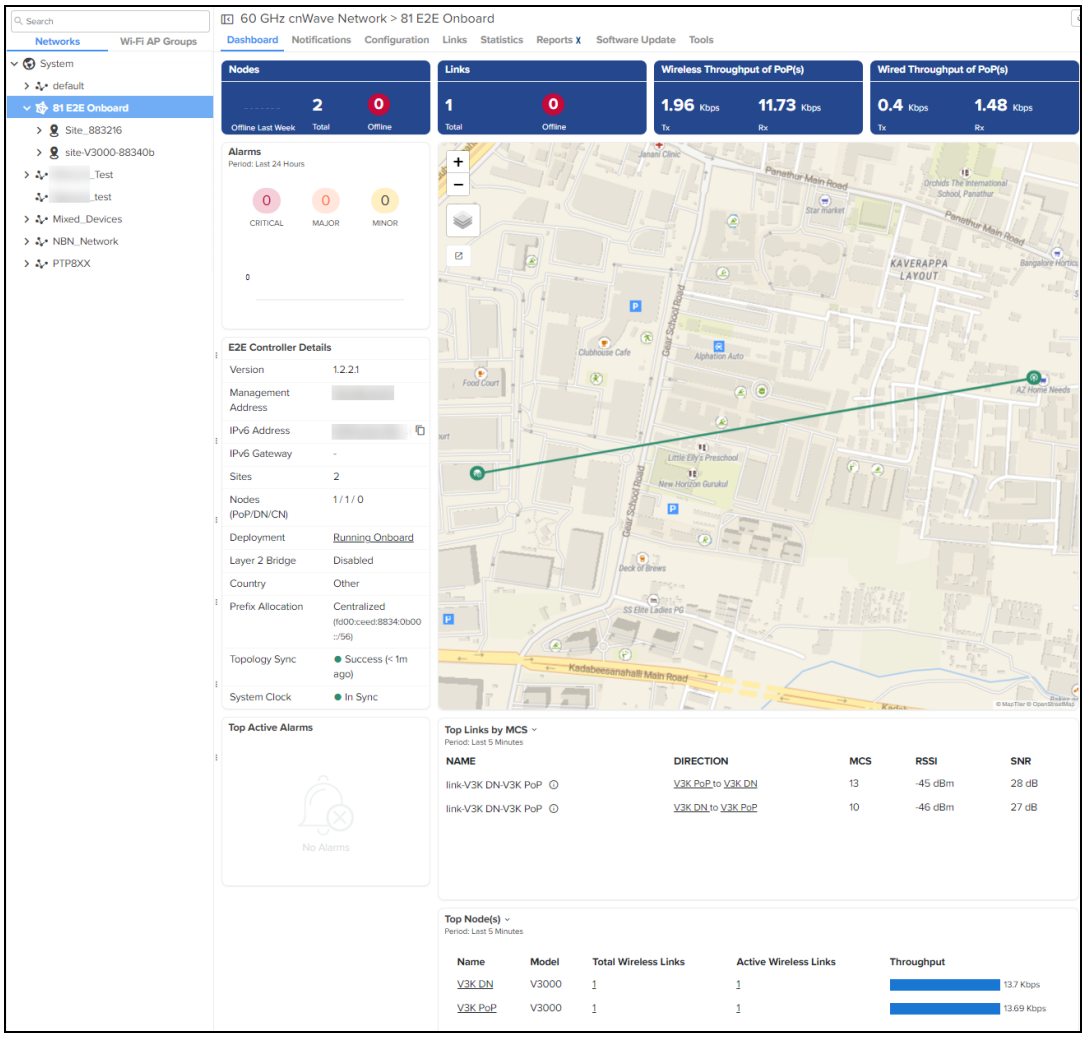
Managing E2E Network

The Monitor and Manage tab displays the monitoring panel of 60 GHz cnWave for cnMaestro. This section includes the following:

- Dashboard
- Notifications
- Configuration
- Links
- Statistics
- Software Update
- Report
- Tools

Dashboard

Dashboard pages are customized for each device type and aggregation level (such as E2E Network, Node, and Site). The dashboard section displays the **Nodes, Links, Wireless Throughput of PoP(s), Wired Throughput of PoP(s), Alarms, E2E Controller Details, Top Active Alarms, Map, Top Links by MCS, Top Links by RSSI, Top Links by SNR, Top Node(s) Top PoP(s), Top DN(s),** and **Top CN(s).**

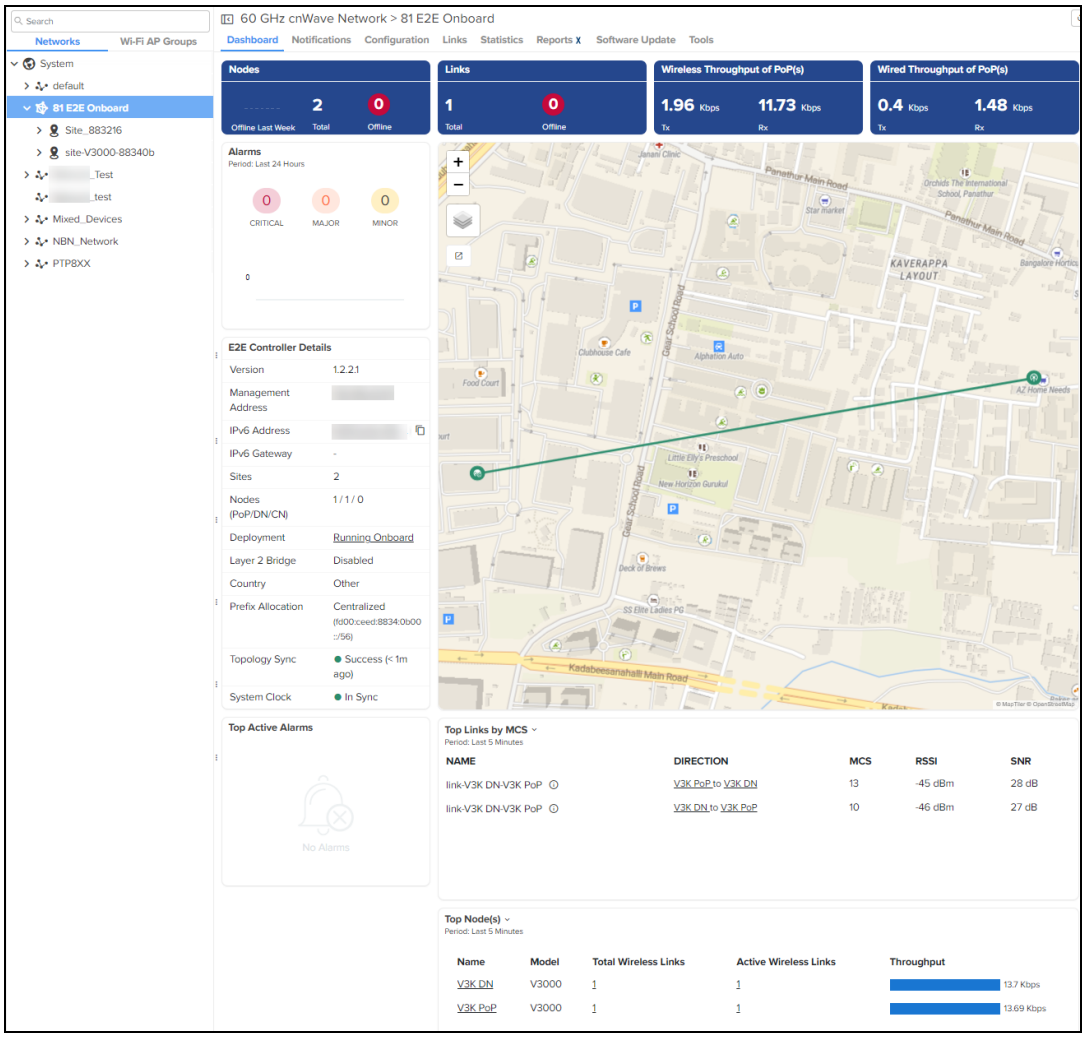


	NOTE: Backup CN links are not shown as Offline links in links widget.

Auto Manage IPv6 Routes (E2E Controller↔ Node)

The **External E2E Network**. dashboard page displays the **Auto Manage IPv6 Routes (E2E Controller ↔ Node)** tab, if you enable **Auto Manage Routes** in the **Tools > Settings** page of **External E2E Network**.

This feature automates IPv6 routes for DNs and CNs based on status of the topology and PoP nodes. It is applicable only if PoP nodes and E2E Controller are in the same Network or containing the same prefix length.

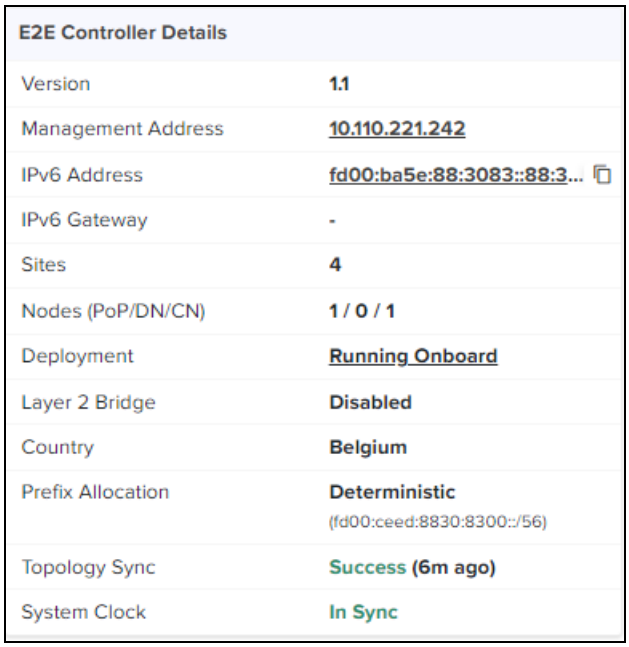


	NOTE: Auto Manage IPv6 Routes is not applicable for Onboard E2E Controller.

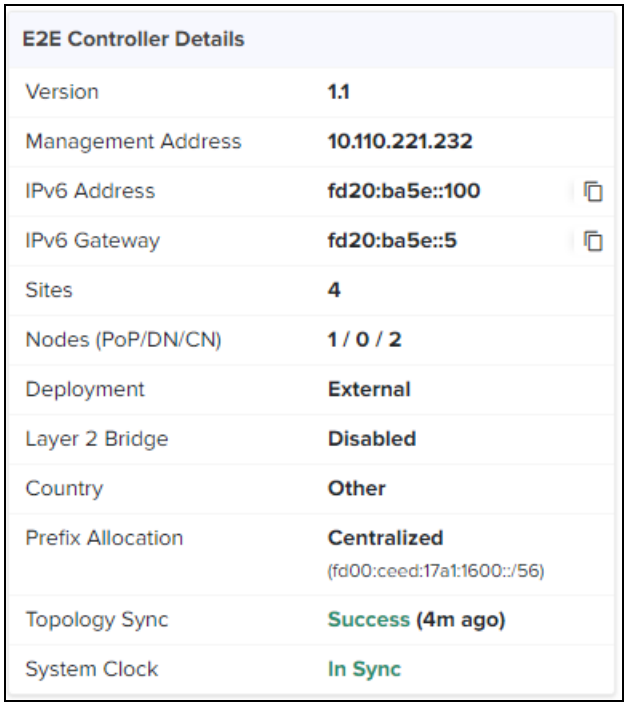
E2E Controller Details

E2E Controller Details displays the details such as **Version**, **Management Address, IPv6 Address, IPv6 Gateway, Sites, Nodes, (PoP/DN/CN), Deployment, Layer 2 Bridge, Country, Prefix Allocation, Topology Sync,** and **System Clock**

- If Onboard E2E controller is enabled in device and managed by cnMaestro, it displays deployment as **Running Onboard.**

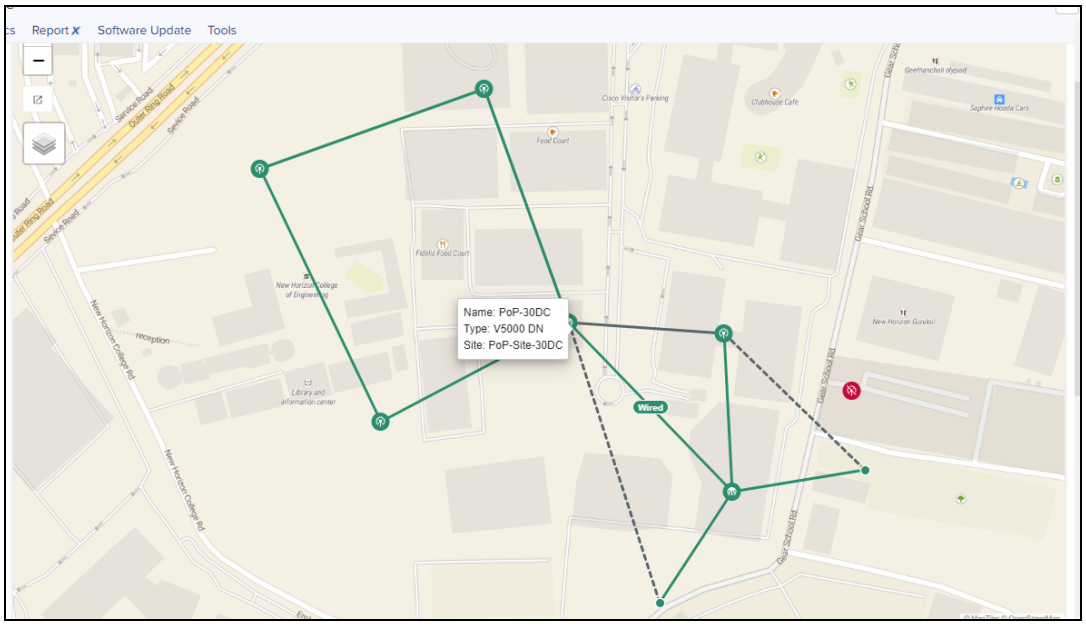


- If External E2E controller is managed by cnMaestro, it displays deployment as **External.**

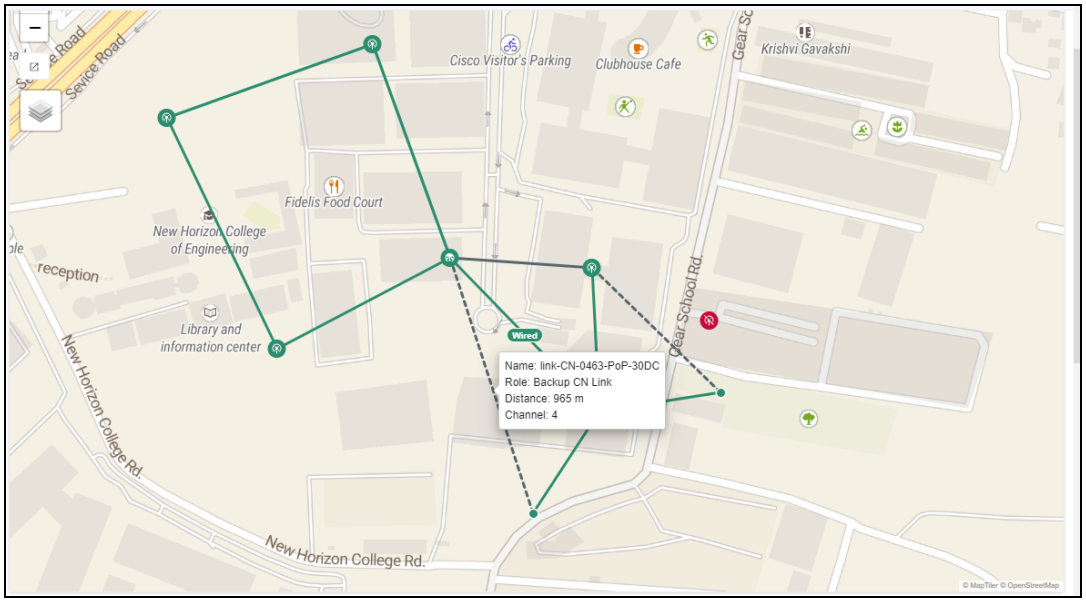


Dashboard Maps

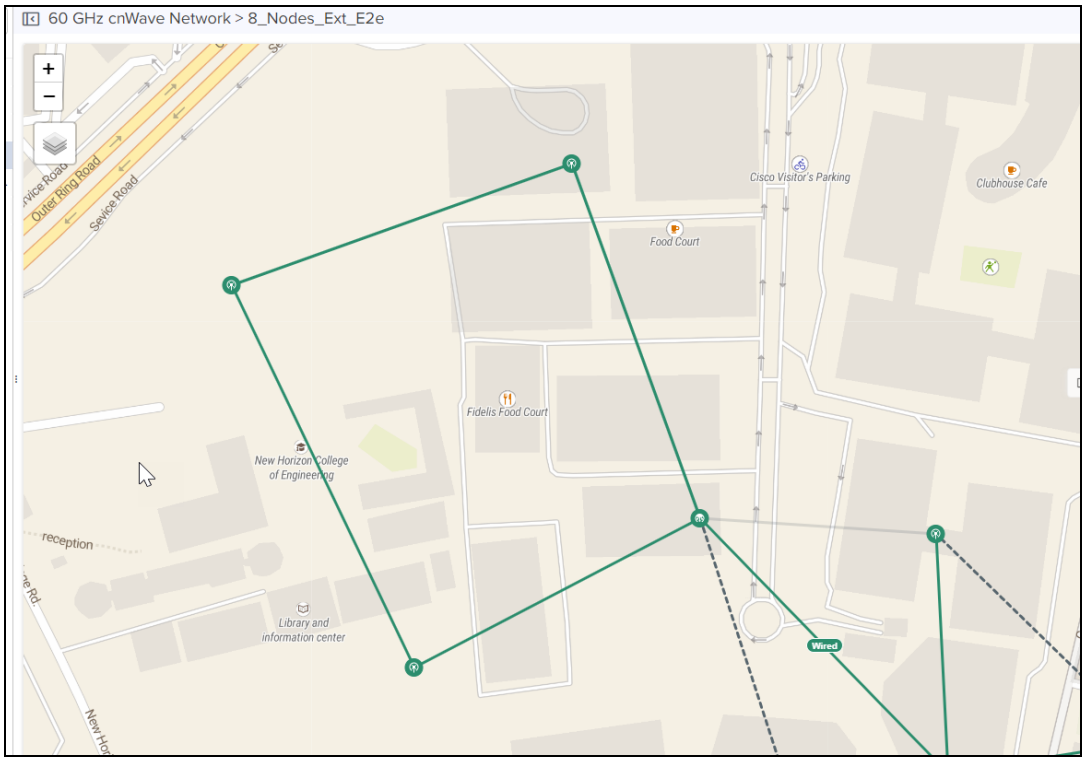
In the dashboard map, when user hovers on particular **PoP, DN** or **CN** it pops-up the device details. When user hovers on particular link it pops up the link details.



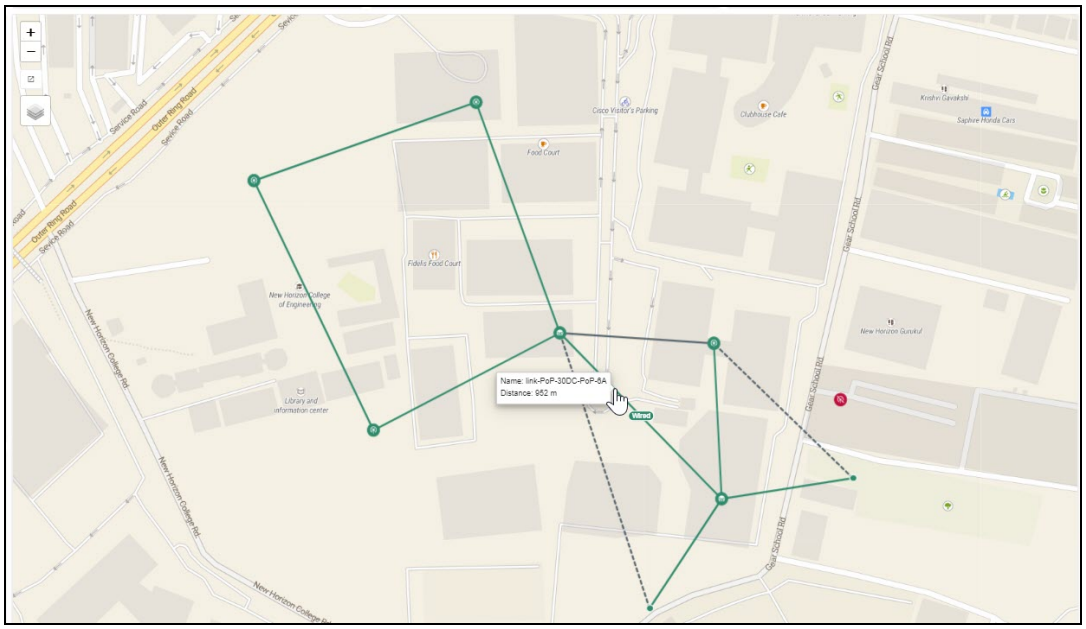
- Dotted line displays the Backup CN link between the DN and CN..



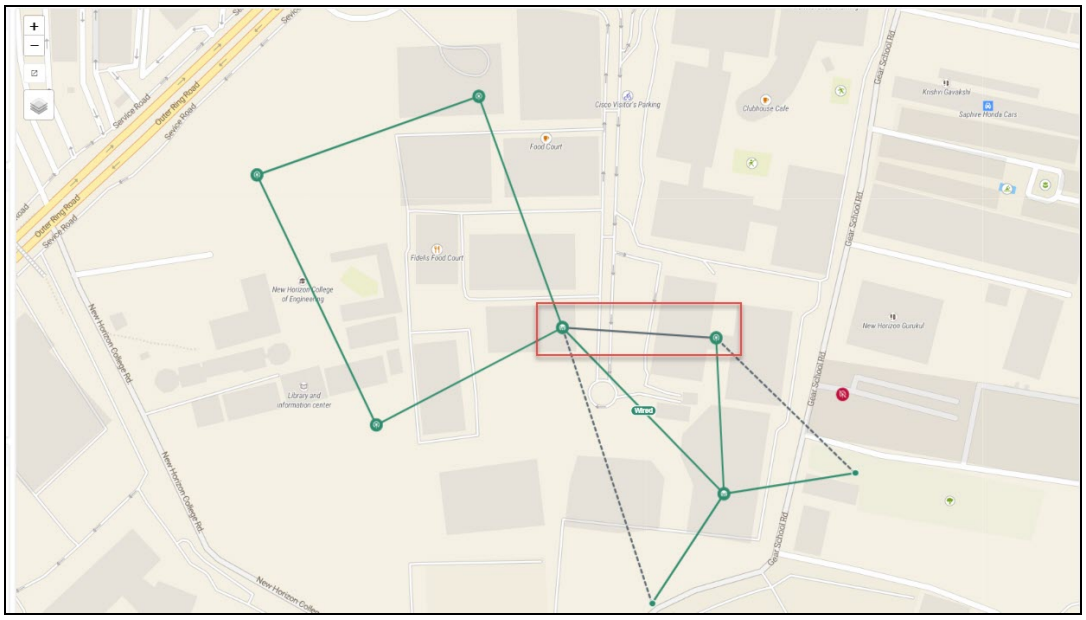
- Continuous line display the wireless link between PoP, DN, or CN..



- Continuous line with **Wired** tag displays the wired link between PoP, DN, or CN.



- Continuous line with gray color displays the **Disabled Ignition** link.



Notifications

Notifications are same as shown above for other devices, refer to Notification for more details.

Configuration

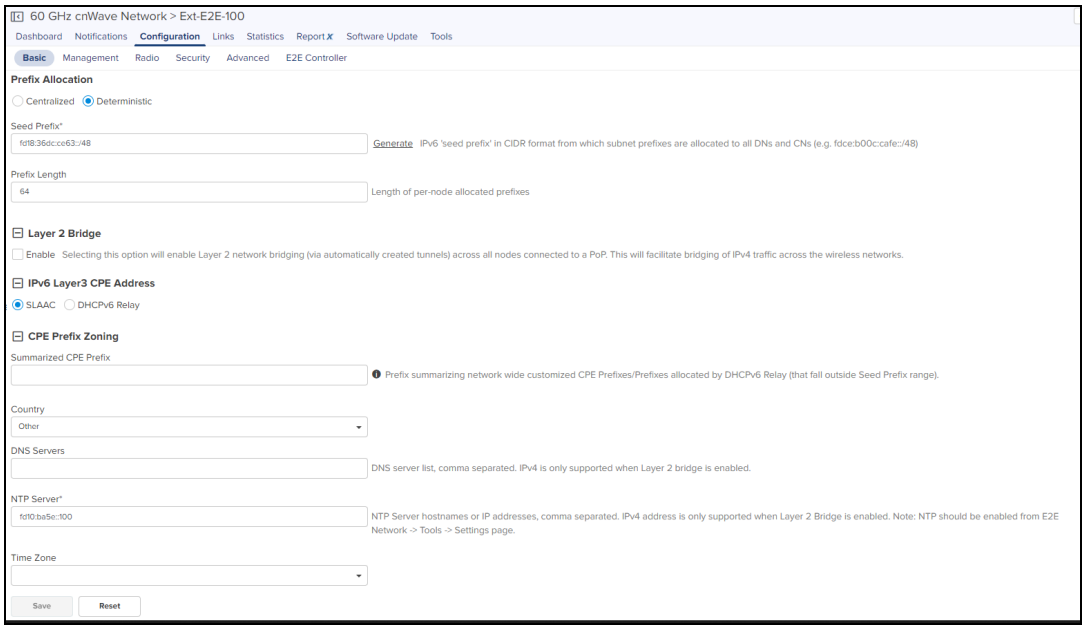
Configure the following after onboarding the External or Onboard E2E Controller:

- Basic
- Management
- Radio
- Security
- Advanced
- E2E Controller

	NOTE: Once user selects the **Auto-assign** IPv6 Addresses while configuring E2E Controller and PoP node. Use the same IPv6 during the prefix allocation.

Basic Configuration

1. Navigate to **Configuration** > **Basic** to configure basic settings of E2E Controller.



	NOTE: • **Prefix allocation** automatically gets updated, when E2E Controller is managed by cnMaestro. • Prefix Length of 48 is supported in Seed Prefix configuration.

2. In the **Prefix Allocation**, select **Centralized** or **Deterministic** to allocate the loopback IPv6 address for the devices.
3. Enter the **Seed Prefix** and **Prefix Length**.
4. Enabling **Layer 2 Bridge** is optional.

   Enabling this option will enable Layer 2 network bridging (via automatically created tunnels) connected across all nodes and facilitates bridging of IPv4 traffic across the wireless networks. It also enables the configuration of VLAN Management and Ports on all PoP, DN, and CN Nodes.

   In **Layer 2 Bridge**, select the check box to enable Layer2 Network Bridging, choose **Tunnel Concentrator** as **Best PoP** or **Static.**

   - If user selects Tunnel Concentrator as Static, enter an external switch/router IPv6 address.

	NOTE: **IPv6 Layer3 CPE Address** can be enabled when E2E Controller is running 1.1 verison and Layer 2 Bridge is disabled.

5. Select the **IPv6 Layer3 CPE Address** as **SLAAC** or **DHCPv6 Relay.**

If user selects **IPv6 Layer3 CPE Address** as **DHCPv6 Relay**, user can configure the DHCPv6 server address. The CPE device sends a DHCP request.The CN device uses the Address and Prefix from the corresponding DHCP pool and DHCPv6 server assigns address to the CPE device.

	NOTE: • By default **Country** is **Other**, user can configure it. • Enter the **Hostnames** or **IP address** of NTP server.

6. Select the **Country** from the drop-down.
7. Enter the **DNS Server.**
8. Enter **NTP Server.**
9. Select the **Time Zone** from the drop-down.

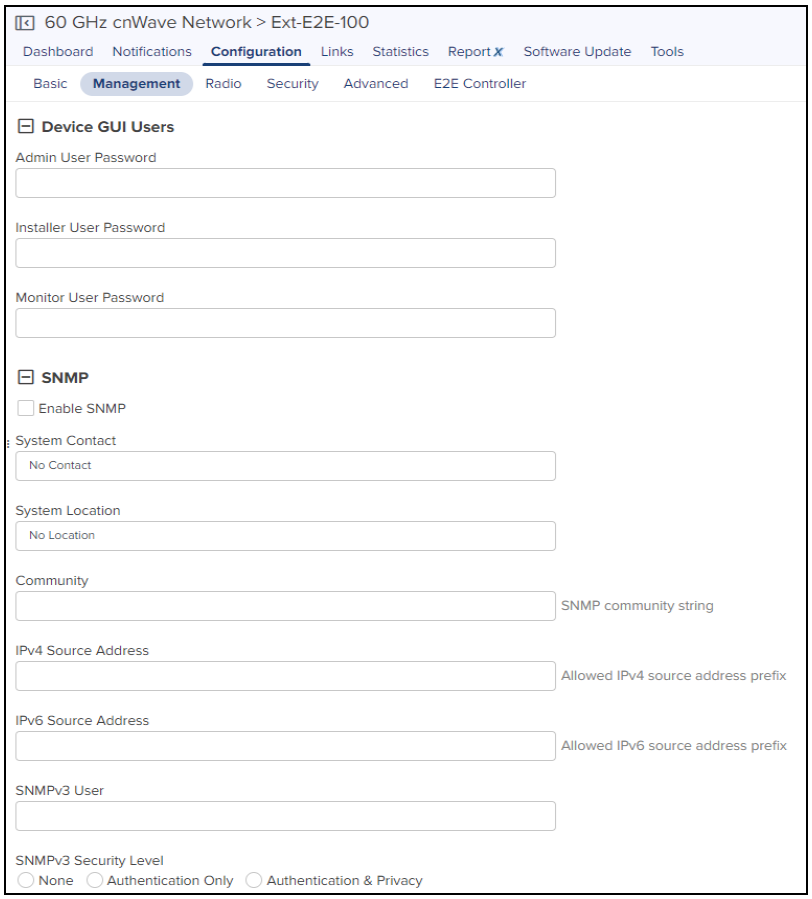
	NOTE: By default **Wireless Scans** will be disabled.

10. Click **Save.**

Management

Management configuration allows user to configure and manage the credentials of the administrator and it allows enable **SNMP**.

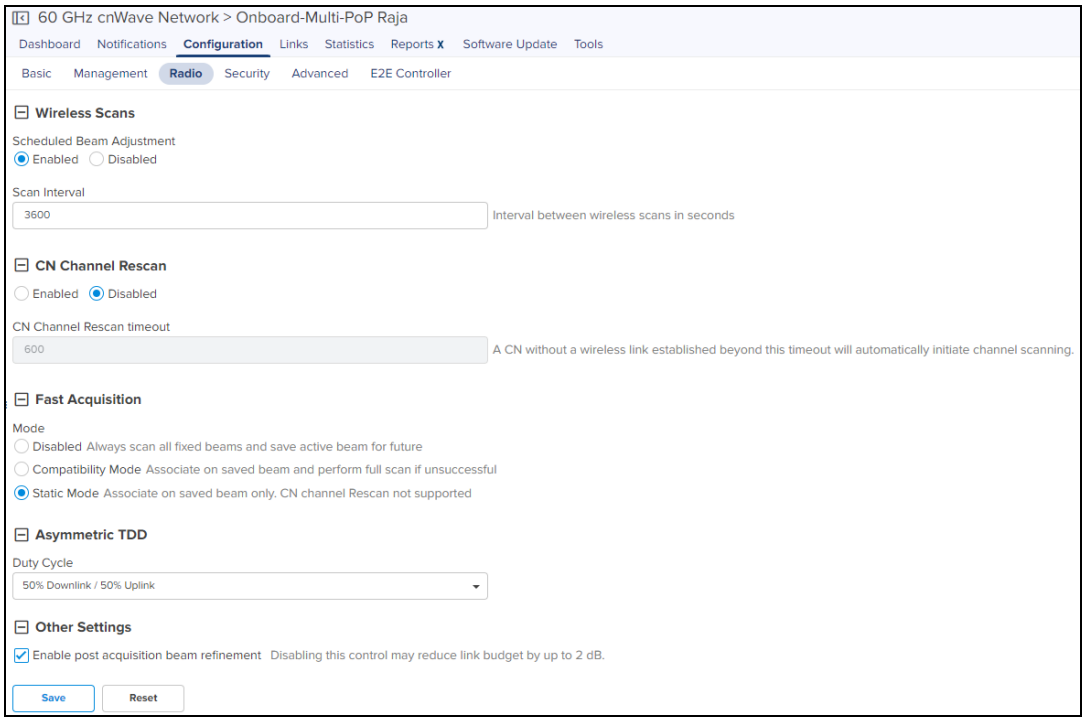
1. Navigate to **Configuration** > **Management** to set the **Device GUI Passwords** and to enable the **SNMP**.



2. Click **Save.**

Radio

The Radio page manages the Radio related settings.



- **Wireless Scans**
  - **Enabled/Disabled**—Enable or disable scheduled beam adjustment.
  - **Scan Interval**—Specify an interval between wireless scans, in seconds.
- **CN Channel Rescan**
  - **Enabled/Disabled—**Enable or disable CN channel rescan.

	NOTE: You can enable CN channel rescan only when Fast Acquisition is set to either **Disabled** or **Compatibility Mode**.

  - **CN Channel Rescan timeout**—Specify a timeout interval for a CN that does not have a wireless link to reinitiate channel scanning, in seconds.
- **Fast Acquisition**

	NOTE: Fast acquisition is supported only on 60 GHz cnWave devices running System Release version 1.3 or later.

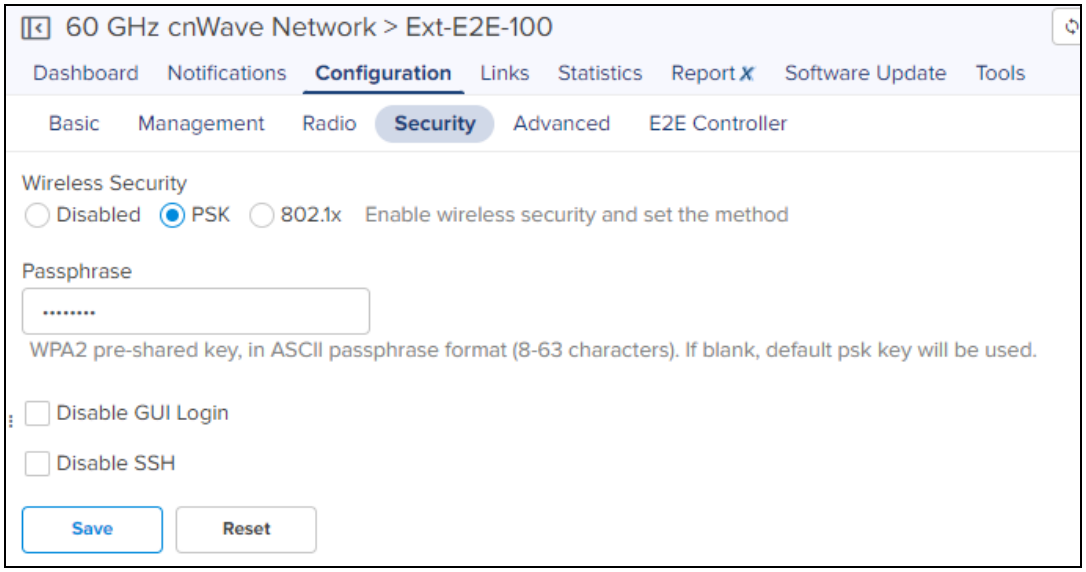
- Mode
  - **Disabled**—On link acquisition, performs IBF scan on 61 fixed beams. This is the default option.
  - **Compatibility Mode**—On link acquisition, tries the last known (if present) beam index. If unsuccessful, tries normal IBF scan.
  - **Static Mode**—On link acquisition, tries the last known (if present) beam index. If unsuccessful, the association fails.
- Asymmetric TDD
  - **Duty Cycle**—Select a duty cycle from the drop-down list. For example:
    - **60% Downlink / 40% Uplink**—Set 60% of physical bandwidth for downloading and 40% of the physical bandwidth for uploading.
- Other Settings
  - **Enable post acquisition beam refinement**—Select to enable.

Security

Security page allows the user to enable the wireless security **PSK** or **802.1x.** The disabled option connects as unsecure devices.

To Enable PSK :

1. Navigate to **Configuration** > **Security** tab.
2. Select **PSK** in **Wireless Security**.



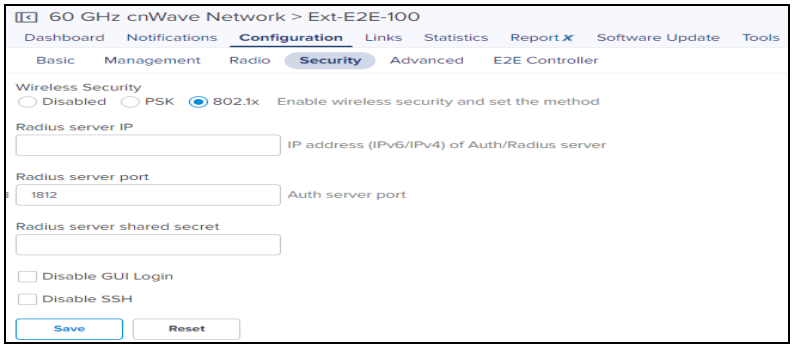
3. Enter the **Passphrase**.

	NOTE: If **Passphrase** field is blank, default psk key is used.

4. Click **Save.**

To Enable 802.1x

1. Navigate to **Configuration** > **Security.**
2. Select **802.1x** in **Wireless Security**.



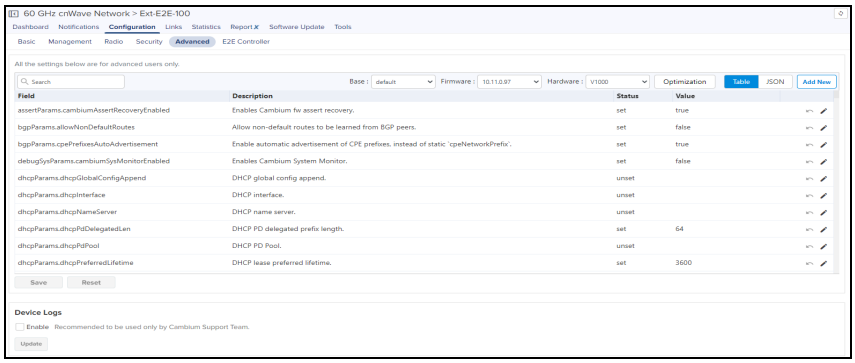
3. Enter the **Radius server IP.**
4. Enter the **Radius Server port.**
5. Enter the **Radius Server Shared Secret.**
6. Click **Save**.

Advanced

Advanced tab allows the advanced user to edit the settings of the Table and JSON format of the E2E Controller.

It also allows to optimize the network using the following options:

- Optimize Control Superframe Allocation
- Optimize DPA Zone Allocation
- Clear Node Auto Configuration

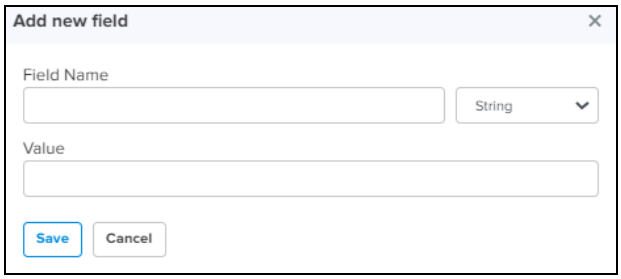


Table

In the **Table** advanced user can view and edit **Field Name** and **Value**. The field names are sorted in alphabetical order.

To add a field:

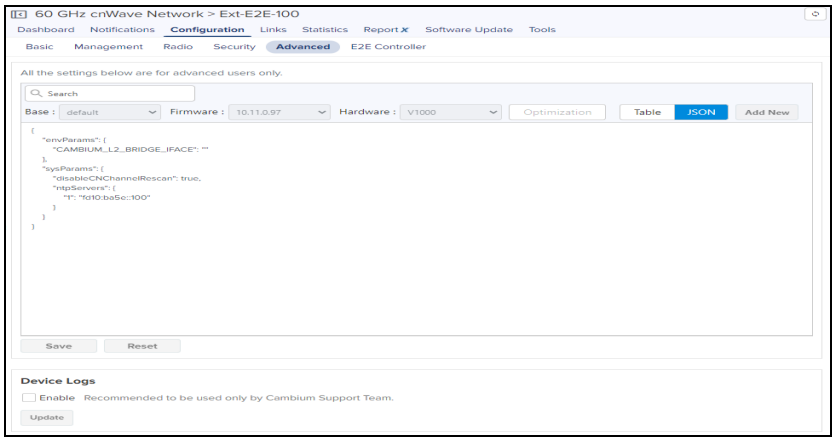
1. Navigate to **Configuration** > **Advanced.**
2. Click **Add New.**
3. Enter the **Field Name** and **Value.**



4. Click **Save.**

JSON

JSON allows Advanced user to download or view and edit in json format.



To view or edit the JSON file:

1. Navigate to **Configuration** > **Advanced > JSON.**

	NOTE: Enabling the Device Logs is supported only for External E2E Controller devices and it allows the Support team to view the logs.

2. Enable **Device Logs** and click **Update.**

E2E Controller

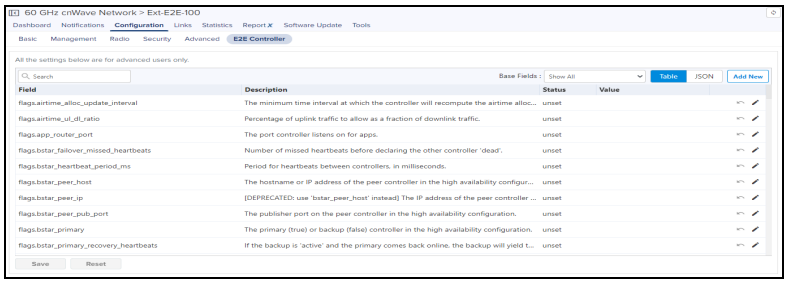
E2E Controller allows the advanced user to set the **Table** and download the **JSON** file.

Table

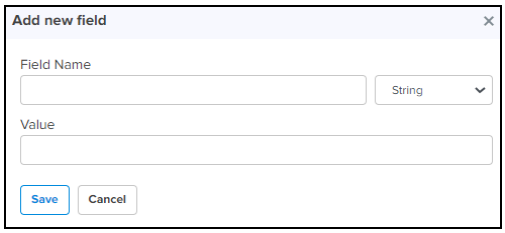
In **E2E Controller Table** user can Edit or add **Field Name** and **Value.**

To Add Field:

1. Navigate to **Configuration** > **E2E Controller.**
2. Click **Add New.**



3. Enter the **Field Name** and **Value.**



4. Click **Save.**

JSON

JSON allows Advanced user to download or view and edit in JSON format.

To view or edit the JSON file:

1. Navigate to **Configuration** > **E2E Controller > JSON.**

Links

Links provide the details about the link established between the nodes and also provides the option to create a new Wireless, Wired and Backup CN link.

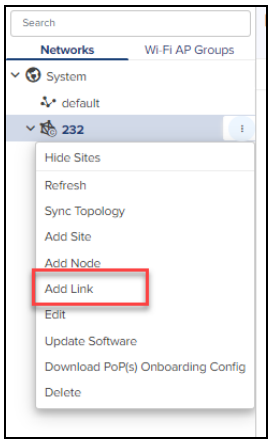
- List
- Statistics
- Events

List

The **List** page provides details of **General**: Name, A-Node, Z-Node, A-Node MAC, Z-Node MAC, Alive, Link Time, Type, Ignition Attempts, Distance, Azimuth, Backup CN Link, and Ignition Status for each link of all the devices in the E2E Network in a page format.

To add a link, perform the following steps:

1. Navigate to the E2E Network tree menu click (⋮) icon and click **Add Link** from the drop-down or navigate to **Network > Links > List > Add New**.



2. **Add Link** window pops-up.
3. Select **Link Type** Wireless or Wired.

Figure 267 Wireless link

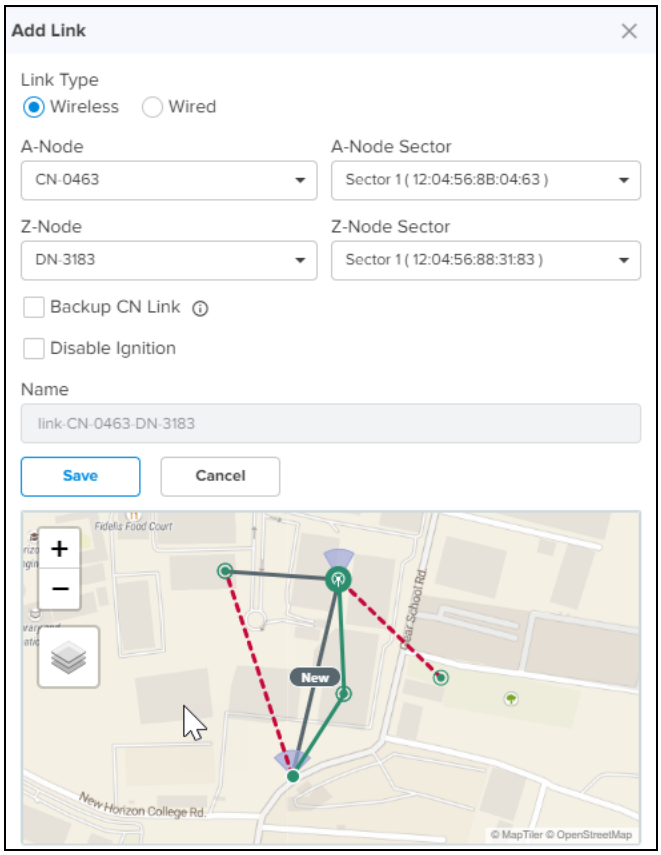
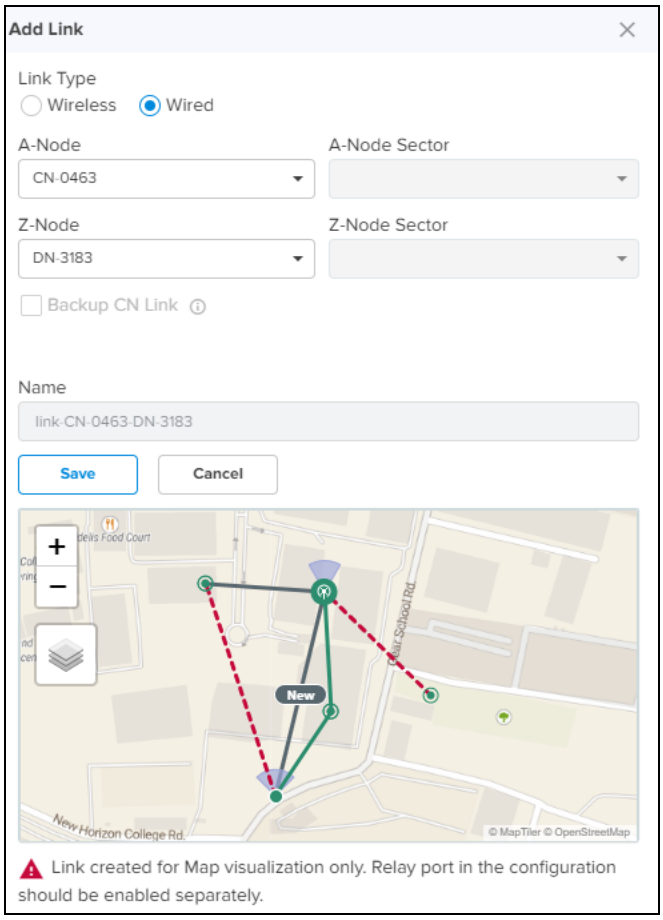
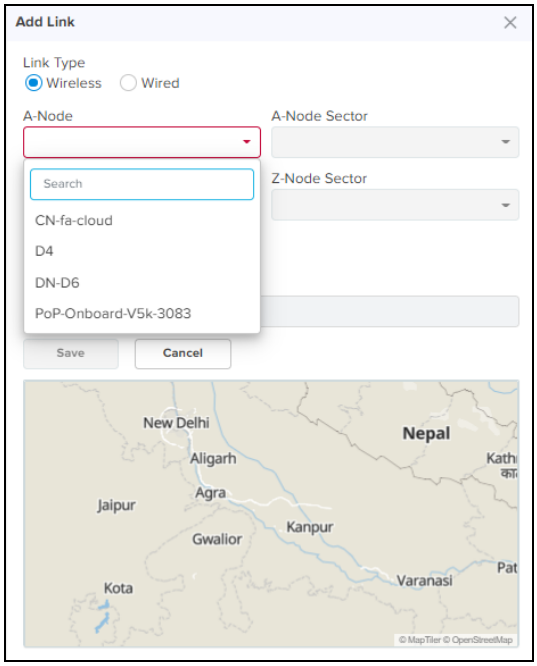


Figure 268 Wired link

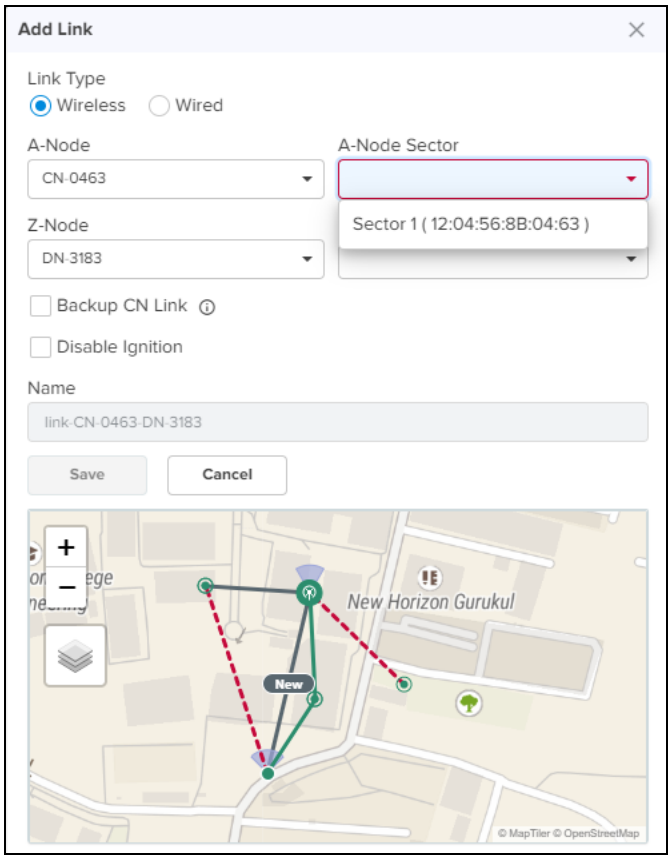
	NOTE: In Wired Link Type, add Sector is disabled.



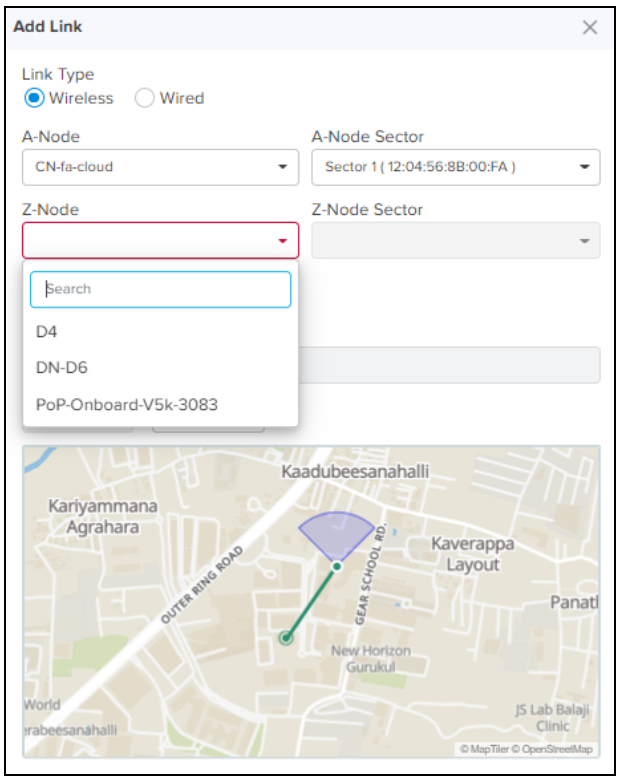
4. Select the **Node** from the drop-down in **A-Node.**



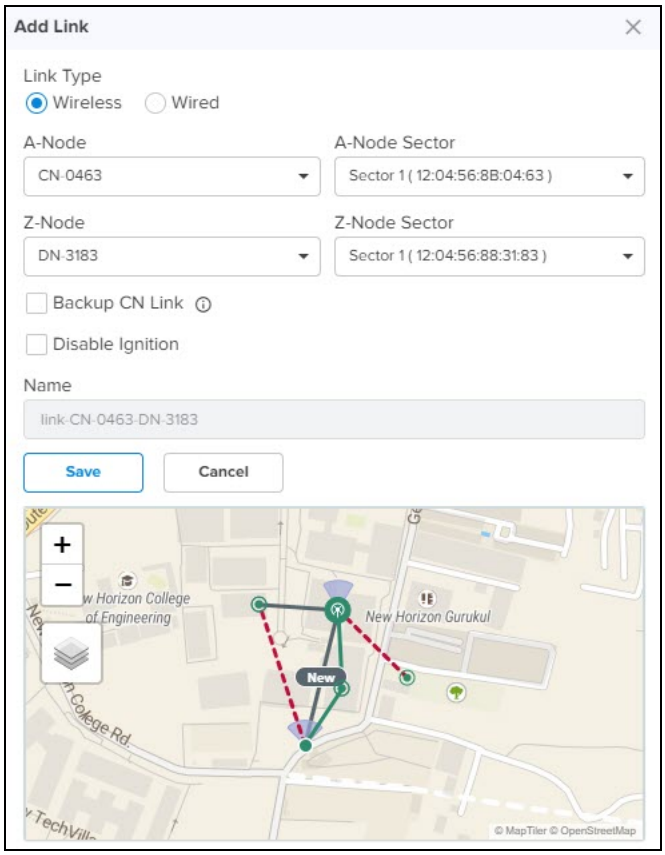
5. Select the **Sector** of the node from the drop-down in **A-Node Sector.**



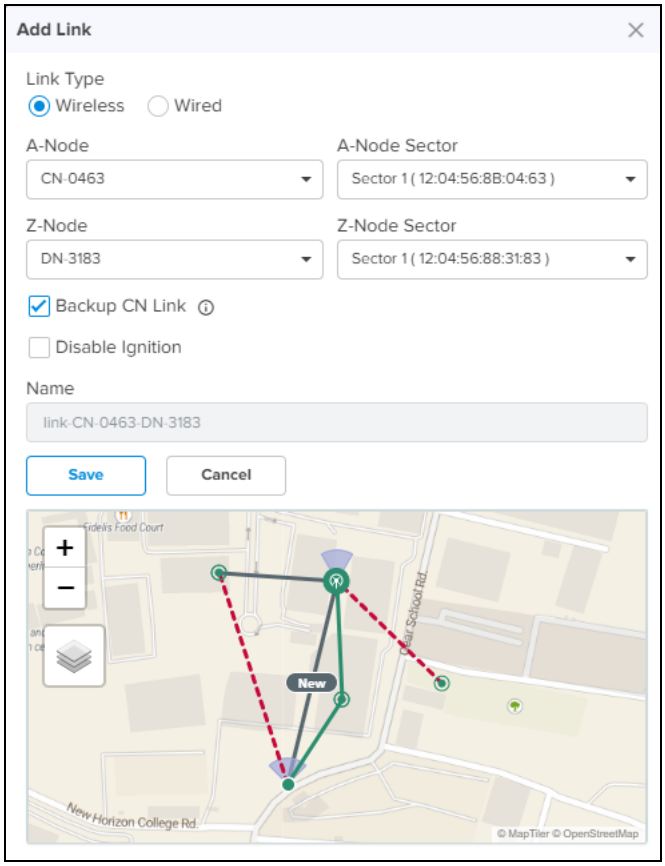
6. Select the **Node** from the drop-down in **Z-Node.**



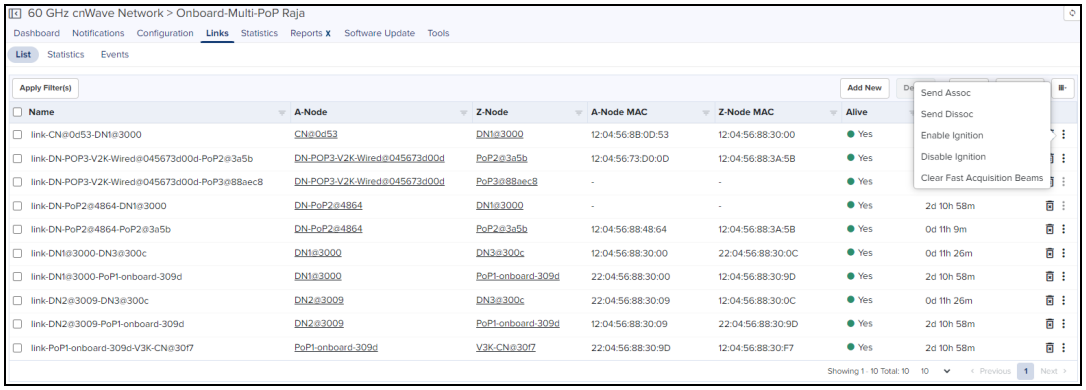
7. Select the **Sector** of the node from the drop-down in **Z-Node Sector.**



8. Enable the **Backup CN Link**.
   - If the link between PoP or DN and CN gets disconnected. This Backup CN link provides the backup connectivity from DN or PoP to particular CN.



9. If user selects **Disable Ignition** option, wireless link creates with disable ignition. User need to manual select **Enable Ignition** from link options.
10. Click **Save**.
11. Once the link is successful it displays the **Alive** status as **Yes**.



Available link options are:

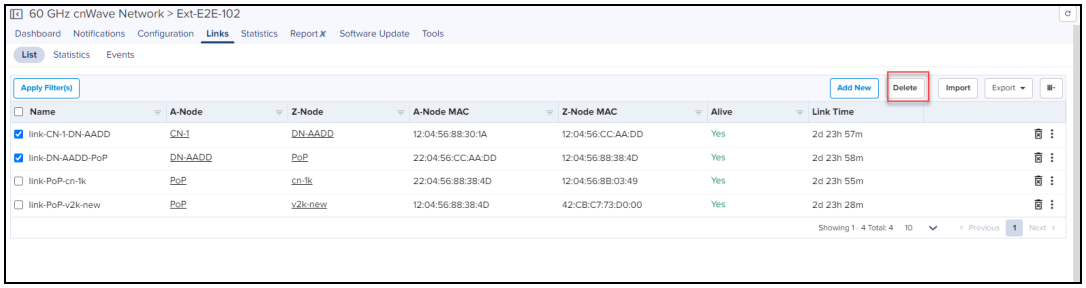
- Send Assoc
- Send Dissoc
- Enable Ignition
- Disable Ignition
- Clear Fast Acquisition Beams

Delete Links

In the **Links** tab you can delete the E2E Controller Network Links.

To delete the links:

1. Navigate to **Links** > **List.**
2. In the **List** table select one or more links to delete. User can also delete individual link, by selecting delete (🗑) icon in the table.



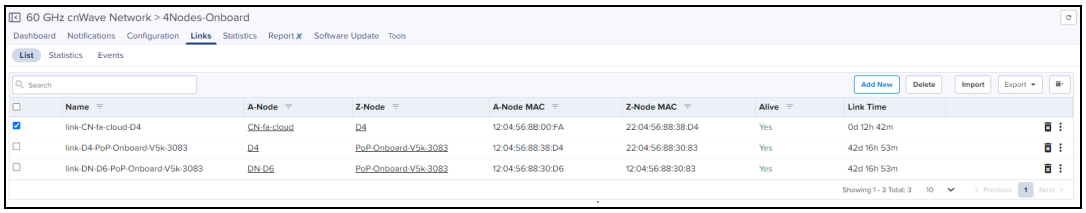
3. Click **Delete**.

Import List

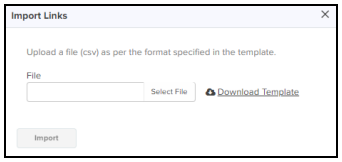
In **Links** tab you can import the E2E Controller Network Links.

To import the links:

1. Navigate to **Links > List.**
2. Select **Import.**



3. **Import Links** pops-up.



4. Click **Download Template** to download the sample template in .CSV format.

	A	B	C	D	E
1	A_NODE_NAME	A_NODE_MAC	Z_NODE_NAME	Z_NODE_MAC	LINK_TYPE
2	A node name of the device	Sector 1/2 MAC Address	Z node name of the device	Sector 1/2 MAC Address	Wireless or Wired
3	POP	[redacted]	DN1	[redacted]	wireless
4	DN1	[redacted]	CN1	[redacted]	wireless
5	DN1		CN2		wired
6					
7					

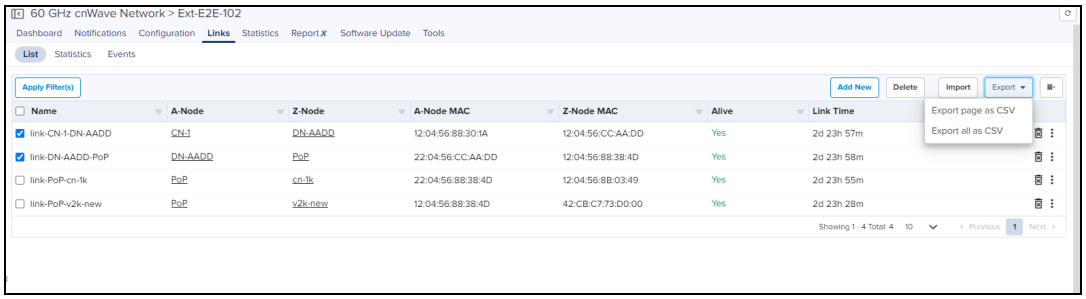
5. Select the file and click **Import**.

Export List

In **Links** tab you can export the E2E Controller Network Links.

To export the links:

1. Navigate to **Links** > **List** > select **Export.**

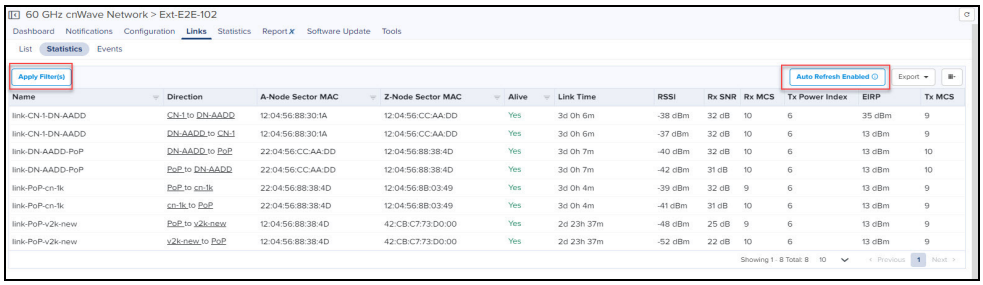


2. It exports .csv file format as shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	LINK_NAME	A_NODE_N	A_NODE_N	Z_NODE_N	Z_NODE_N	LINK_TYPE	ALIVE	IGNITION_	DISTANCE	AZIMUTH	BACKUP_C	IGNITION_	TIMESTAMP		
2	Link Name	A node nai	Sector 1/2	Z node nai	Sector 1/2	Wireless o	Yes/No	Ignition At	Distance b	Azimuth (D	Yes/No	Enabled/D	Timestamp		
3	link-CN-fa-cloud-D4	CN-fa-clou	12:04:56:8	D4	22:04:56:8	Wireless	Yes	16	996	54.9	No	Enabled	2021-07-23T02:49:06.317Z		
4	link-D4-PoP-Onboard-V5k-3083	D4	12:04:56:8	PoP-Onbo	22:04:56:8	Wireless	Yes	0	988	158.8	No	Enabled	2021-07-23T02:49:06.317Z		
5	link-DN-D6-PoP-Onboard-V5k-3083	DN-D6	12:04:56:8	PoP-Onbo	12:04:56:8	Wireless	Yes	0	979	105.2	No	Enabled	2021-07-23T02:49:06.317Z		

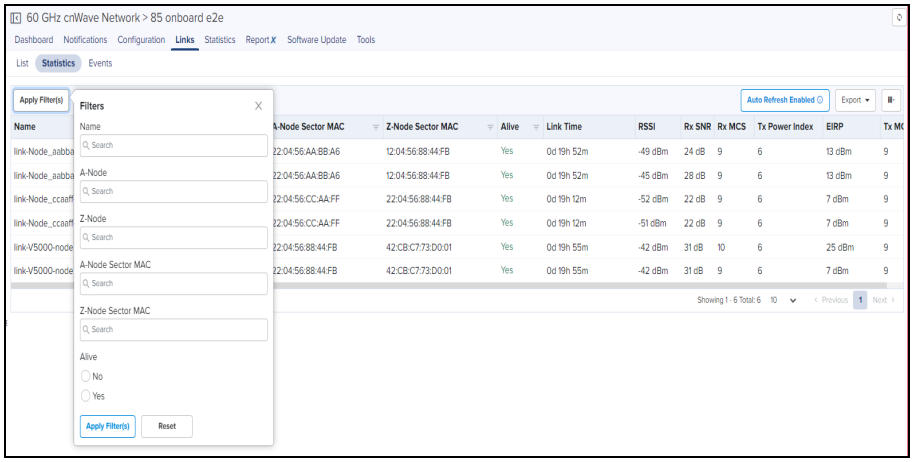
Statistics

Statistics pages provides details of **Basic**: Name, Direction, A-Node, Z-Node, Alive, Link Time, Type, Distance, Azimuth, Rx Golay, Tx Golay **Detailed Statistics**: A-Node Sector MAC, Z-Node Sector MAC, RSSI, Rx Airtime%, Rx Beam Azimuth Angle, Rx Beam Elevation Angle, Rx SNR, Rx MCS, Rx PER, Rx Scan Beams, Rx Throughput, Tx Airtime%, Tx Beam Azimuth Angle, Tx Beam Elevation Angle, Tx Power Index, EIRP, Tx MCS, Tx PER, Tx Scan Beams, Rx Errors, Rx Frames, Tx Errors, Tx Frames, Tx Throughput, Rx Time, Tx Time and Link Fade Margin each link of all the devices in the E2E Network in a page format.

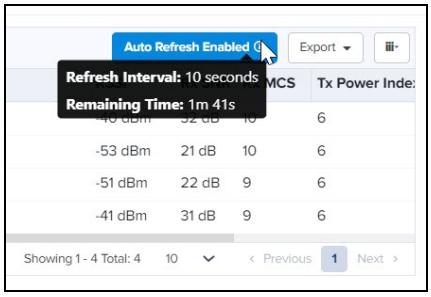


You can **Apply Filter(s)** for Name, A-Node, Z-Node, A-Node Sector MAC, Z-Node Sector MAC, and Alive. The **Auto Refresh** option allows to refresh data automatically as per Refresh Interval, which is configured for five minutes. By default, Refresh Interval is 10 seconds. This option gets disabled after five minutes. Then you must click **Enable Auto Refresh** and specify the refresh intervals to enable this option. To **Enable Auto Refresh**, perform the following steps:

1. Click **Enable Auto Refresh**.
2. Select **Refresh Interval** from the drop-down.
   - 10 seconds
   - 30 seconds
   - 60 seconds
3. Click **Start** to start **Auto Refresh.**



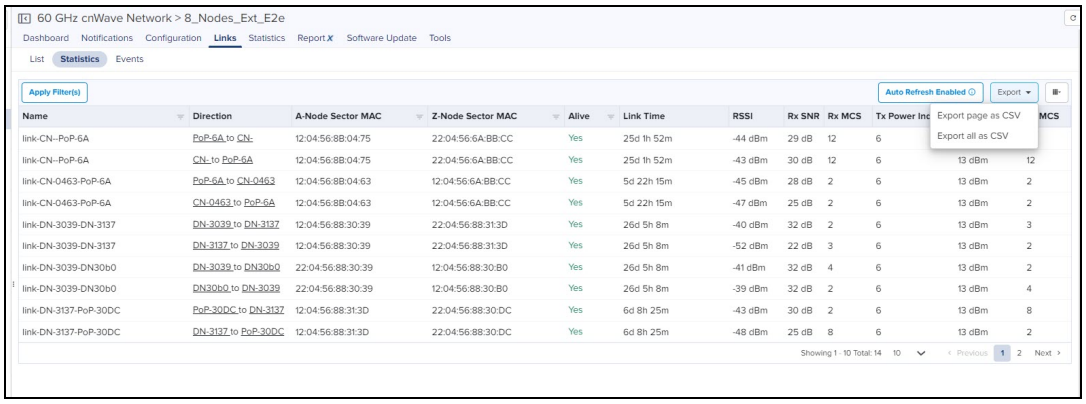
4. Click the info icon to view **Refresh Interval** and **Remaining Time**.



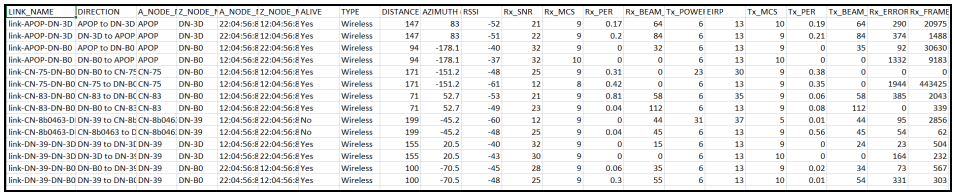
Export Statistics

To export the Statistics:

1. Navigate to **Links > Statistics >** select **Export.**



2. It exports .csv file format as shown below.



LINK_NAME	DIRECTION	A_NODE_I	Z_NODE_I	A_NODE_F	Z_NODE_F	ALIVE	TYPE	DISTANCE	AZIMUTH	RSSI	Rx_SNR	Rx_MCS	Rx_PER	Rx_BEAM_	Tx_POWE	EIRP	Tx_MCS	Tx_PER	Tx_BEAM_	Rx_ERROR	Rx_FRAME
link-APOP-DN-3D	APOP to DN-3D	APOP	DN-3D	22:04:56:8	12:04:56:8	Yes	Wireless	147	83	-52	21	9	0.17	64	6	13	10	0.19	64	290	20975
link-APOP-DN-3D	DN-3D to APOP	APOP	DN-3D	22:04:56:8	12:04:56:8	Yes	Wireless	147	83	-51	22	9	0.2	84	6	13	9	0.21	84	374	1488
link-APOP-DN-B0	APOP to DN-B0	APOP	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	94	-178.1	-40	32	9	0	32	6	13	9	0	35	92	30630
link-APOP-DN-B0	DN-B0 to APOP	APOP	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	94	-178.1	-37	32	10	0	0	6	13	10	0	0	1332	9183
link-CN-75-DN-B0	DN-B0 to CN-75	CN-75	DN-B0	12:04:56:8	12:04:56:8	Yes	Wireless	171	-151.2	-48	25	9	0.31	0	23	30	9	0.38	0	0	0
link-CN-75-DN-B0	CN-75 to DN-B0	CN-75	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	171	-151.2	-61	12	8	0.42	0	6	13	9	0.35	0	1944	443425
link-CN-83-DN-B0	CN-83 to DN-B0	CN-83	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	71	52.7	-53	21	9	0.81	58	6	35	9	0.06	58	385	2043
link-CN-83-DN-B0	DN-B0 to CN-83	CN-83	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	71	52.7	-49	23	9	0.04	112	6	13	9	0.08	112	0	339
link-CN-8b0463-D	DN-39 to CN-8b	CN-8b046	DN-39	12:04:56:8	22:04:56:8	No	Wireless	199	-45.2	-60	12	9	0	44	31	37	5	0.01	44	95	2856
link-CN-8b0463-D	CN-8b0463 to D	CN-8b046	DN-39	12:04:56:8	22:04:56:8	No	Wireless	199	-45.2	-48	25	9	0.04	45	6	13	9	0.56	45	54	62
link-DN-39-DN-3D	DN-39 to DN-3D	DN-39	DN-3D	12:04:56:8	22:04:56:8	Yes	Wireless	155	20.5	-40	32	9	0	15	6	13	9	0	24	23	504
link-DN-39-DN-3D	DN-3D to DN-3	DN-39	DN-3D	12:04:56:8	22:04:56:8	Yes	Wireless	155	20.5	-43	30	9	0	0	6	13	10	0	0	164	232
link-DN-39-DN-B0	DN-B0 to DN-3	DN-39	DN-B0	12:04:56:8	12:04:56:8	Yes	Wireless	100	-70.5	-45	28	9	0.06	35	6	13	9	0.02	34	73	567
link-DN-39-DN-B0	DN-39 to DN-B	DN-39	DN-B0	22:04:56:8	12:04:56:8	Yes	Wireless	100	-70.5	-48	25	9	0.3	55	6	13	10	0.01	54	331	303

Events

Events provide the details of link availability, hourly link availability in percentage, link availability in different time lines, and distance of the link.

Figure 269 Links > Events

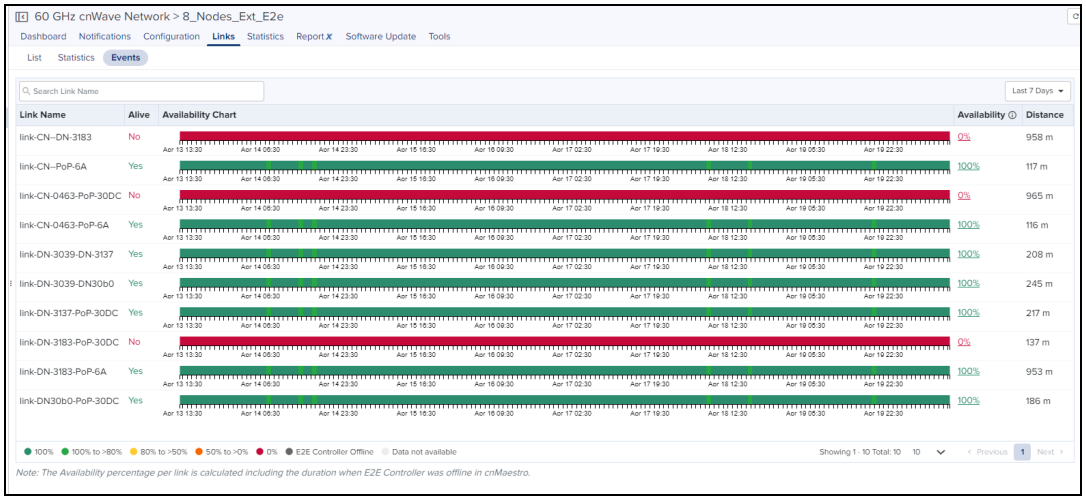


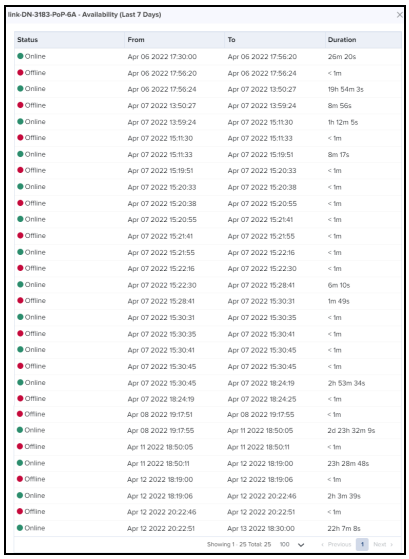
Table 67: Events fields

Field	Description
Link Name	Name of the link.
Alive	Status of the link (Yes or No).
Availability Chart	Displays the link availability based on time range selected from the drop-down.When you hover the mouse on the Availability Chart, the link availability is shown as described: 1. If you select time range as **Last 1 Hour**, then link availability for every 5 minutes is displayed.

Table 67: Events fields

Field	Description
	2. If you select time range other than **Last 1 Hour**, then link availability for every 1 hour is displayed. • Hover on the link to see the hourly availability as shown in Figure 271. • Clicking on percentage link availability displays pop-up window as shown in Figure 272 • Link availability is presented in different colors in the chart as shown in Figure 270
Availability Percentage	Availability of link is shown in percentage in the Availability column as shown in Figure 271.
Distance	Distance of the link in meters.

Figure 270 Link Availability in Percentage



Availability percentage per link is calculated including the duration when E2E Controller was Offline in cnMaestro.

Figure 271 Link Availability

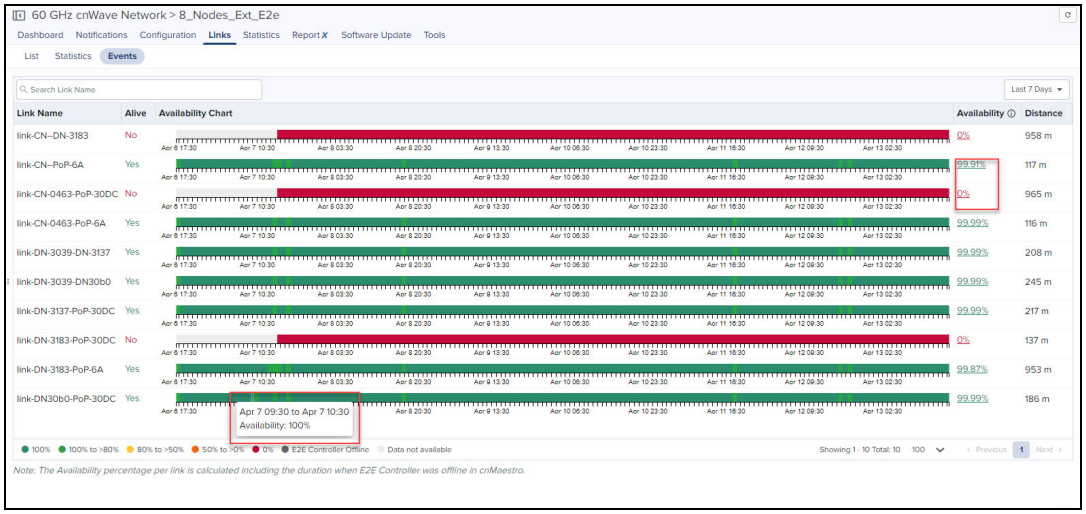
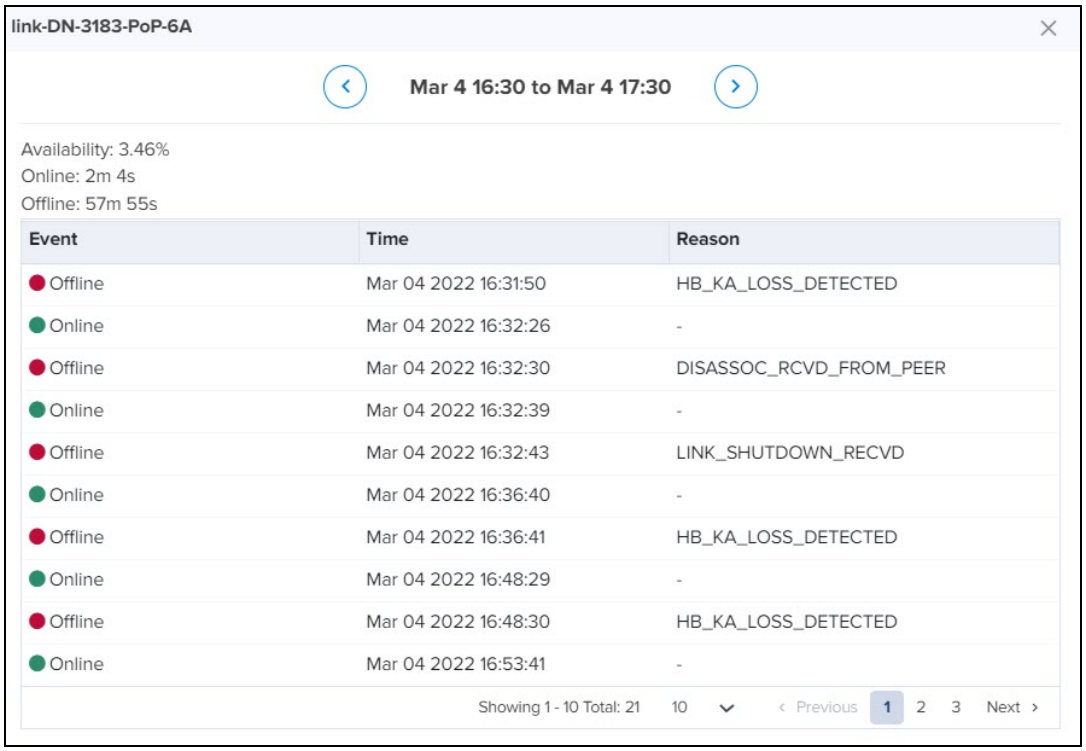


Figure 272 Link Status



Events details are available for Last 1 hour, Last 6 hours, Last 12 hours, Last 24 Hours, Last 2 days, Last 4 days, and Last 7 days.

NOTE:

Event details for **Custom Range** and **Last 30 days** is available only for cnMaestro X users.

Statistics

The E2E Network provides the following statistics:

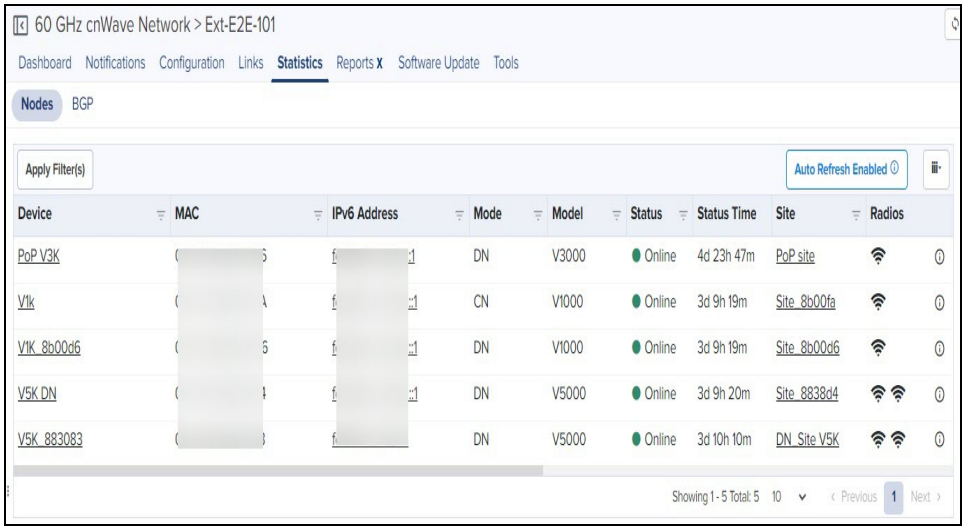
- Nodes

- BGP

Statistics

Nodes provide a tabular aggregation of data, including General information on the nodes monitored, as well as Wireless, Network, and Traffic metrics. Node Statistics pages provide details of **General**: Device, Serial Number, IPv6 Address, MAC, Mode, Model, Status, Status Time, Site, Zone, PoP Node, Software Version. **GPS**: Sync Mode, Fix Type, Satellites Tracked, Latitude, Longitude, Height. **Network**: Radio Channel, Main Aux SFP, Sector Throughput (Tx), Sector Throughput (Rx),Ethernet Throughput (Tx), and Ethernet Throughput (Rx) each device in E2E Network, generally in a page format.

Figure 273 Nodes Statistics

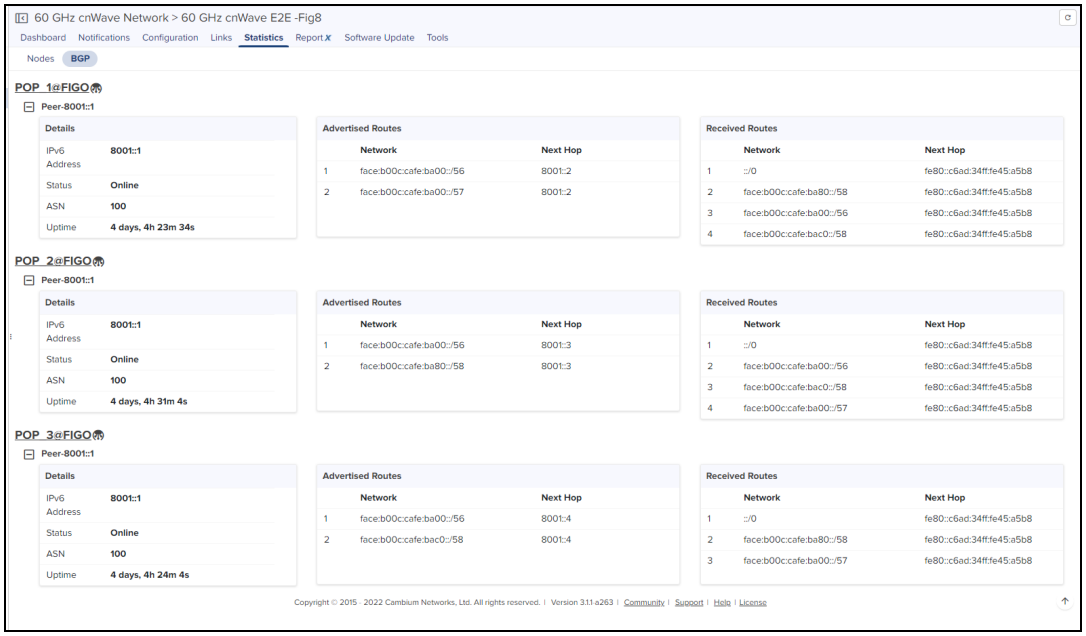


BGP

	NOTE: BGP statistics displays only if BGP option is enabled in Routing in PoP configuration.

BGP provides the details of **Advertised Routes, Received Routes,** and **Peer** details.

Figure 274 BGP Statistics

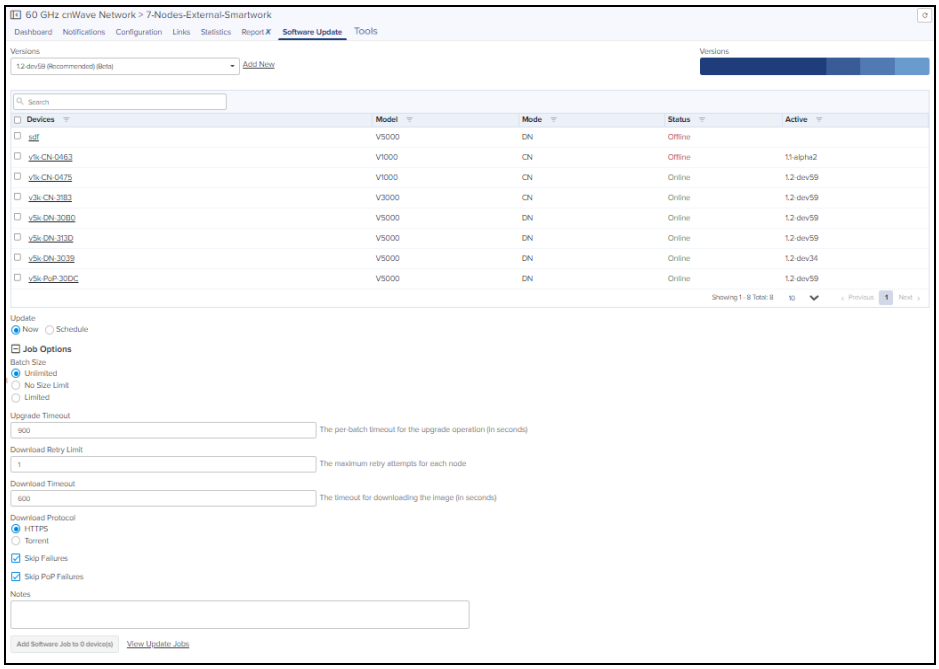


Software Update

The **Software Update** tab allows to update with the latest device software.

To update the software:

1. Select the **Network** and navigate to the **Software Update** tab.
2. In **Software Update** tab select the desired Versions from drop-down in **Versions** tab.
3. Select the **Device**.
4. In **Job Options**, do the following:
   - Select **Batch Size**
   - Enter **Upgrade Timeout.**
   - Enter **Download Retry Limit.**
   - Enter **Download Timeout.**
   - Select the Download Protocol as **HTTPS** or **Torrent.**
   - Enable the **Skip Failures** or **Skip PoP Failures**.
5. Click **Add Software Job to device.**



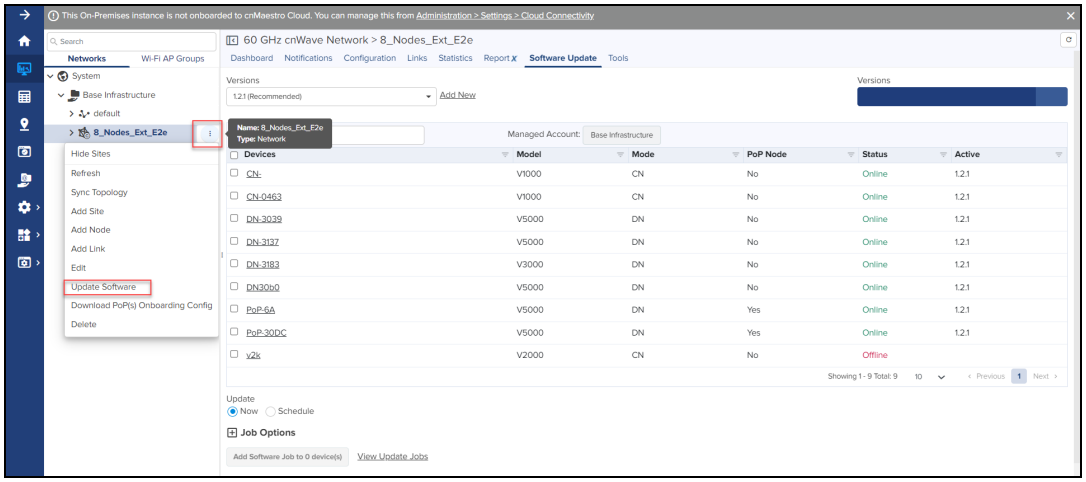
	NOTE: Onboard E2E controller will support only one synced image. If user needs to sync another image, select the image from **Versions** drop down and click **Sync Selected Image.**

The Software Update is performed on the devices managed by External E2E Controller and Onboard E2E Controller as follows:

External E2E Controller

1. In the **Networks**, select External E2E Controller and check the Software Version.
2. From External E2E Controller menu options, select **Update Software**.

Software Update page appears.



3. In **Versions** drop-down select the version and the devices in the network for software upgrade.

Device software update version check for External E2E Controller is described in Table 68.

Table 68: Device Software Update: External E2E Controller

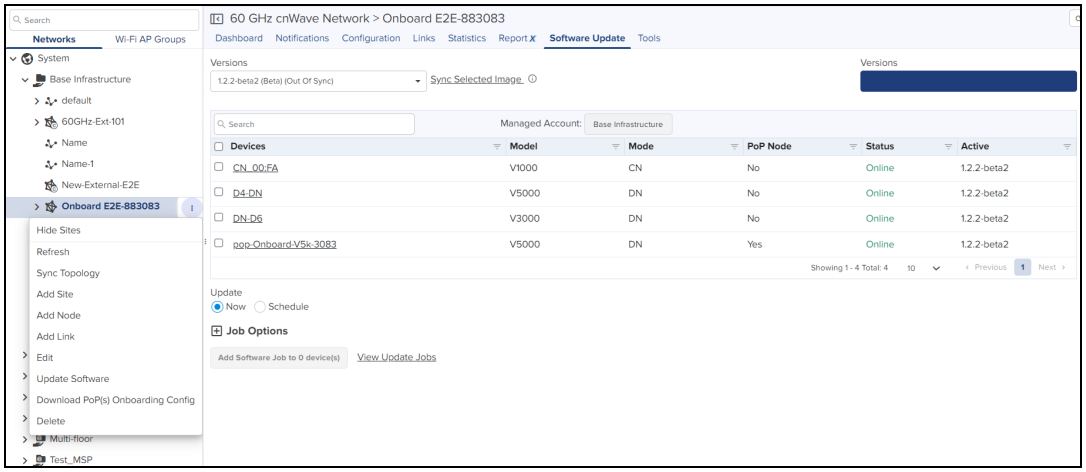
Version	Example
If Software Version of the device is less than the Software Version of the External E2E Controller then Software Upgrade is successful.	External E2E Controller software version: 1.2.1 When Device Software Version is selected as 1.2.1 or lower then Device Software is upgraded successfully.
If Software Version of the Device is selected higher than the External E2E Controller version then Software Upgrade fails.	E2E External Controller Software Version :1.2.1 When Device Software Version is selected as 1.2.2 or higher then Device Software upgrade fails. Error message: **Device version should not be higher than External E2E Controller version 1.2.1**

Onboard E2E Controller

1. In the **Networks**, select Onboard E2E Network and check the software version.

2. From Onboard E2E Network menu options, select **Update Software.**

Software Update page appears.



Device software update version check for Onboard E2E Controller is described in Table 69.

Table 69: Device Software Upgrade: Onboard E2E Controller

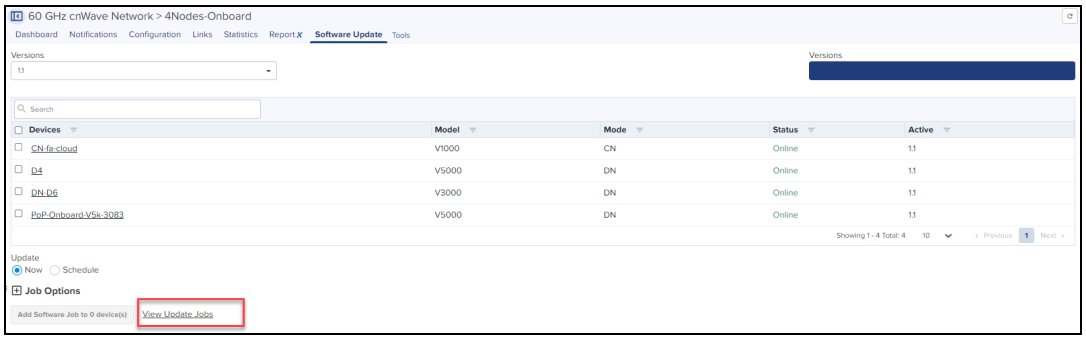
Software Upgrade	Example
If software version of Onboard PoP device is lower and upgraded to higher version then Software Upgrade is successful.	If the Onboard PoP device is running with 1.2, and selected software version is 1.2.1 or higher then Onboard PoP device is upgraded successfully.
If software version of all devices including Onboard PoP are lower and upgraded to higher version then Software Upgrade is successful.	If all the devices including the Onboard PoP are running with 1.2, and selected software version is 1.2.1 or higher then all the devices including PoP device are upgraded successfully.
If software version of all devices are higher and downgraded to lower version except Onboard PoP then Software Upgrade are successful.	If all the devices are running with 1.2.2, and selected software version is 1.2 then all the devices expect PoP device are upgraded successfully.
If software version of all devices including PoP are higher and downgraded to lower version then Software Upgrade are successful.	If all the devices including PoP are running with 1.2.2, and selected software version is 1.2 then all the devices are upgraded successfully.
If software version of all devices including Onboard PoP are higher and downgraded to lower version then Software Upgrade should fail if one or more nodes running with higher version in list.	If all the devices including the Onboard PoP are running with 1.2.2, and selected software version is 1.2.1 then Software Upgrade should fail.
If software version of Onboard PoP device is higher and upgraded to lower version then Software Upgrade for PoP fails, only when other devices software version are higher.	If the Onboard PoP device is running with 1.2.2, and selected software version is 1.2.1 or lower then Software Upgrade of Onboard PoP device fails, only when the other devices software version is 1.2.2.
If software version of all devices are lower and upgraded to higher version except Onboard PoP then Software Upgrade should fail.	If all the devices including Onboard PoP are running with 1.2.2, and selected software version is 2.0 excluding PoP node, then Software Upgrade for all the devices should fail except PoP node.
If software version of all devices including PoP is running with same version, and when you select all nodes to upgrade, then PoP fails to upgrade. You need to manually upgrade the PoP node.	If all the devices including PoP are running with software version 1.1 and selected software version is 1.2. If PoP failed to upgrade, then you need to manually upgrade the PoP.

4. From the **Versions** drop-down, select the version and the devices in the network for software upgrade.

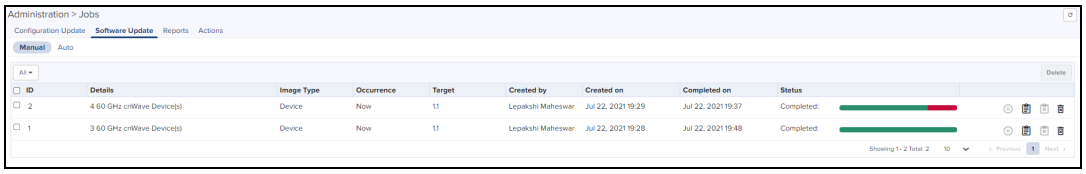
The Software Upgrade scenario for Onboard E2E Controller is explained in Table 69.

View Update Jobs

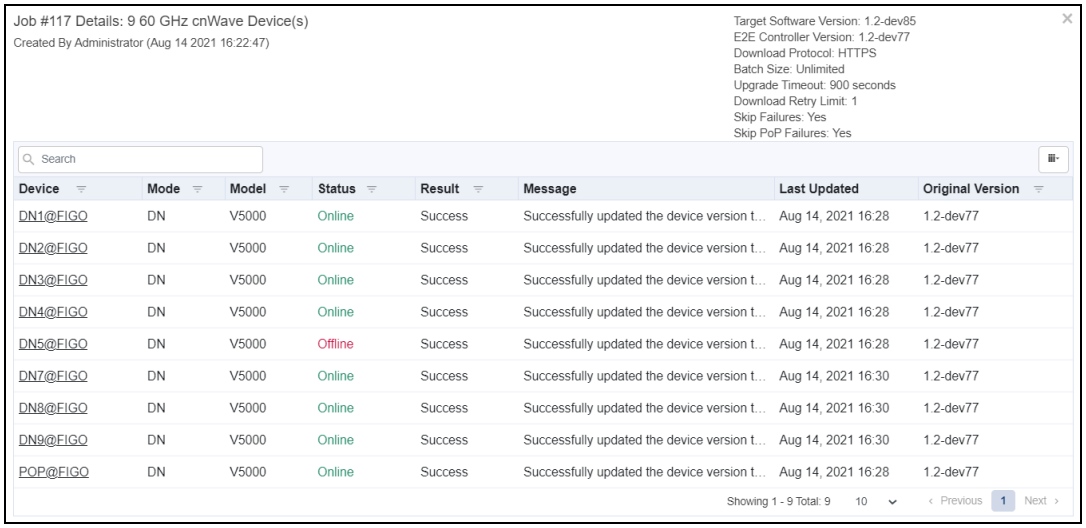
After adding the new Software Images, click **View Update Jobs.**



1. Navigate to the **Administration > Jobs > Software Update**.



2. Click **Show More** to view the Job Details.



Reports

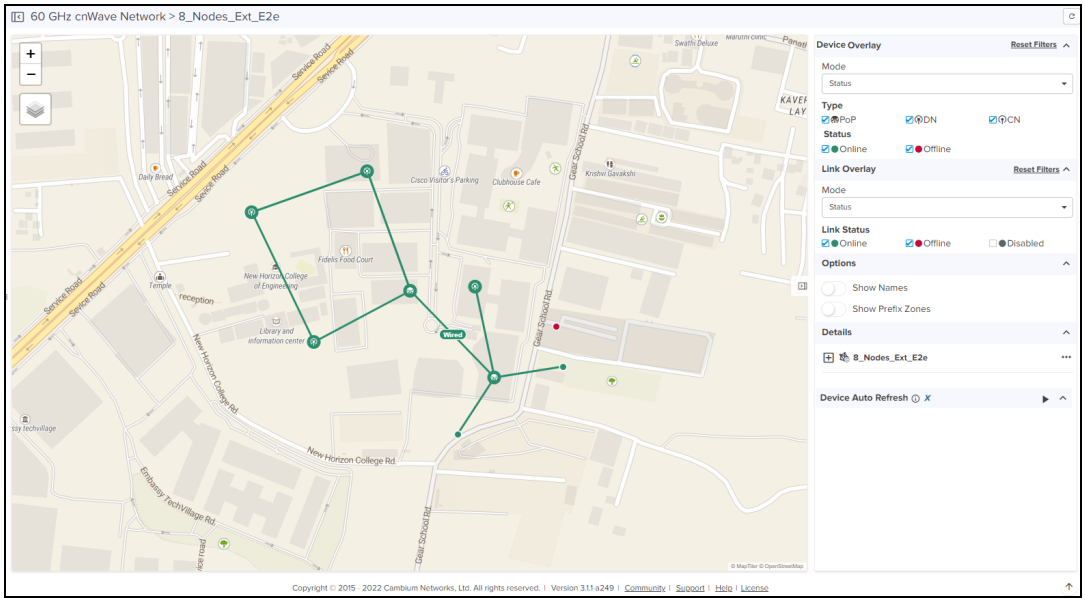
Reports page provides details on how to schedule and generate different types of data reports such as Devices, Active Alarms, Alarm History, and Events. For further details refer to Reports.

Map

Map shows how devices are connected in a E2E network, the state of the devices, and links in the E2E network. To view the map, perform the following:

- Navigate to **E2E Network** > select **Map** icon in the left pane of the homepage to view E2E Network and 60 GHz cnWave devices and links as shown in Figure 275.

Figure 275 Viewing E2E Network



NOTE:
Gray color lines are un-managed links and gray color nodes are un-managed nodes.

The following fields provides visual representation of the nodes and links:

- Device Overlay
- Link Overlay
- Options
- Details
- Device Auto Refresh

Table 70: Map fields in E2E Network

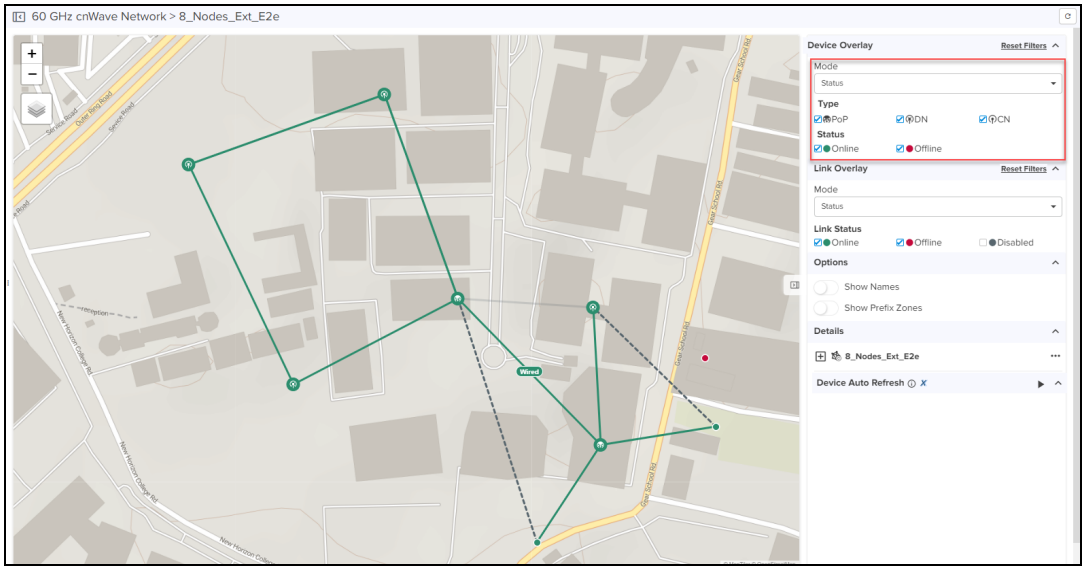
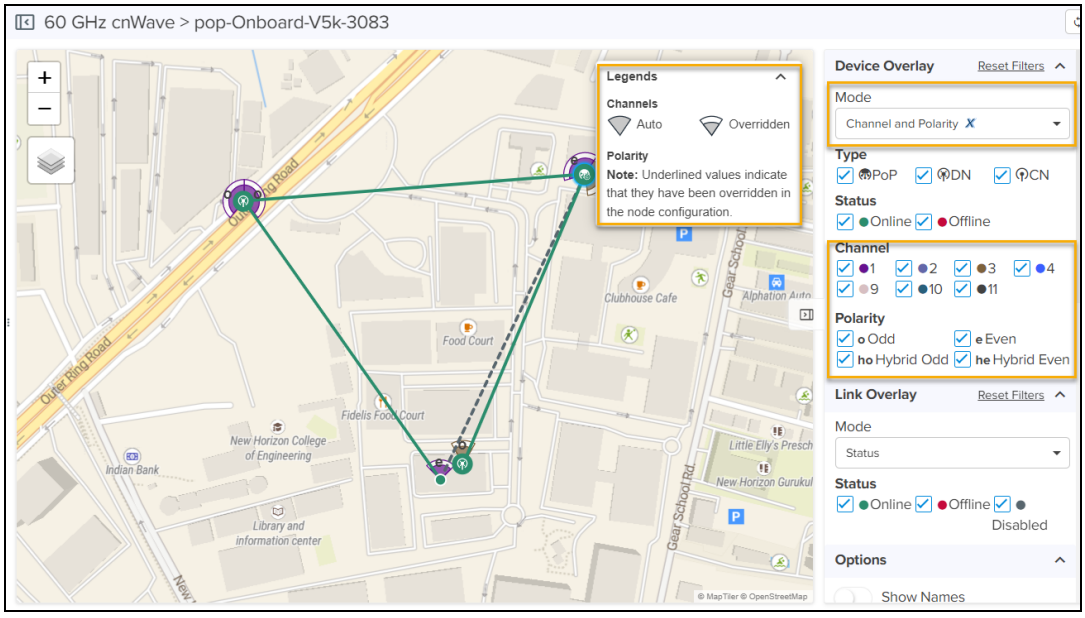
Field	Description
Device Overlay	1. Select the **Mode** type as **Status** to view the following: ● Status: The device status is Online or Offline. ● Type: The device types are PoP, CN, or DN in the E2E Network.  2. Select the **Mode** type as **Channel and Polarity** to view the following: ● Channel: The seven channels are represented in different color codes. Auto channel is indicated as and Overridden channel is indicated as . ● Polarity: The polarity is represented as odd, even, hybrid odd, and hybrid even. Underlined values indicate they have been Overridden in the node configuration.  3. Select the **Mode** type as **Sector** to view the following: Sector: The two sectors are represented in two different color codes.

Table 70: Map fields in E2E Network

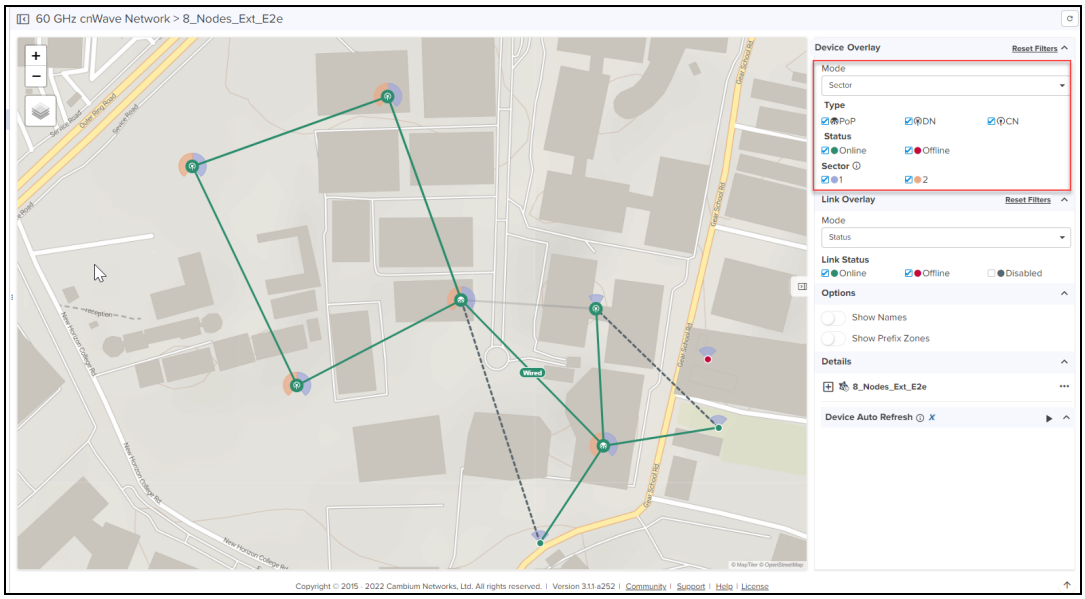
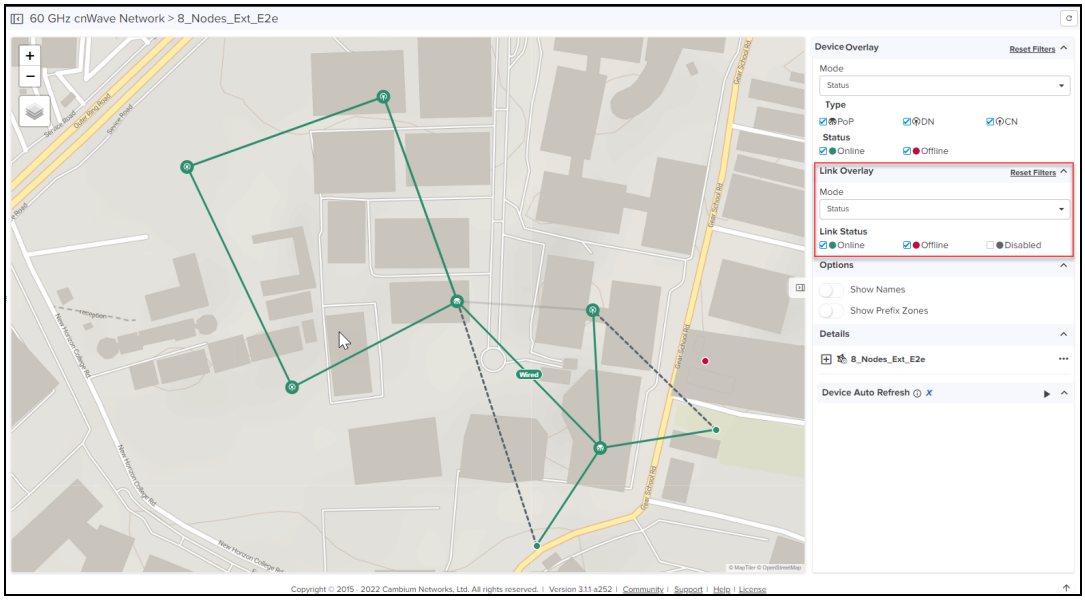
Field	Description
	 V5000 Sectors is shown below: 
Link Overlay	1. Select the **Mode** type as **Status** to view the following: • Status: The link status is Online or Offline.  By default **Ignition Disabled** is checked, which appears in light gray.

Table 70: Map fields in E2E Network

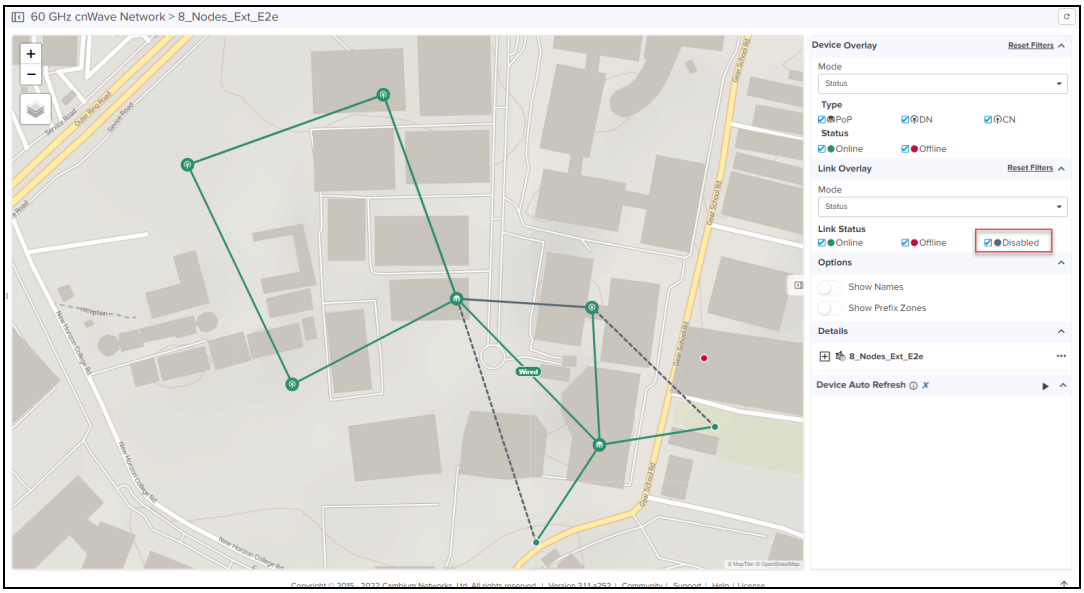
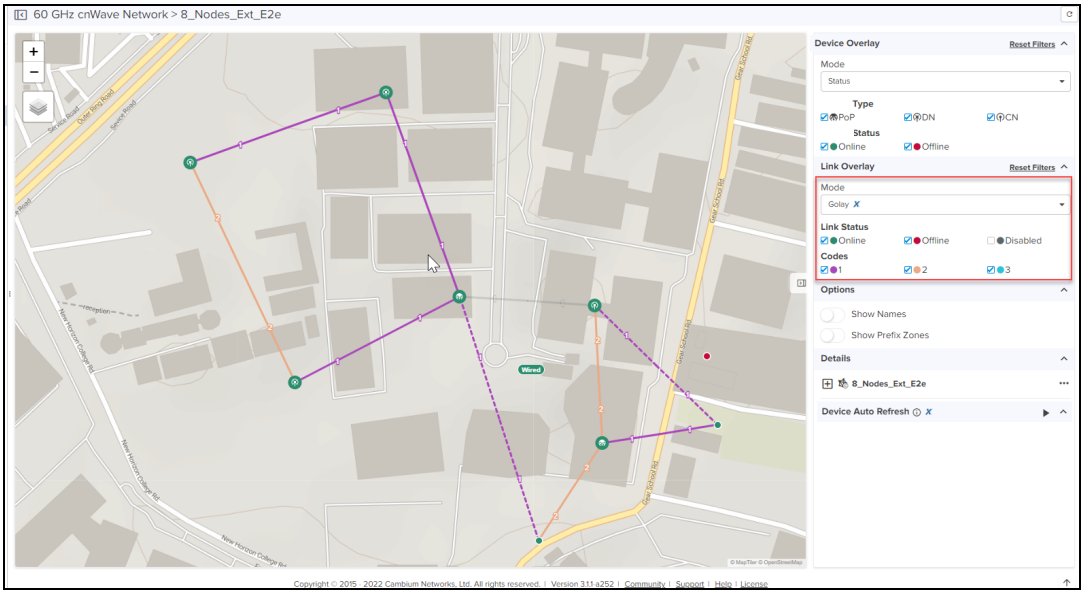
Field	Description
	 2. Select the **Mode** type as **Golay** to view codes. • Golay: Golay is represented in color codes, as shown below:  3. Select the **Mode** type as **SNR** to view link qualities. • SNR: SNR shows various SNR link qualities and is represented in different colors.

Table 70: Map fields in E2E Network

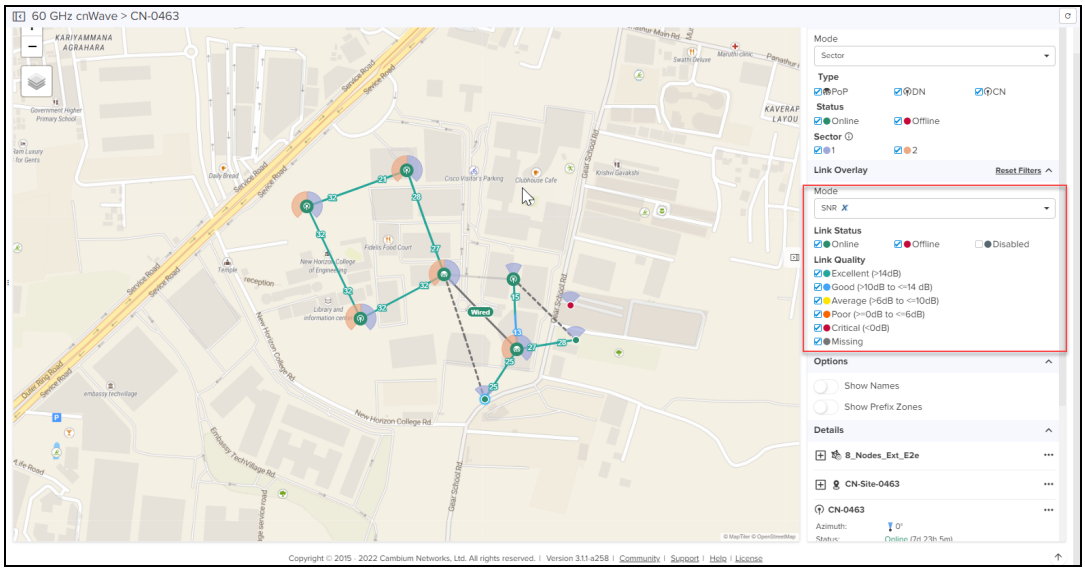
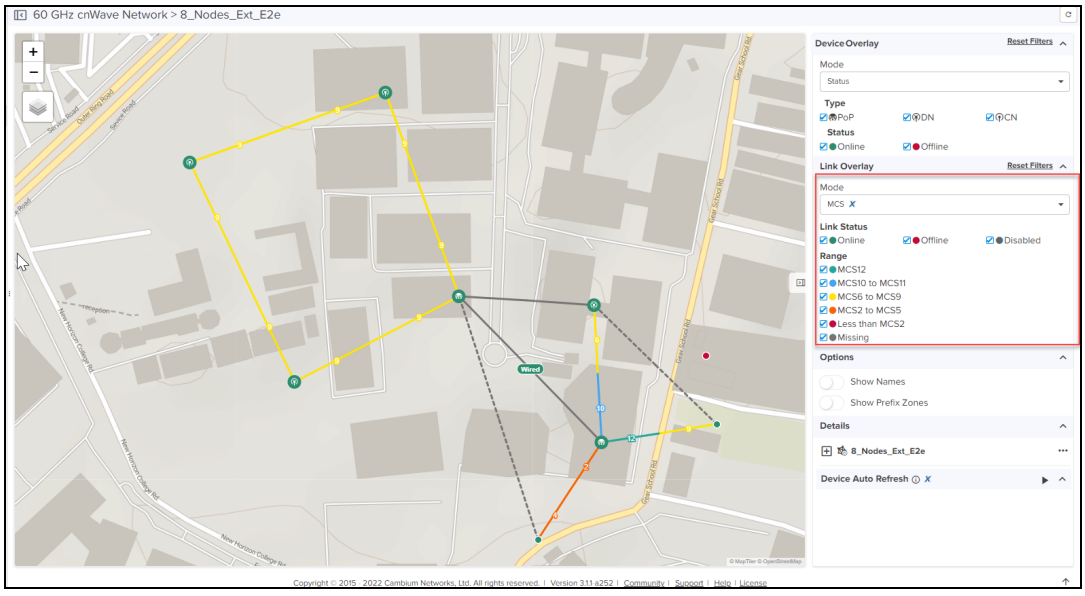
Field	Description
	 4. Select the **Mode** type as **MCS** to view link range. • MCS: MCS shows the link status, and various link ranges represented in different colors.  5. Select the **Mode** type as **RSSI** to view link qualities. • RSSI: RSSI shows various RSSI link qualities represented in different colors.

Table 70: Map fields in E2E Network

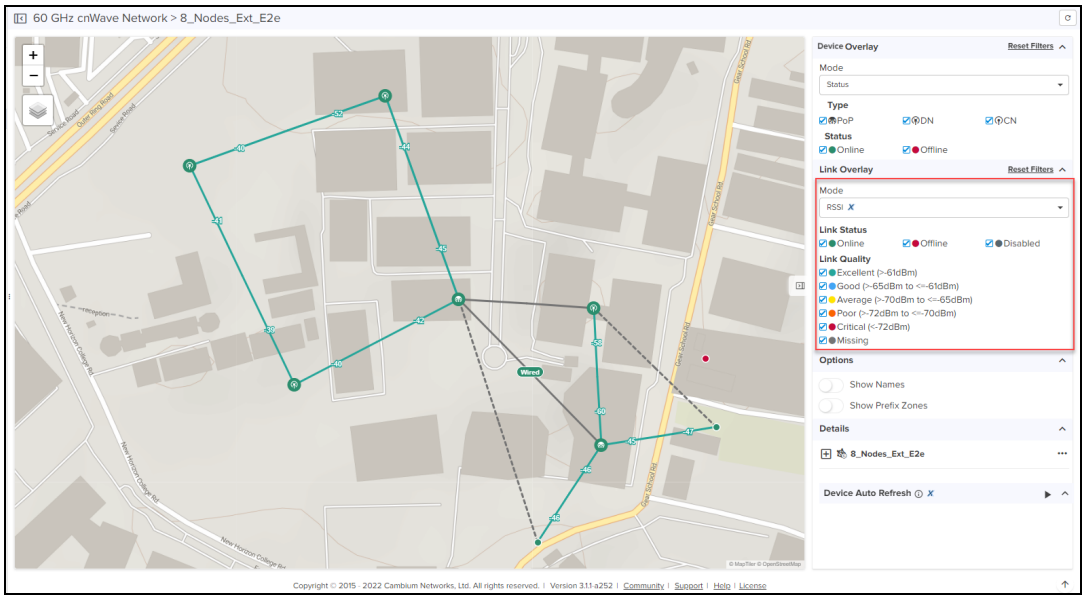
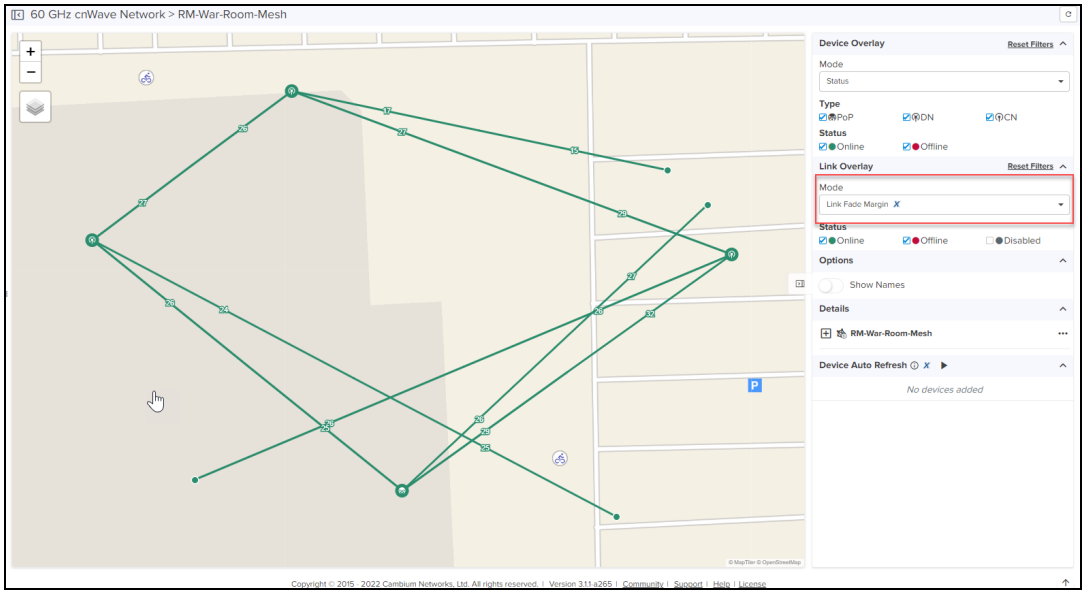
Field	Description
	 6. Select the **Mode** type as **Link Fade Margin** to view link fade margins. • Link Fade Margin: calculates link fade margins between two devices. For details on overview and calculation, refer to the example described in Figure 276.  Note: Link Fade Margin is applicable only when E2E Controller and Device version are 1.2.2. • Airtime% • Throughput (Mbps)
Options	Toggle to view **Show Names** and **Show Prefix Zones,** as described**:** • **Show Name**: shows the name of the nodes available in the E2E Network.

Table 70: Map fields in E2E Network

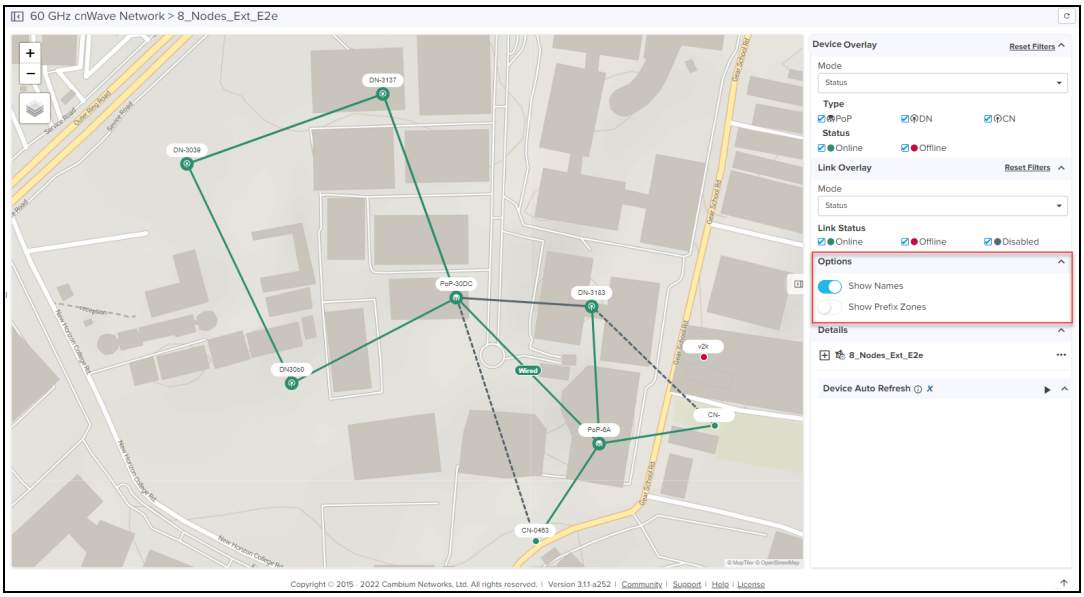
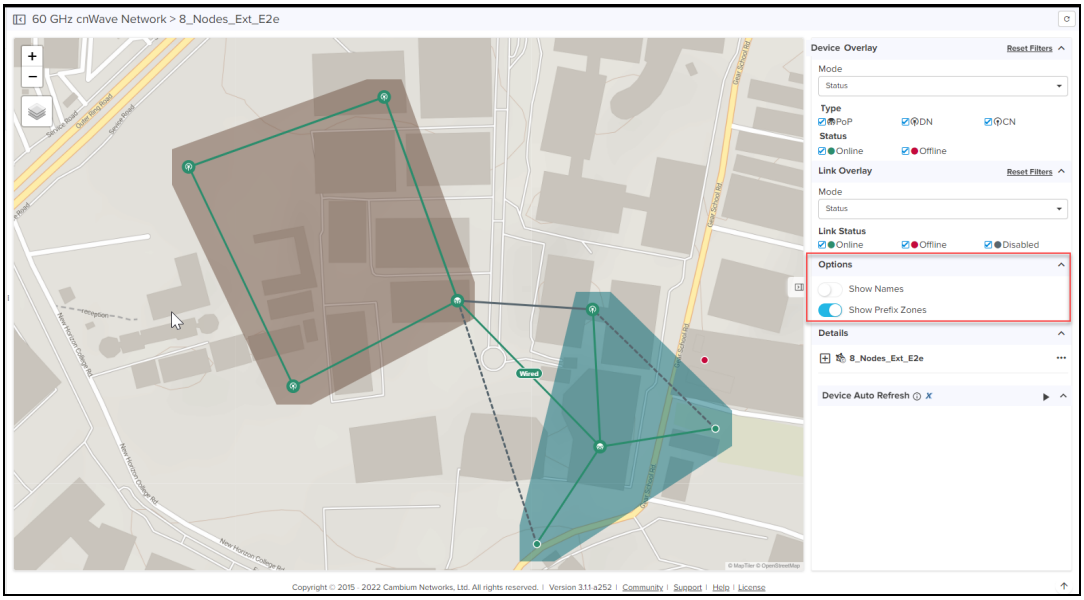
Field	Description
	 • **Show Prefix Zones**: shows the prefix zone of each PoP that is communicating with each other. 
Details	Details: displays the basic details of E2E Network when E2E Network is selected from the tree.

Table 70: Map fields in E2E Network

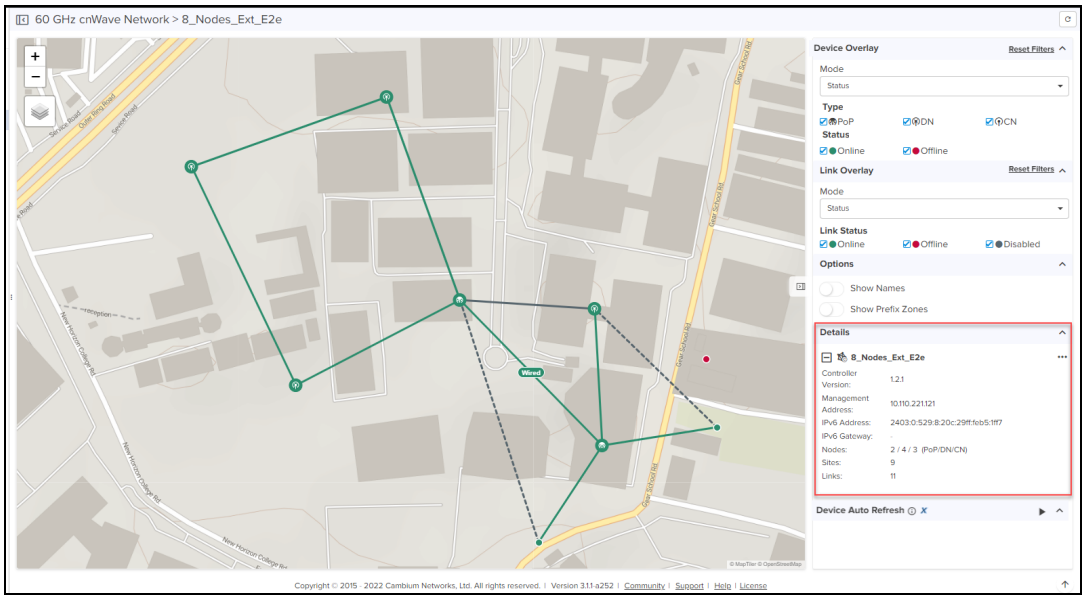
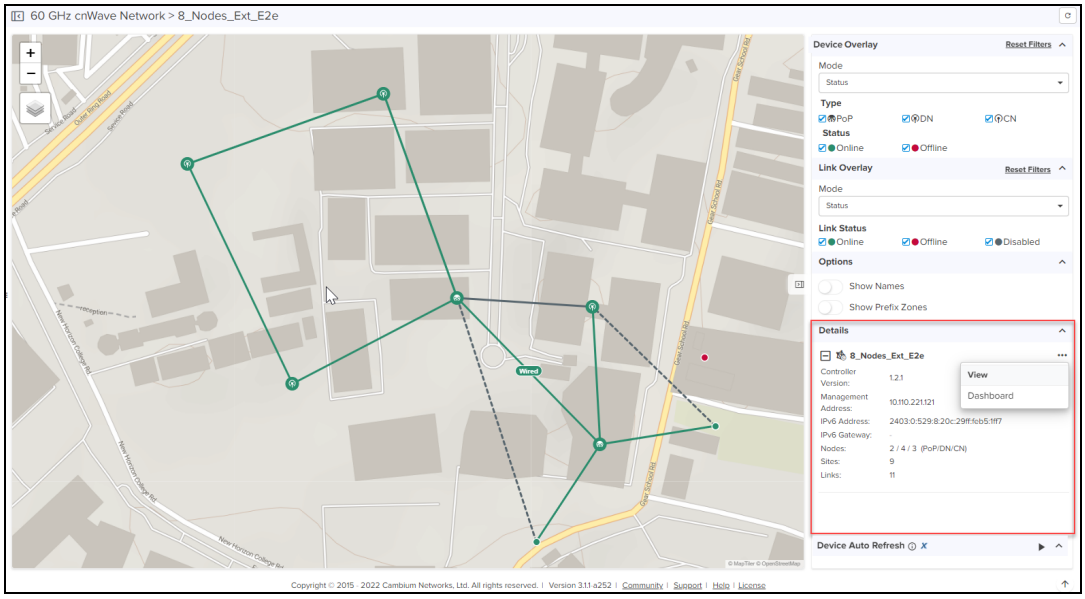
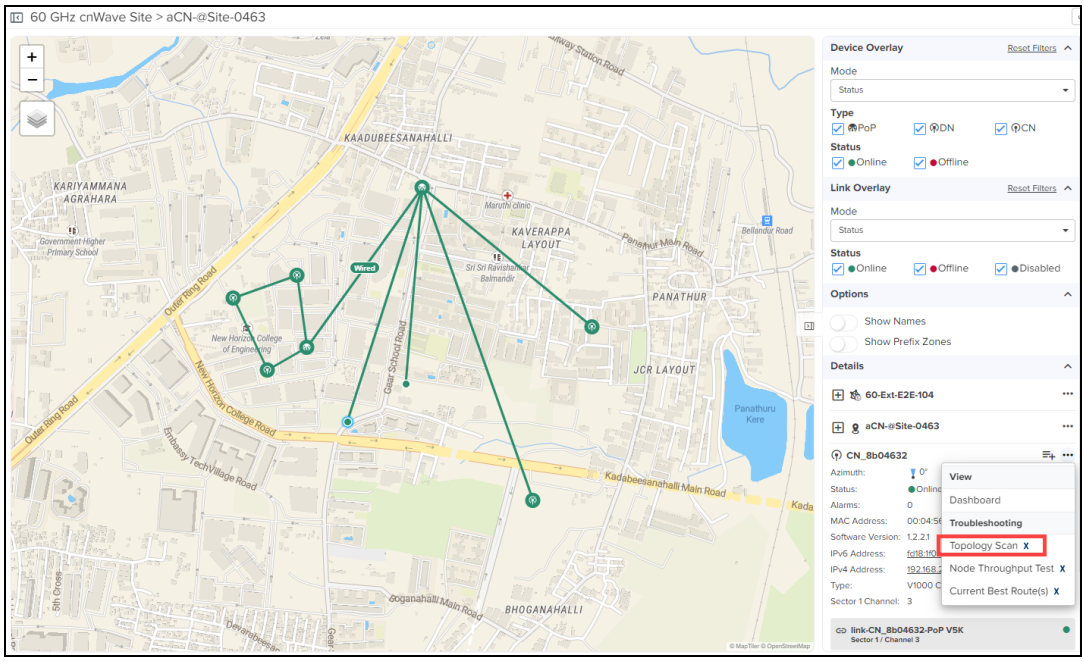
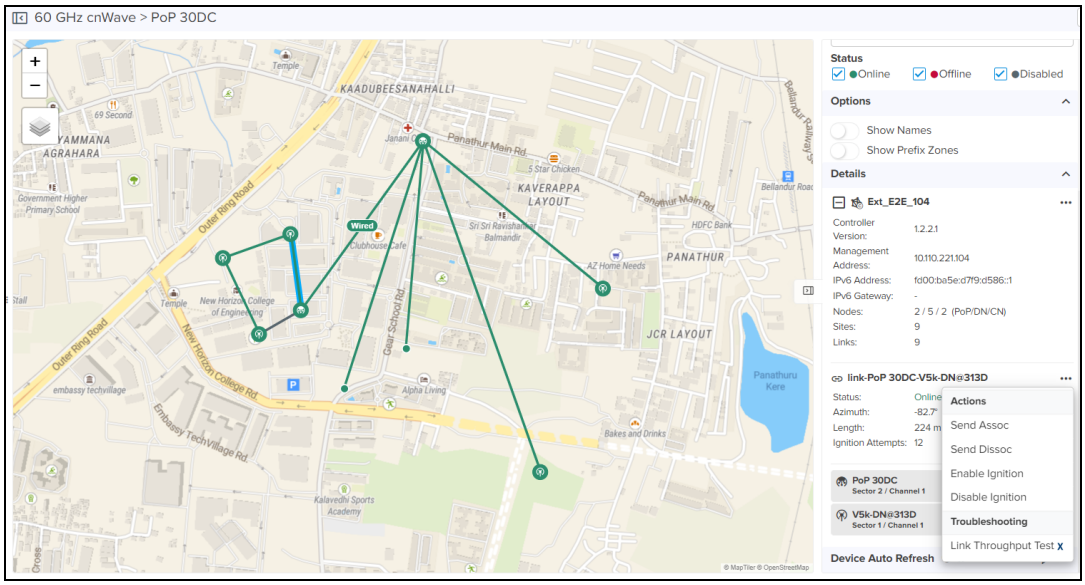
Field	Description
	 1. Click ellipsis (...) icon in the **Details** section to view E2E Network Dashboard.  2. When a device is selected from the map, the device details are displayed. Click ellipsis (...) icon next to the device to view the device **Dashboard** and **Topology Scan.** For more details on how to troubleshoot a node using Topology Scan refer Topology Scan.

Table 70: Map fields in E2E Network

Field	Description
	

- Node Throughput Test and Current Best Routes are added in the Troubleshooting section.

3. When a link is selected from the map, link details are displayed. Click ellipsis (...) icon next to link to view the **Actions** details for the links.

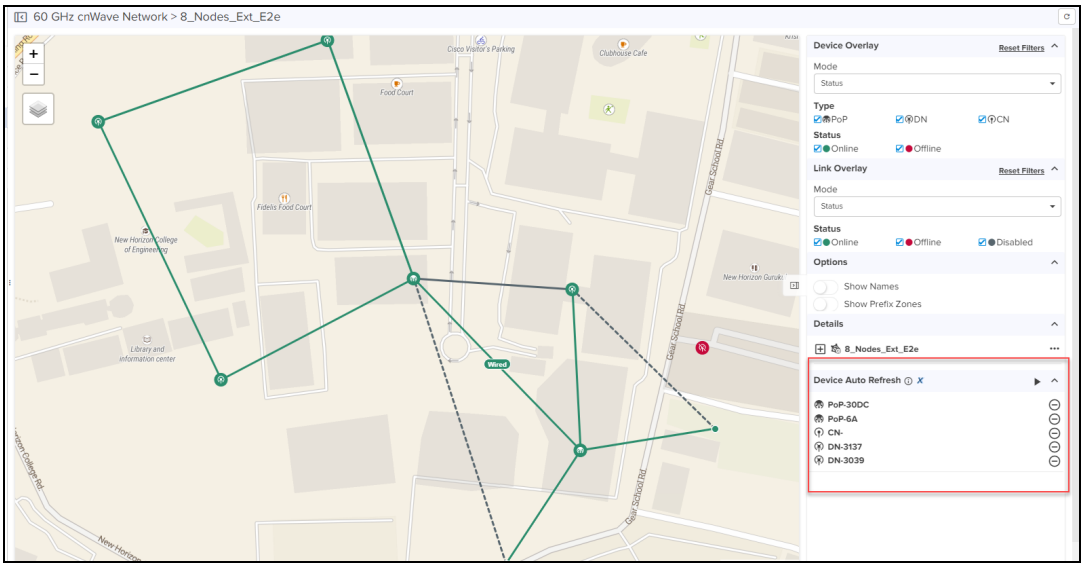


- Link Throughput Test is added in the Troubleshooting section.

Device Auto Refresh: allows to refresh data automatically in the E2E Network.

1. Select the devices in the map and add it to the watch list for **Device Auto Refresh**.
2. Click the (▶) play icon to start **Auto Refresh**.

Table 70: Map fields in E2E Network

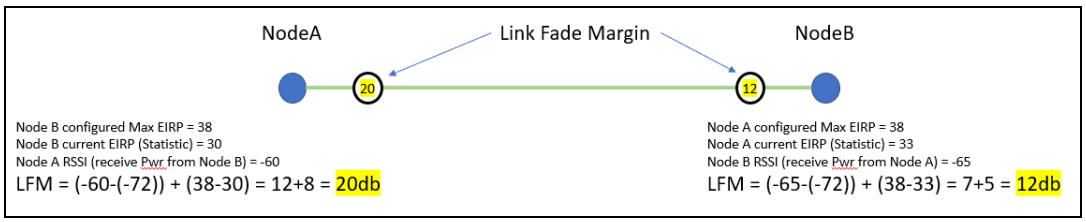
Field	Description
	 Note: A maximum of 10 devices can be added to **Device Auto Refresh**. 3. Click (⊖) to remove devices from **Auto Refresh**.

NOTE:

- Channel and Polarity mode type are available for cnMaestro X users only.
- Airtime%, Golay, SNR, RSSI, MCS, Link Fade Margin, and Throughput (Mbps) are cnMaestro X features.

A new Link Fade Margin (LFM) statistics has been added to the displayed **Link Statistics** tab in 60 GHz cnWave 1.2.2 software version release. This statistic is shown in units of dB, and it is meant to provide operators with a quick way to assess any additional **system gain** a RF link has available in order to help ride out potential RF link fades due to weather (most typical) or other temporary RF link impairments. The rough calculation for LFM is comprised of the RSSI received from a remote transmitter and assessing how much more TX power is available (from the remote transmitter) and how far away the RSSI value is from an established receiver sensitively floor of -72 dBm. The LFM allows operators quicky assess if/where you may have some marginal RF links that need to be addressed in some way. Typical options would be changing an existing node out for a V3K (to get more margin) or possibly dropping in an intermediate DN node such that their RF paths are shorter, typically resulting in a much larger LFM.

Figure 276 Link Fade Margin



Troubleshooting

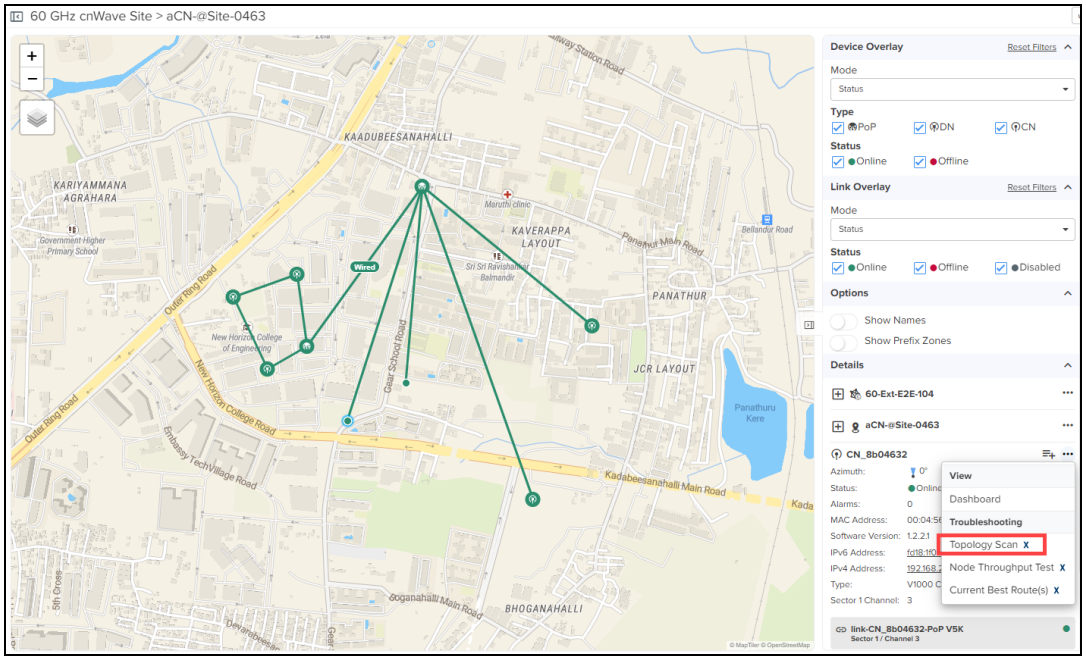
- Topology Scan
- Node Throughput Test
- Current Best Routes
- Link Throughput Test

Topology Scan

Topology Scan X allows you to discover your entire network and create comprehensive, detailed network topology maps. This tool will only detect nodes operating in responder mode. It will not detect CNs with a wireless link already established. Offline nodes with a configured channel override will not be detected on a different channel.

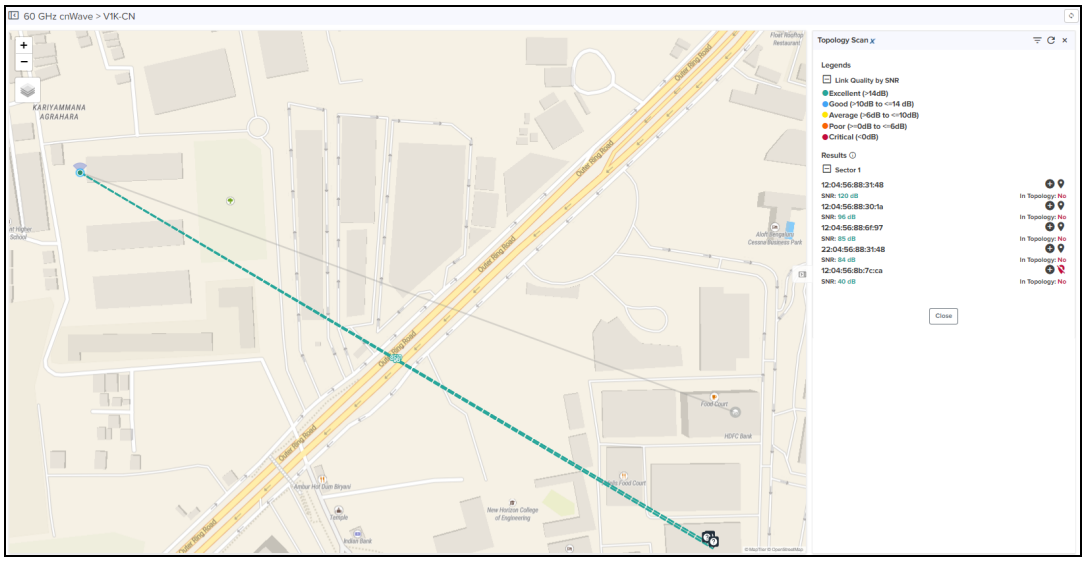
	NOTE: Topology Scan will cause a momentary throughput reduction in nearby links.

1. Select a Node from the Map.
2. Click ellipsis (•••) icon next to the device to select the **Troubleshooting** > **Topology Scan.**



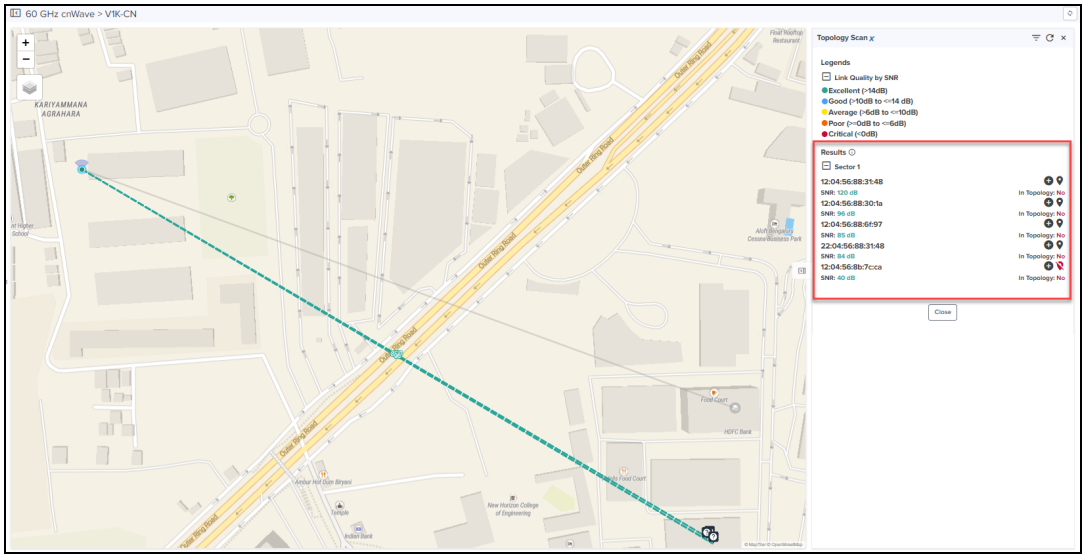
Topology Scan preview window is displayed towards the left pane.

3. Click **Start Topology Scan**. Topology Scan begins as shown in the following figure.



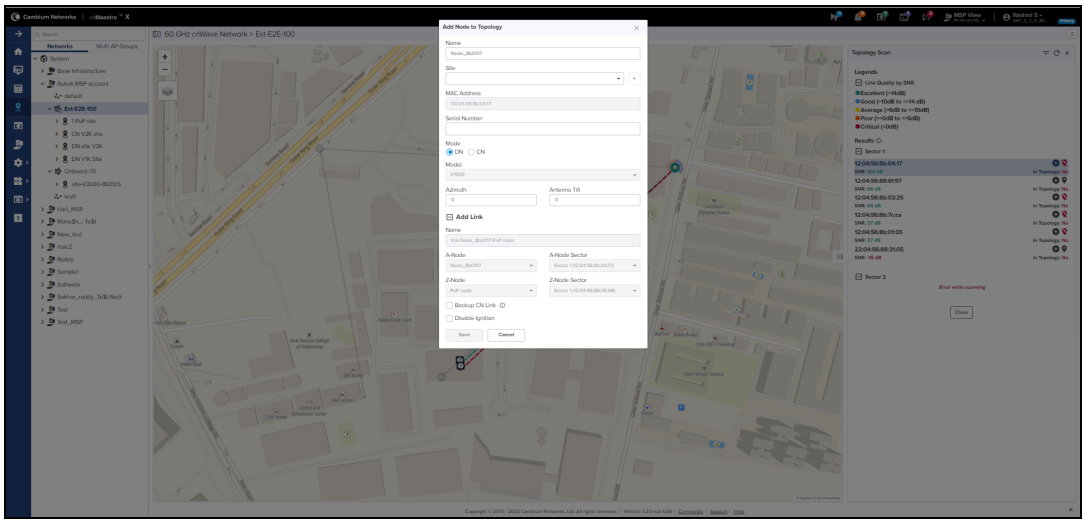
4. Click **Configure SNR Limit** ( ) next to **Topology Scan** header to add new value or reset the existing value. By default SNR value is 5 dB.
5. Click ( ) refresh icon to scan again.

The results are based on **Link Quality by SNR** and the results are shown in the left pane. MAC Address of the links and the Link Quality is displayed.



After topology scan, map displays available nodes and links in the network by Link Quality color codes. Only links available with GPS coordinates are shown in the map. You can add site, node, and link to the topology by clicking the plus sign **In Topology.**

6. **Add Node to Topology** window pops up.

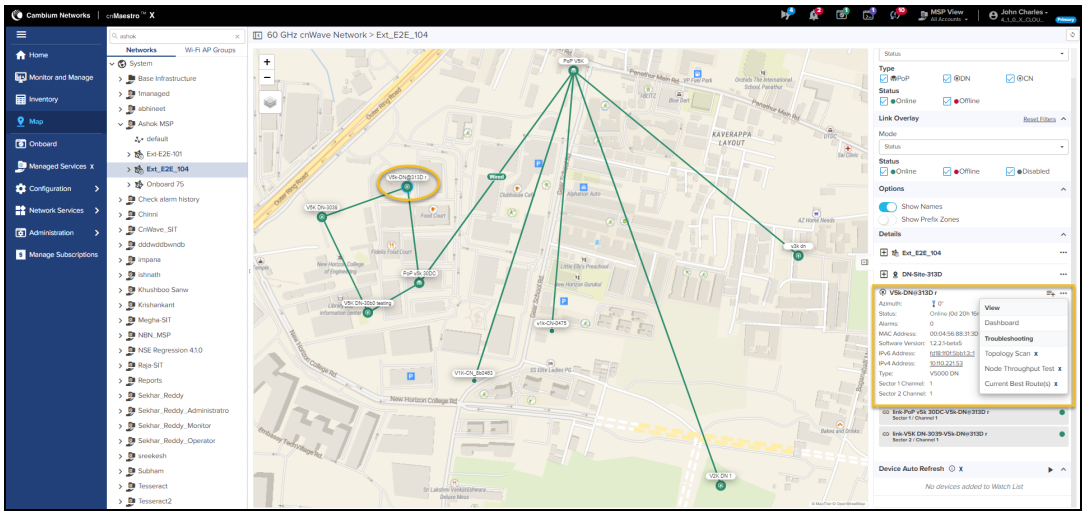


7. Enter the node and link details and click **Save**.

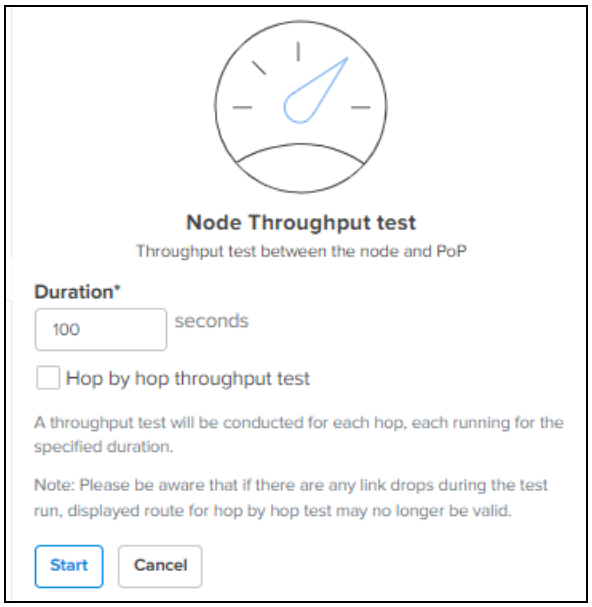
Node Throughput Test X

To run a node throughput test, do the following:

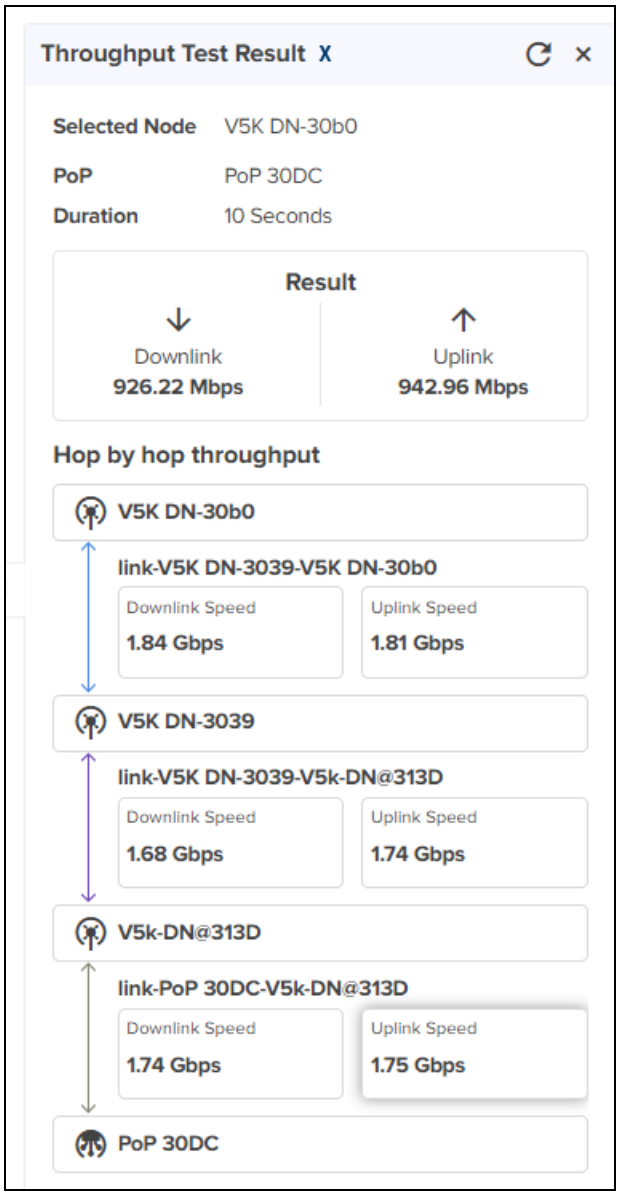
1. Select a device except the POP Node from the Map.



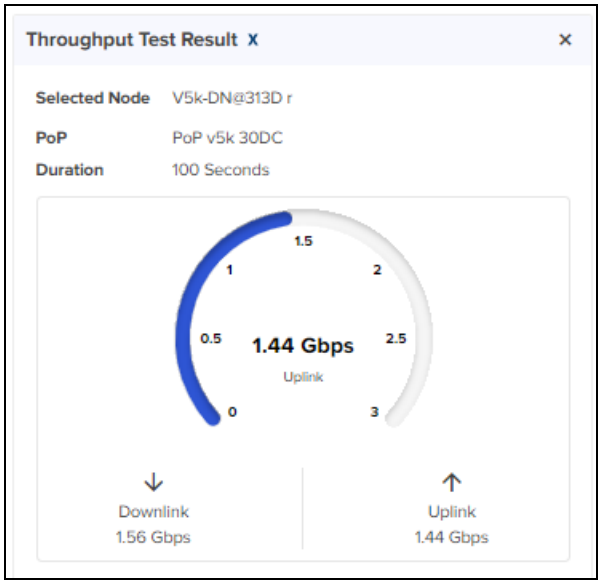
2. Click ellipsis (...) icon next to the device name in the right pane, and select **Troubleshooting** >**Node Throughput Test X**



3. Enter the **Duration** between 5 to 300 seconds.
4. Select the **Hop by hop throughput test** check box to view the throughput for each hop separately.



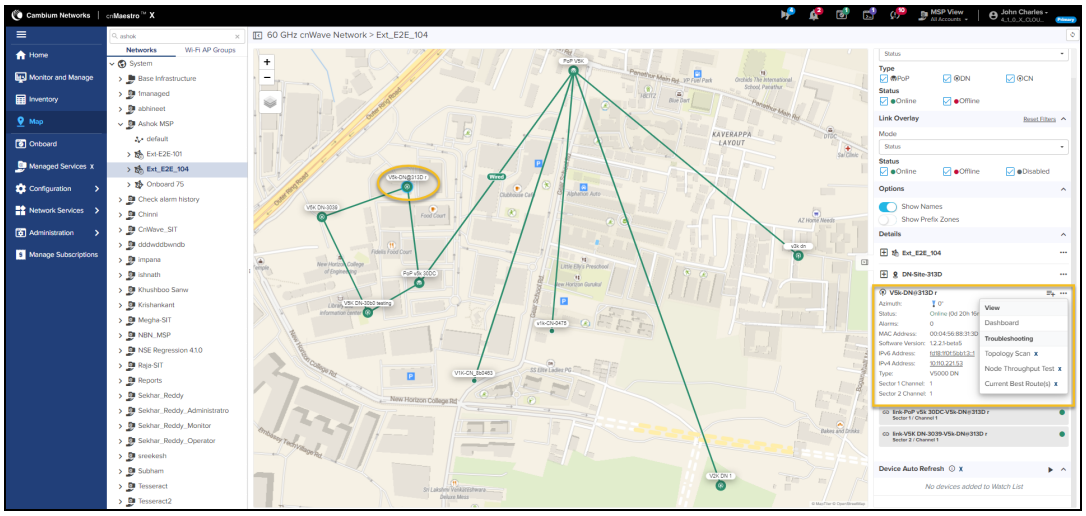
5. Click **Start**.



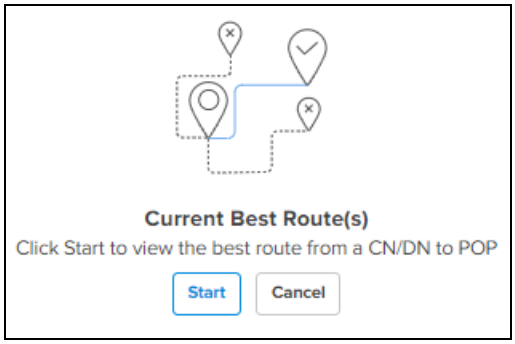
Current Best Routes X

To find the current best routes, do the following:

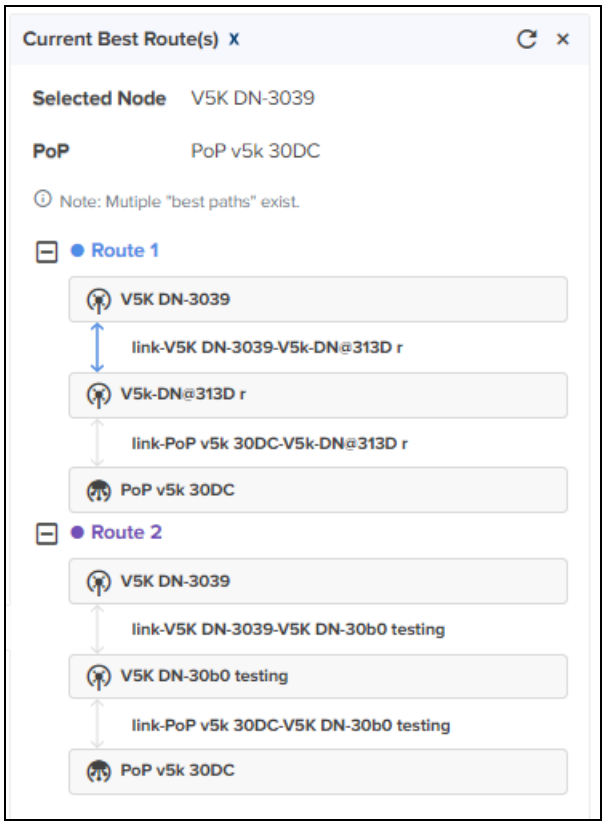
1. Select two nodes from the Map.



2. Click ellipsis (•••) icon next to the device, and select **Troubleshooting** >**Current Best Routes X**



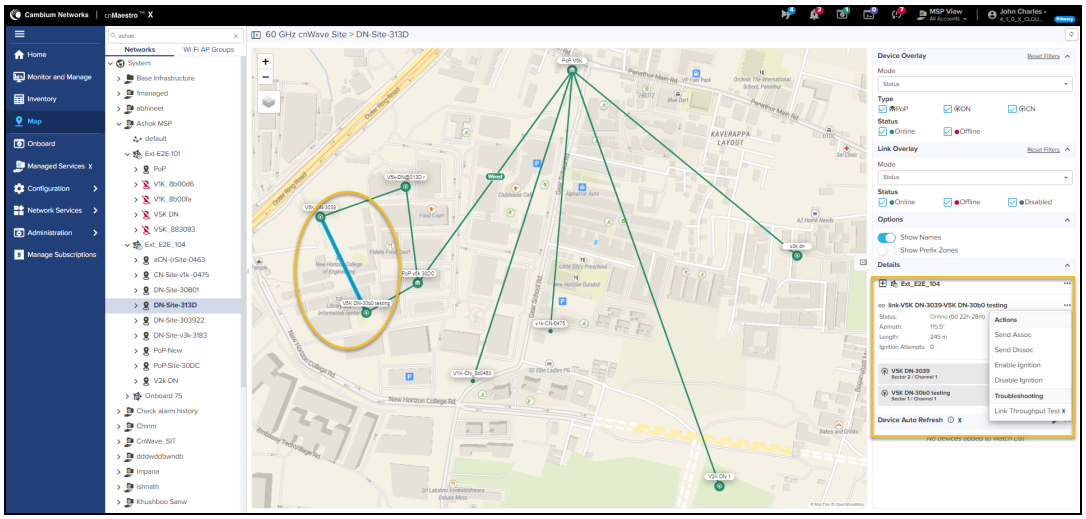
3. Click **Start**.



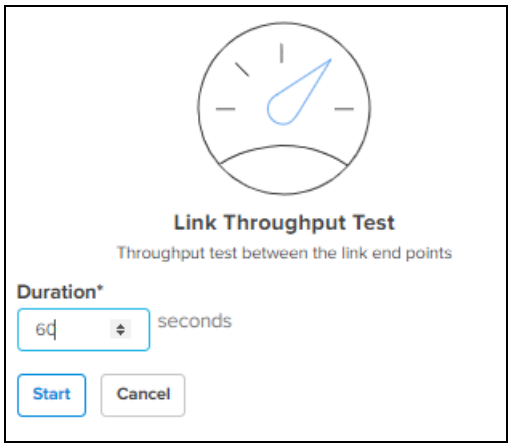
Link Throughput Test X

To run a link throughput test, do the following:

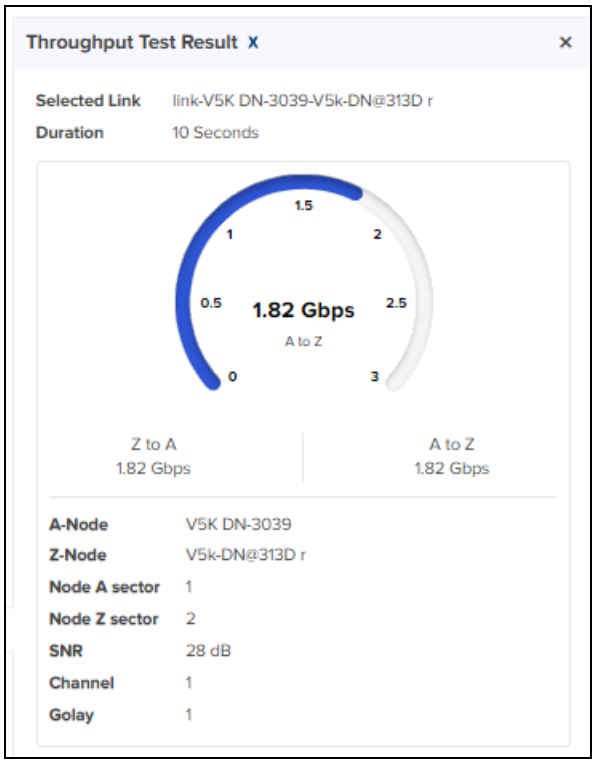
1. Select a Link from the Map.



2. Click ellipsis (•••) icon next to the link, and select the **Troubleshooting** >**Link Throughput Test X**



3. Enter the **Duration** between 5 to 300 seconds.
4. Click **Start**.



	NOTE: **Show Prefix Zones** is enabled only if **Prefix Allocation** is set to **Deterministic**.

Tools

The Tools page allows the user to perform the following actions:

- Operations
- Diagnostics
- Debug
- Remote Command

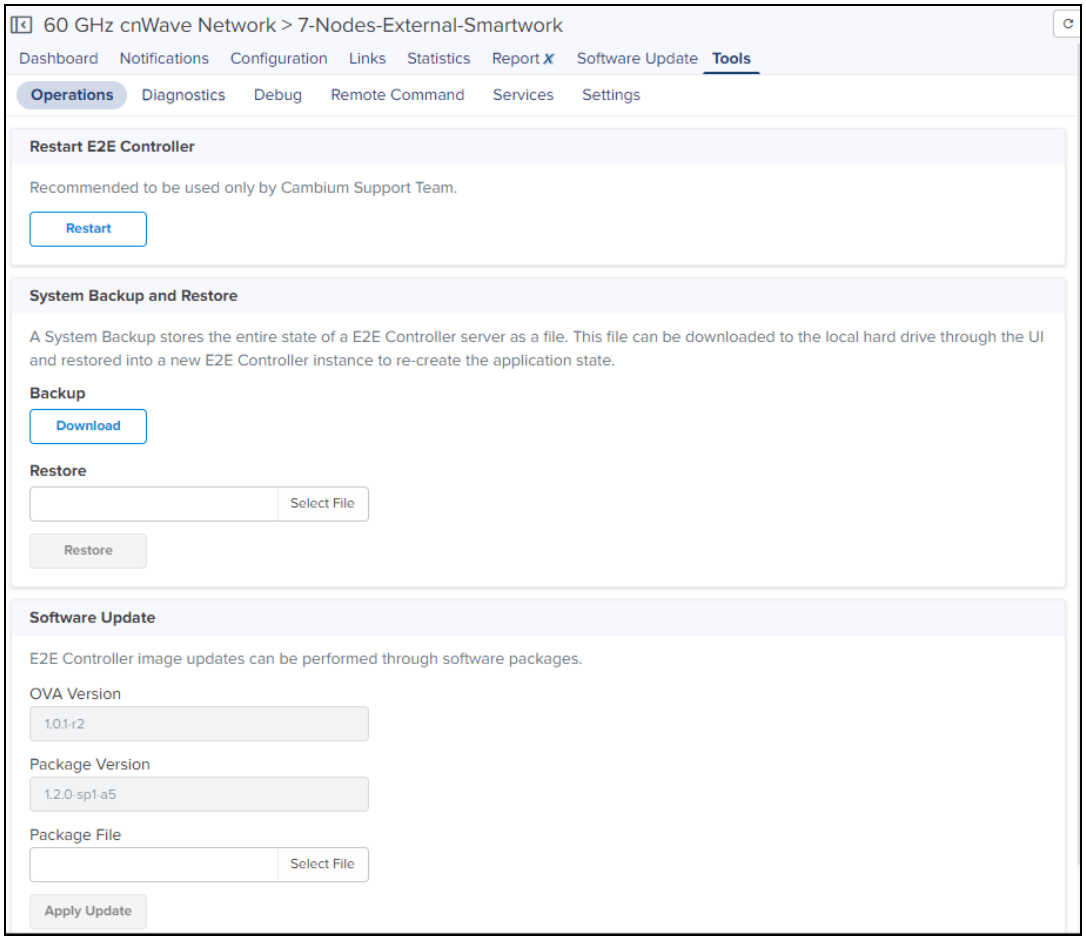
- Services
- Settings

Operations

External E2E Controller deployment

If the device is deployed through **External E2E Controller** it displays the operations page as follows:

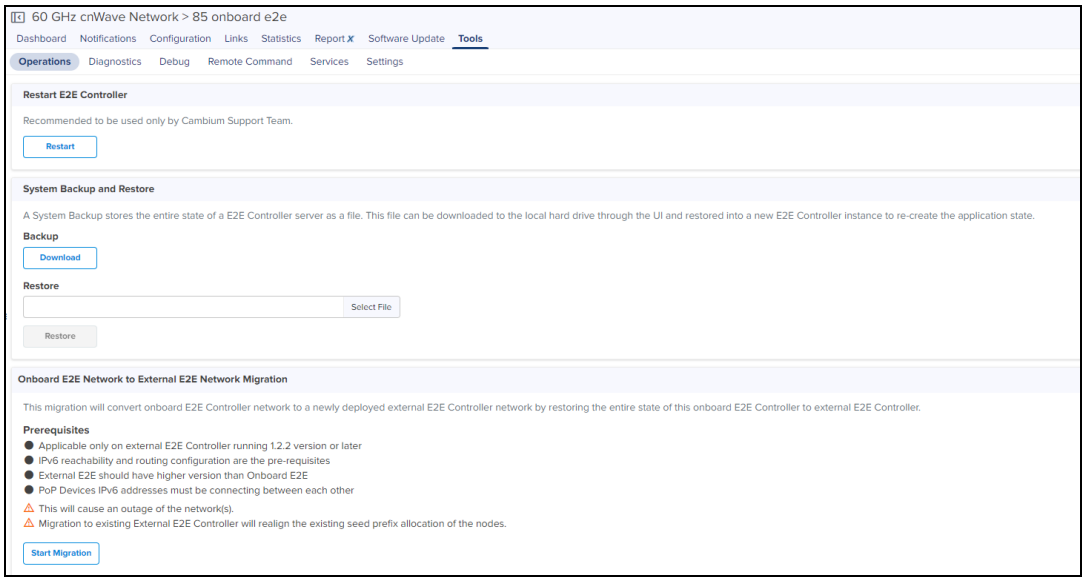
- **Restart E2E Controller** performs the **Restart.**
- A **System Backup and Restore** the entire state of a E2E Controller server as a file and file can be used to transfer data between two E2E Controller instances. It can be saved in local hard drive through the UI and restored into a new E2E Controller instance to re-create.
- The **Software Upgrade** is to upgrade E2E controller and can be done through E2E controller package.



Onboard E2E Controller deployment

If the device is running **Onboard E2E Controller** it displays the operations page as follows:

- **Operations** page allows the user to **Restart E2E Controller** and perform the **System Backup**. It also stores the entire state of a E2E Controller server as a file and file can be used to transfer data between two E2E Controller instances. It can be saved in local hard drive through the UI and restored into a new E2E Controller instance to re-create the application state.



Onboard E2E to External E2E Migration

When you onboard an E2E Controller to External E2E Controller with or without sites, consider the following prerequisites:

- Applicable only on external E2E Controller running with 1.2.2 version or later.
- IPv6 reachability and routing configuration are pre-requisites.
- External E2E Controller should have higher version than Onboard E2E.
- PoP Devices IPv6 addresses must be connecting between each other.

When you onboard an E2E Controller to External E2E Controller with sites, consider the following prerequisites:

- Multiple Multi-PoP Networks must not be connected to same wired switch.
- Selected Onboard Network and External E2E Controller networks for migration should not have same site and device names.

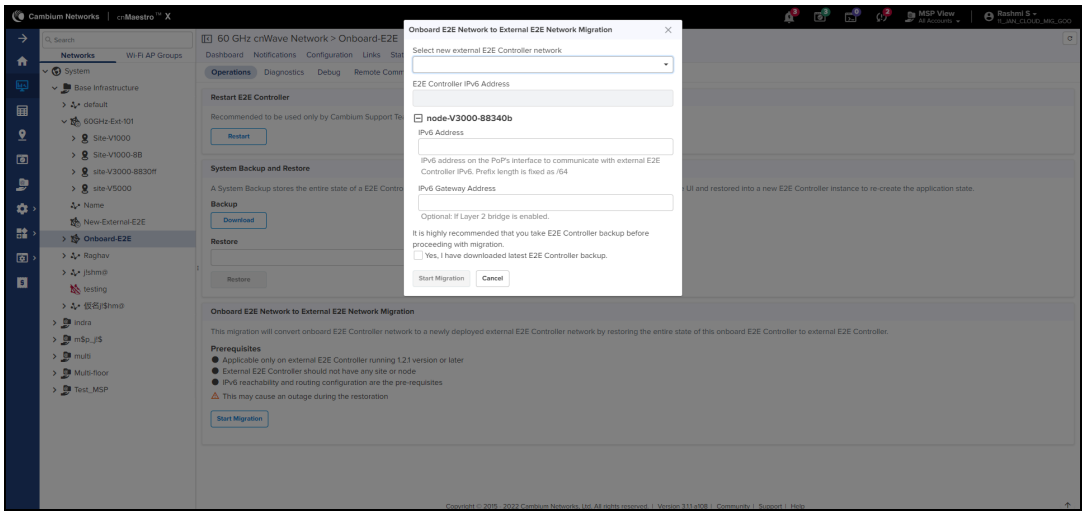
Post Migration Steps:

- Multi-PoP / Relay Port should be updated with the interface as in PoP interface configuration if not already done, to allow the connection between PoPs.
- If the existing E2E Network if configured with BGP, migrated PoP BGP Configuration must be updated in cnMaestro and then in POP GUI
- If the PoPs are not on the same L2 network:
    - Controller configuration about broadcast should be set to true.
    - If External E2E Controller and PoP devices are not connected/routed through a network router
        - It is recommended to set Deterministic prefix algorithm
        - Routes to each PoP with respective Seed Prefix should be added manually in E2E Controller.

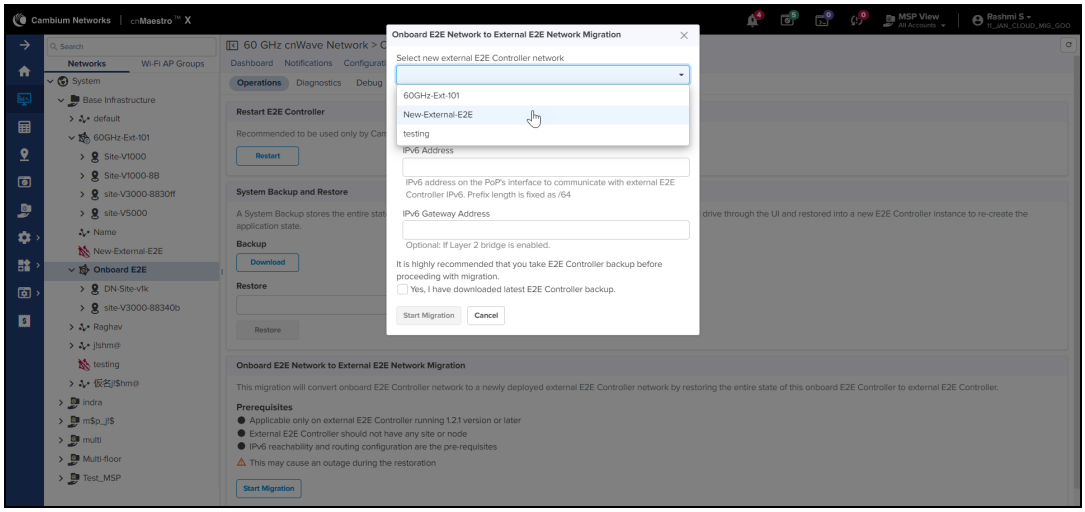
Perform the following steps to migrate Onboard E2E Controller to External E2E Controller:

1. Select Onboard E2E Network > **Tools** > **Operations.**
2. Click **Start Migration**.

The **Onboard E2E Controller to External E2E Migration** window appears.

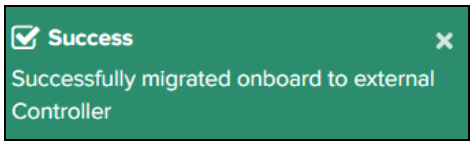


3. Select a new external E2E Controller network from the drop-down.

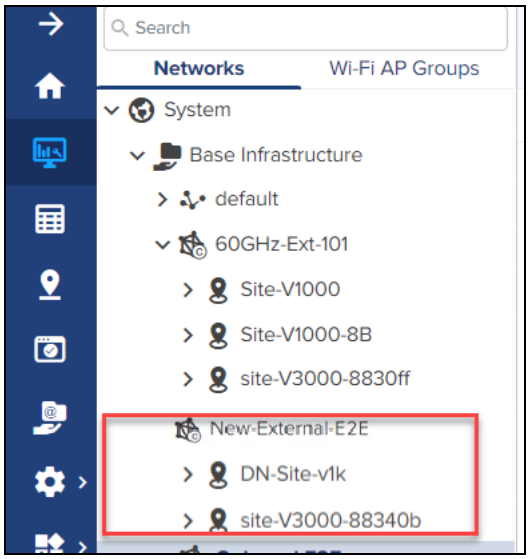


4. Enter **IPv6 Address**.
5. Enter **IPv6 Gateway Address** of PoP node, which is optional.
6. Select the checkbox next to **Yes, I have downloaded latest E2E Controller backup**.
7. Click **Start Migration**.

A successful message on migration process is displayed.



The Onboard E2E Controller network is migrated with all the sites and nodes into External E2E Controller, as shown below:



Fallback to Onboard E2E Network

The fallback process is applicable only for External E2E networks where Onboard to External E2E Network migrated. Perform the following steps to fallback to Onboard E2E Network after the migration from Onboard to External E2E Network.

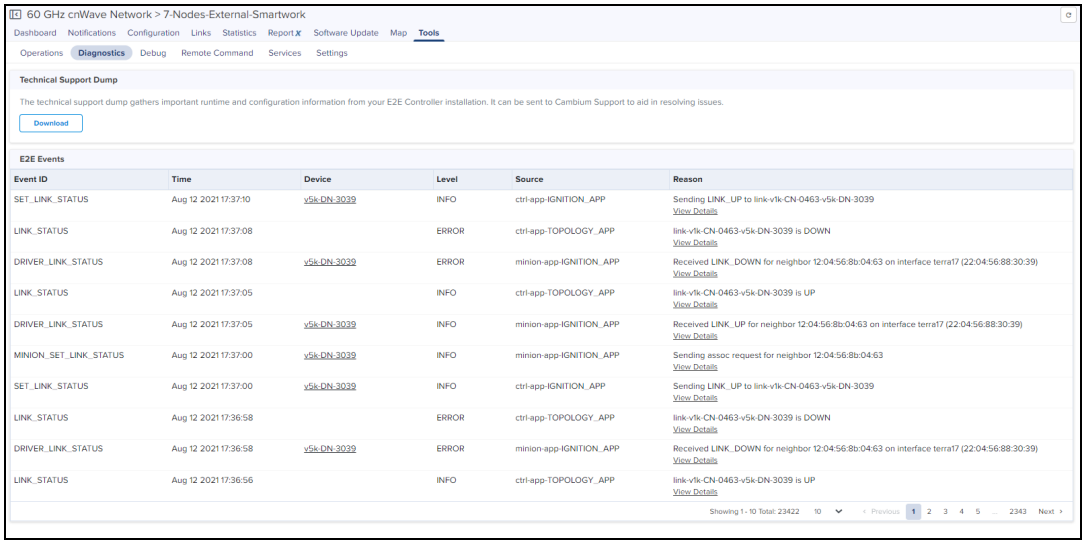
1. Change the Controller IPv6 in the PoP from cnMaestro in External E2E Controller.
2. Go to PoP GUI and when the status displays as not connected, Enable Onboard E2E Controller.
3. Disconnect the External E2E controller from cnMaestro.
4. Delete the devices and sites in cnMaestro when the External Controller is offline, as they will conflict with Onboard E2E network devices when connected to cnMaestro.
5. In cnMaestro, approve the Onboard E2E network and restore the backup taken before the Migration.
6. Verify the Network and devices status in PoP device GUI and cnMaestro.

Diagnostics

Diagnostics page allows the user to gather Technical Support Dump and can be downloaded and sent to cambium support team.

All the events information of E2E controller can be viewed under E2E Events. In **E2E Events** tab user can view the **Event ID, Time, Device, Level, Source** and **Reason** of the E2E Network.

Figure 277 Diagnostics



Debug

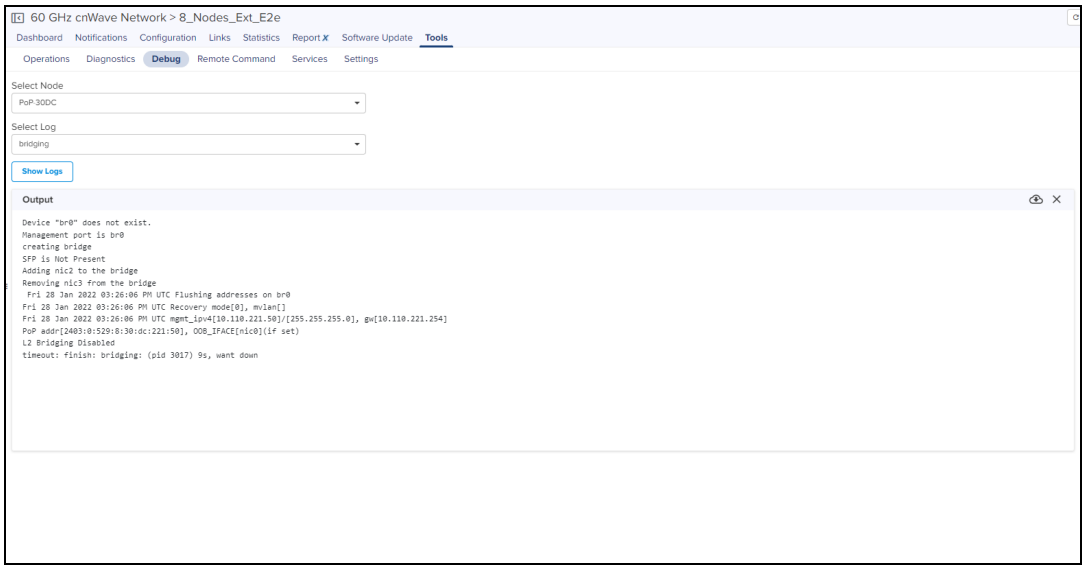
In **Debug** tab, you can view and download the Node logs by executing the following log:

- bridging
- e2e_minion
- openr
- pop_config (available for PoP device)
- exabgp (available for PoP device)
- cnAgent (available for Onboard PoP device)
- e2e_controller (available for Onboard PoP device)

To view the logs:

1. Navigate to **Tools > Debug**.
2. Select a node name from the **Select Node** drop-down.
3. Select the required log name from the **Select Log** drop-down.
4. Click **Show Logs.**

The output for the selected criteria appears as shown:



- Click download ( ) icon to download the generated output.
- Click clear (✕) icon to clear the output.

Remote Command

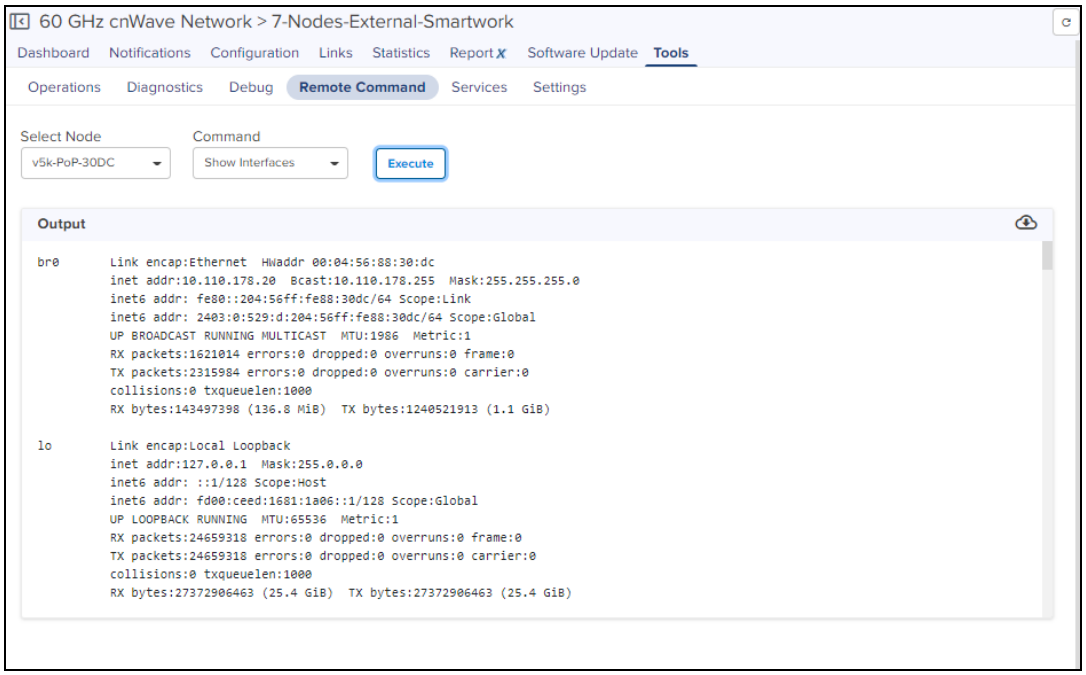
In **Remote Command** tab, user can view or download command logs by executing the following command:

- Show Interfaces
- Show Routes
- Show OpenR Adjacencies
- Show OpenR Prefixes
- Show SFP Power Details (applicable for V5000 and V3000)
- Show IPv4 Neighbors
- Show IPv6 Neighbors
- Show Wired Interface State Changes
- Ping

To execute the command:

1. Navigate to **Tools > Remote Command**.
2. Select a node name from the **Select Node** drop-down.
3. Select the required command from the **Command** drop-down.
4. Click **Execute.**

The output for the selected criteria appears as shown:



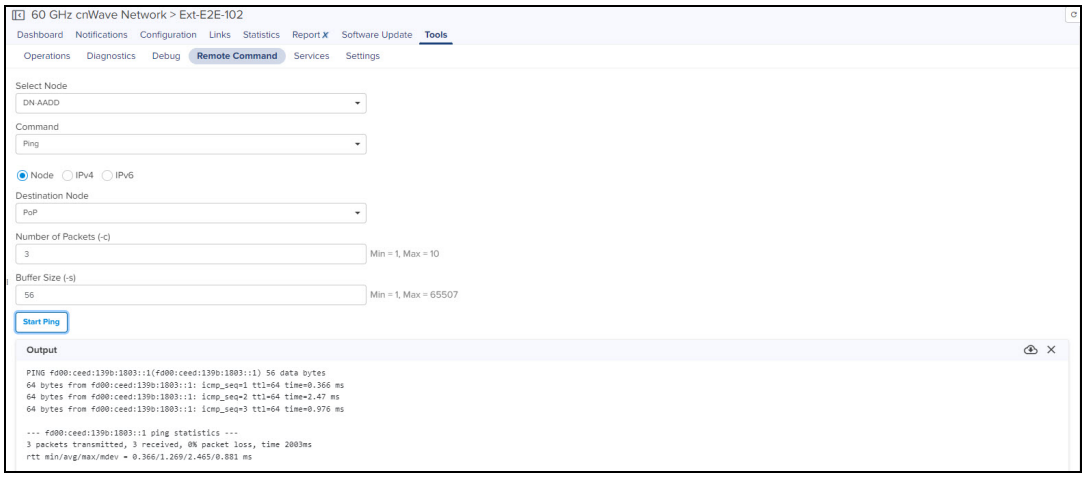
5. Click the download ( ) icon to download the generated output.
6. Click the clear (✕) icon to clear the generated output.

To execute Ping command, perform the following steps:

1. Select the **Ping** command from drop-down.
2. Select **Node** or type of **IP address** (IPv4 or IPv6).
3. Select the following options:
   - Destination Node
   - Number of packets minimum 1 to maximum 10 (-c)
   - Buffer Size minimum 1 to maximum 65507 (-s)
4. Click **Start Ping**.

Output is displayed, as shown in Figure 278.

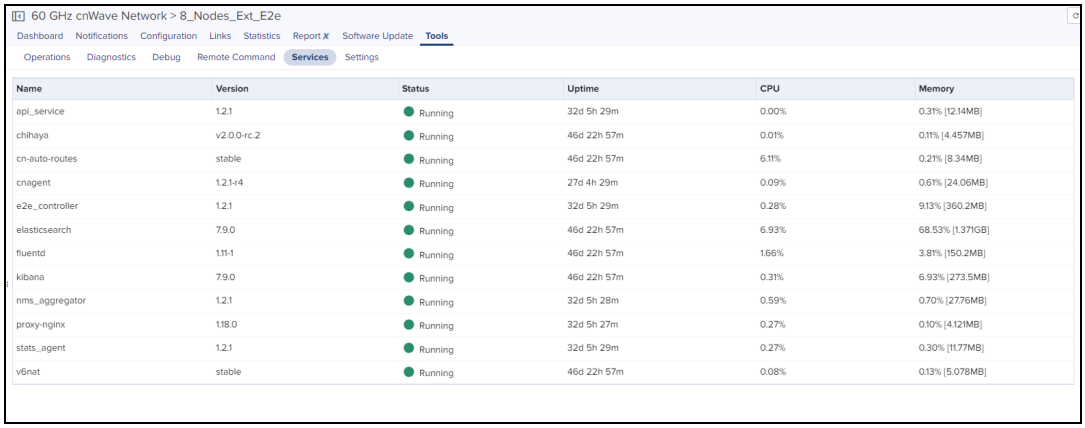
Figure 278 Remote Command: Ping



Services

In **Services** page user can view the services running in E2E Controller.

Figure 279 Services



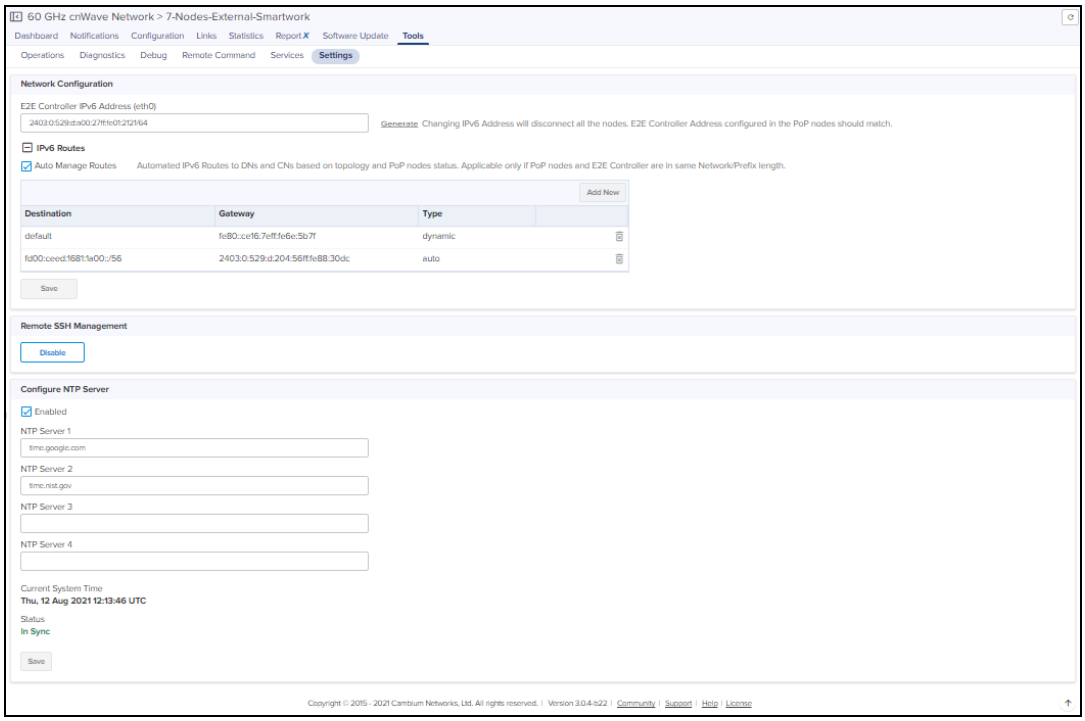
Settings

	NOTE: E2E Settings are not applicable for Onboard E2E Controller deployment.

External E2E Controller deployment

External E2E Network displays the **Settings** page as follows:

Remote SSH Management allows the user to enable and disable **Remote SSH Management**.



In **Network Configuration** user can configure the **E2E Controller IPv6 Address** and **IPv6 Routes**.

To change **E2E Controller IPv6 Address**, perform the following:

1. Navigate to **Tools > Settings > Network Configuration** tab.

2. Click **Generate** to automatically generate IPv6 address or manually change the IPv6 Address of E2E Controller.
3. Click **Save**.

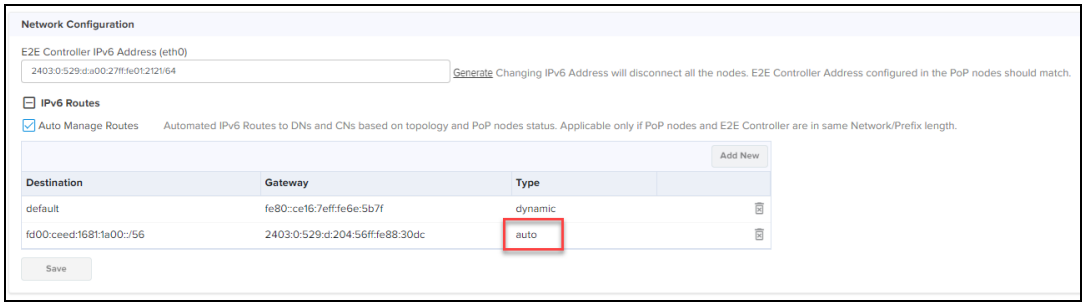
To configure **IPv6 Routes**, perform the following:

You can also enable the **Auto Manage Routes**. This automates IPv6 Routes to DNs and CNs based on the topology and PoP nodes status. It is applicable only if PoP nodes and E2E Controller are in same Network/Prefix length.

If IPv6 routes is enabled as **Auto Manage Routes**, **Type** field displays as **Auto**.

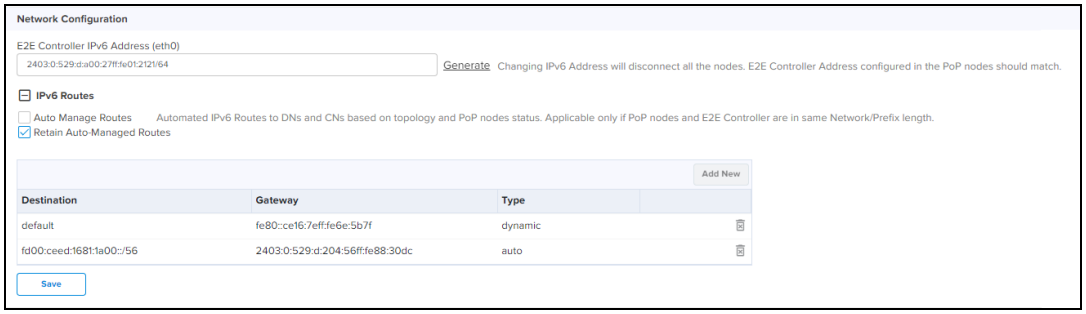
To Enable Auto Managed Routes:

1. Navigate to **Tools > Settings > Network Configuration** tab.
2. Enable **Auto Manage Routes**.
3. Click **Save**.

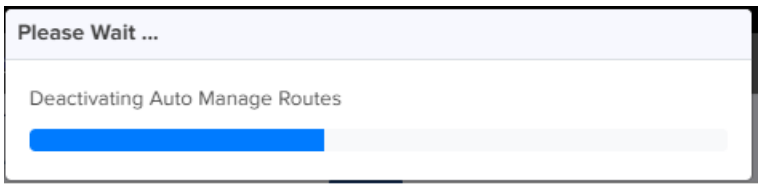


To retain auto-managed routes, even after auto-managed routes is disabled, complete the following steps:

1. Navigate to **Tools > Settings > Network Configuration** tab.



2. Enable **Retain Auto-Managed Routes.**
3. Click **Save.**



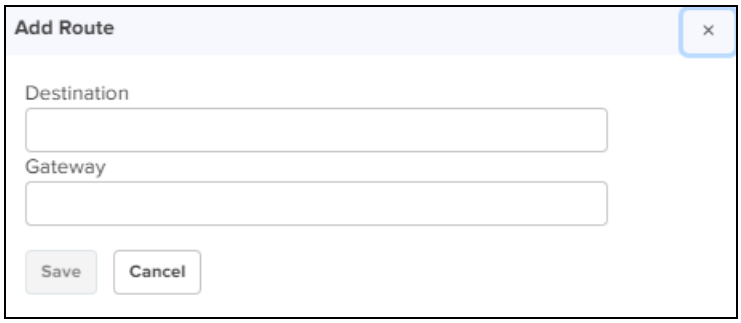
4. Please wait pops-up.

Once the Auto Manage Routes is disabled, IPv6 routes can be managed through static routes and in type it displays as **Static**.

5. Click **Save**.

To add new static **IPv6 Routes**:

1. Click **Add New**.

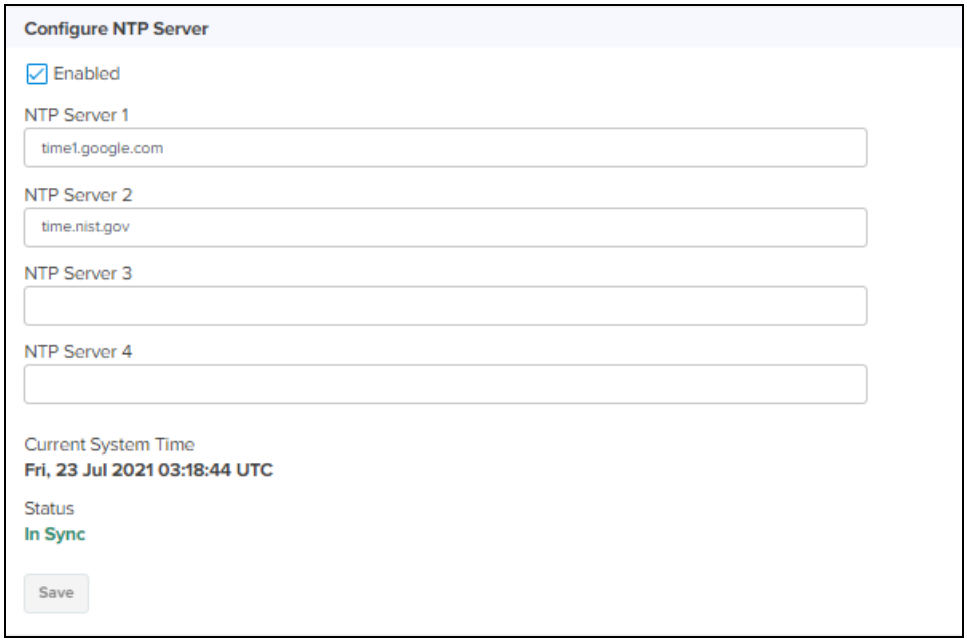


2. Enter **Destination** and **Gateway**.
3. Click **Save.**

The user can configure the **NTP Settings** to configure the time configuration of the server with hostname or IP address.

To configure the NTP server:

1. Navigate to **Tools > Settings > NTP Settings** tab.
2. Enable the **NTP Settings**.
3. Enter **Host Name** or **IP Address**. It displays **Current System Time** and **Status** of the server.

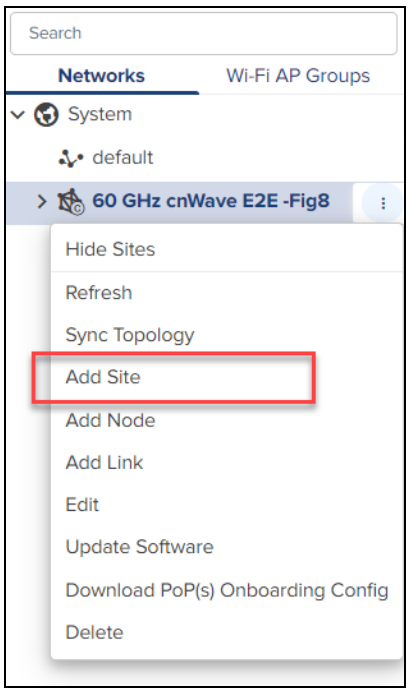


Site Configuration

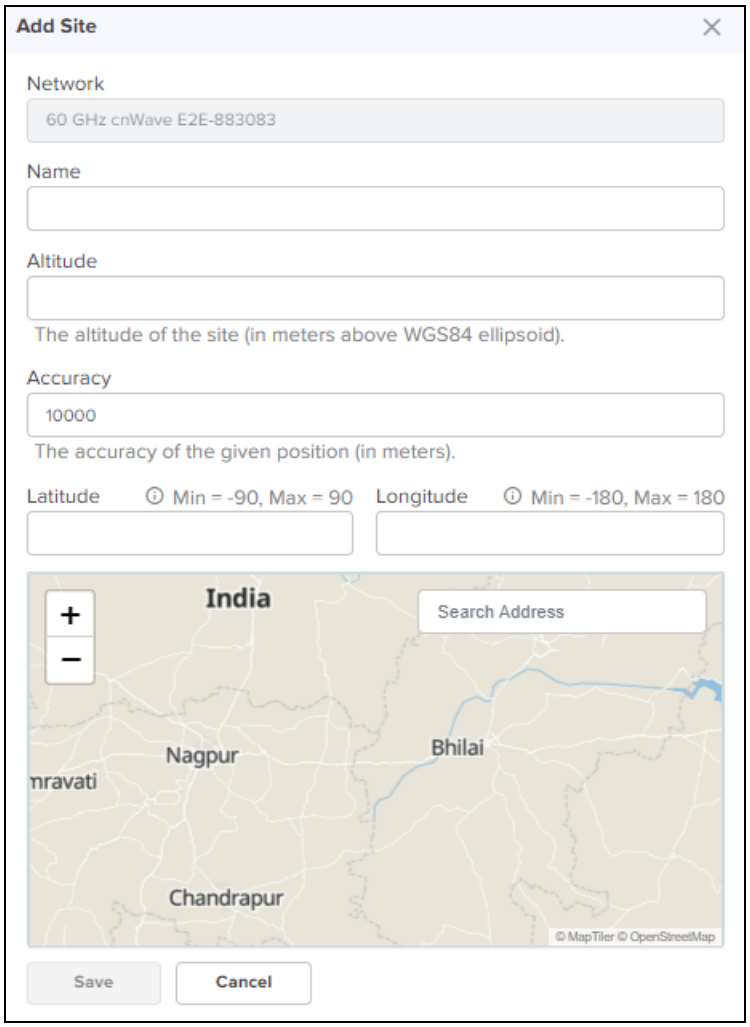
Sites are located within the networks and wireless access points attached to it.

To Add a Site

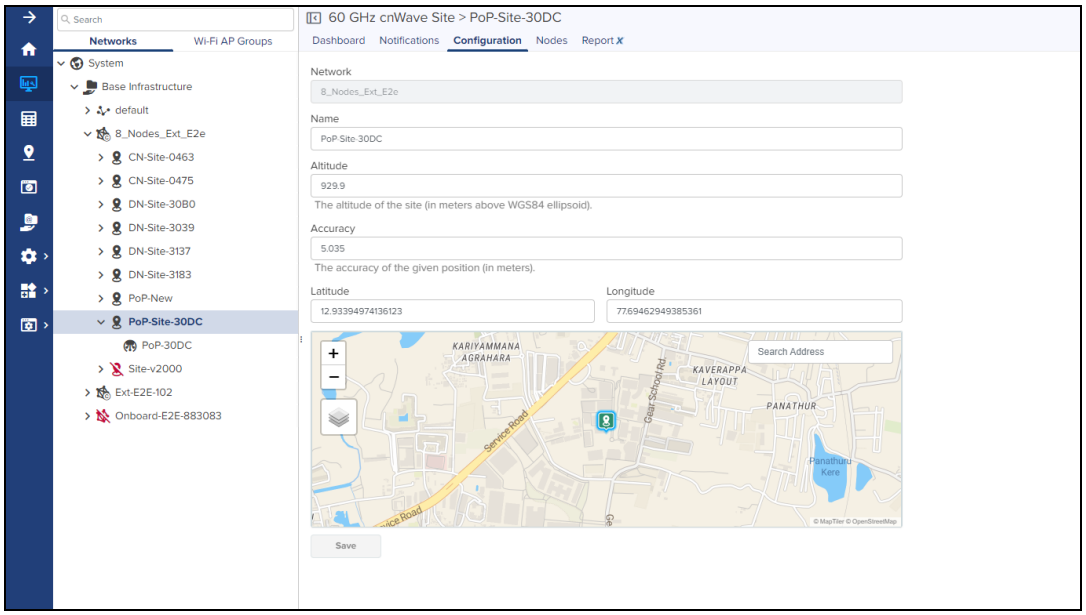
1. Navigate to **Network** and click ⋮ icon.
2. Select **Add Site** from the drop-down.



3. Enter the **Name**, **Altitude**, and **Accuracy.**
4. Once the address is entered in the Map, Latitude and Longitude gets fetched automatically. You can also enter the details Manually.

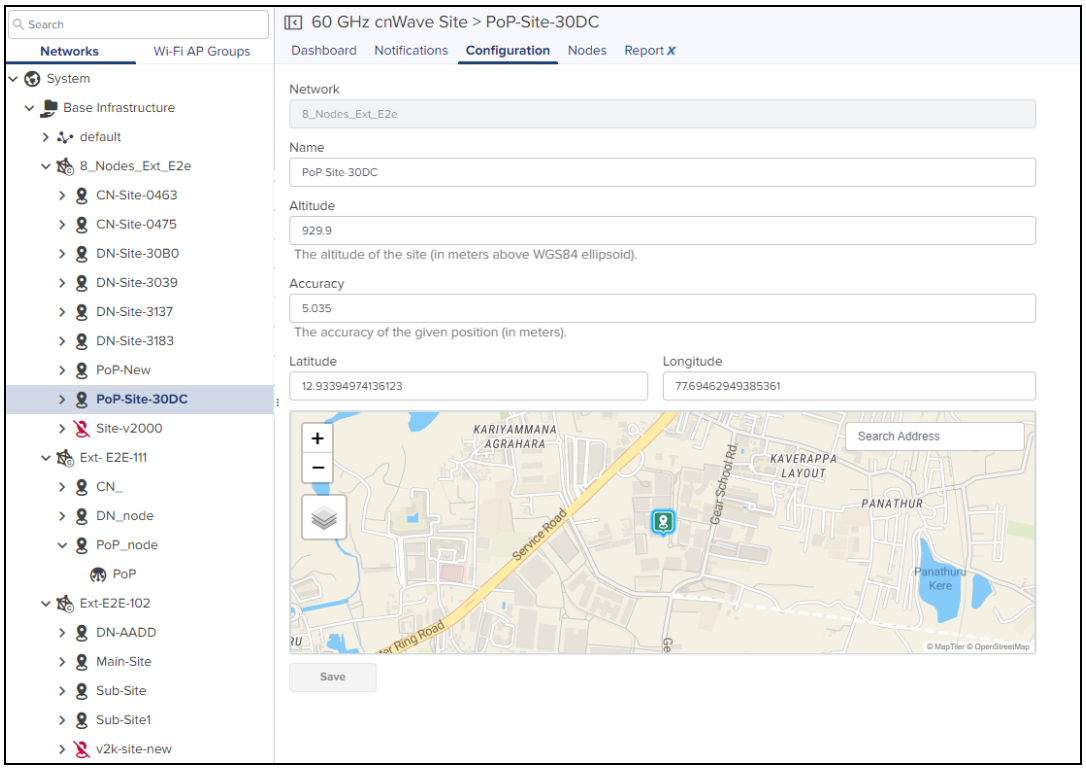


5. Click **Save**. When the Site is configured it gets added under the E2E Network.



To edit the **Site** perform the following:

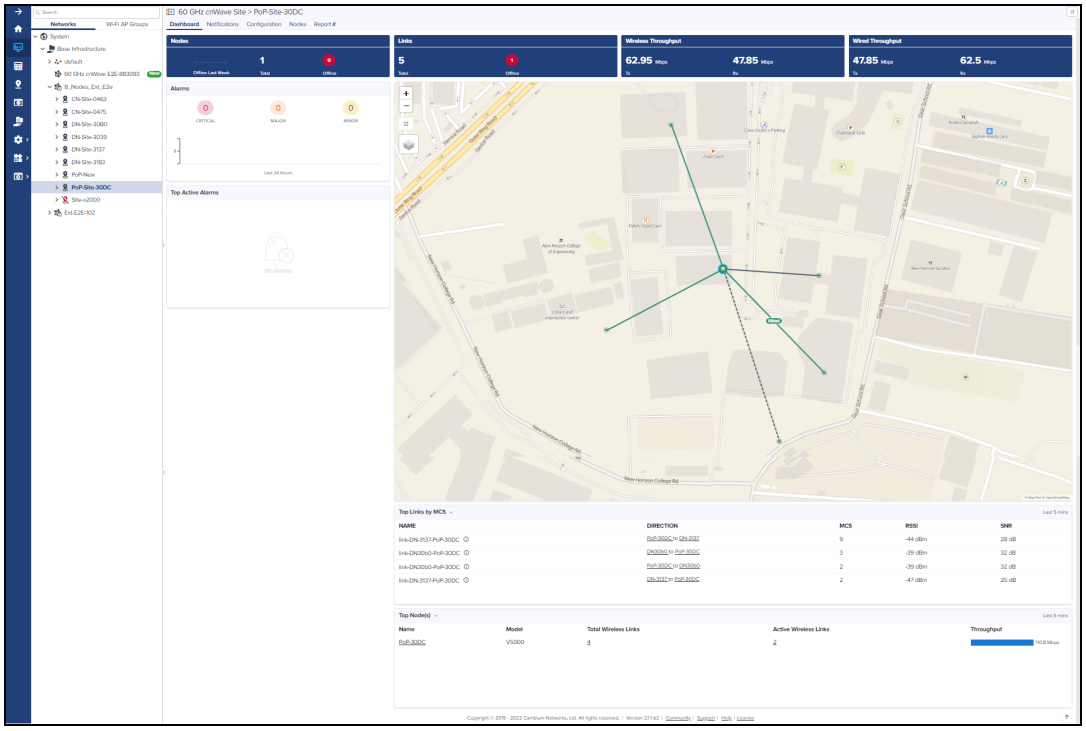
1. Navigate to **Network** > **Site** > **Configuration**.
2. Edit the details and click **Save.**



Site Dashboard

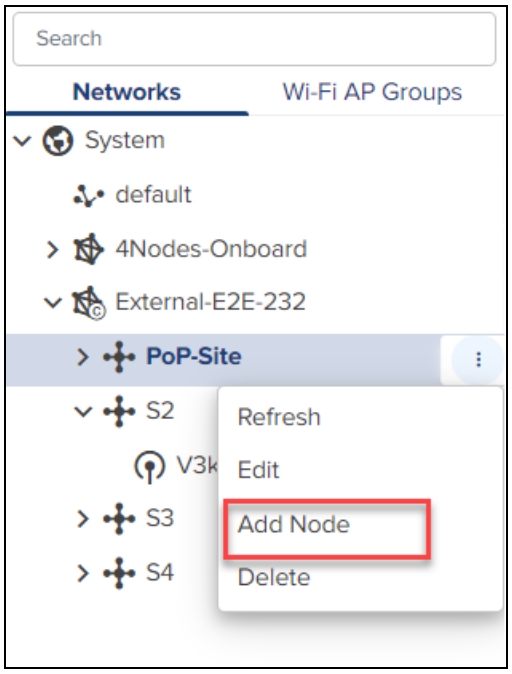
Dashboard pages are customized for each device type and aggregation level. The Site dashboard section displays the **Nodes, Links, Wireless Throughput, Wired Throughput, Alarms, Top Active Alarms, Top Links by MCS, Top Links by RSSI, Top Links by SNR, Top Node(s), Top PoP(s), Top DN(s), and Top CN(s).**

Figure 280 Site Dashboard



Node Configuration

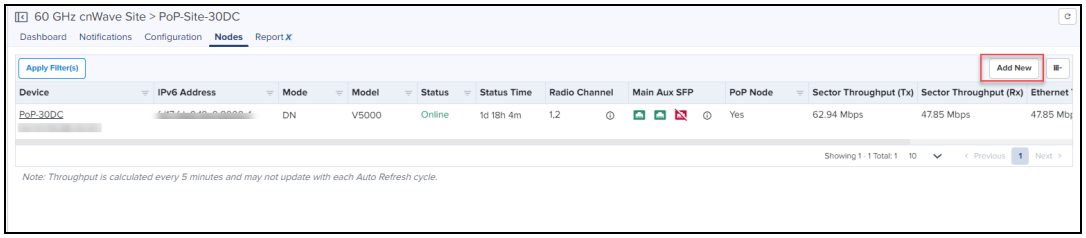
Node can be configured through the **Site Menu** option by clicking the ⋮ icon in **Network** or **Site** tree menu or through **Network** > **Site** > **Nodes** and click **Add.**



	NOTE: From 3.1.1 release V2000 device (beta version) is supported.

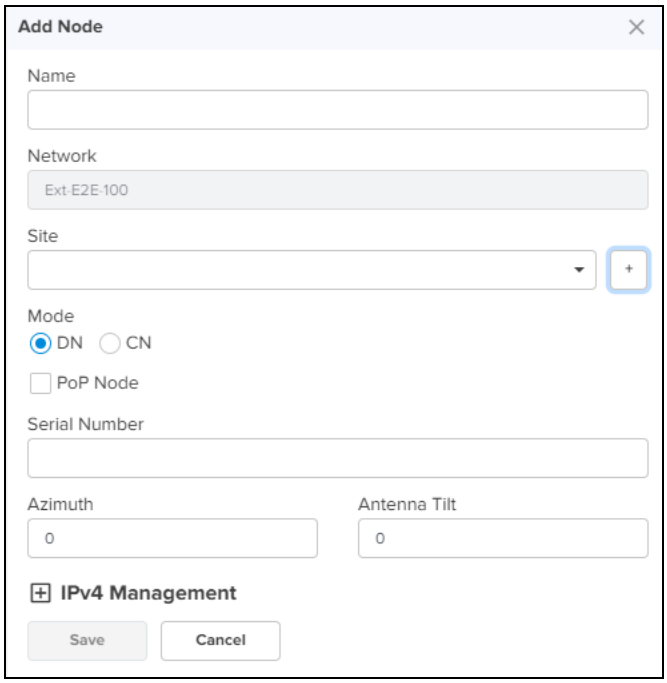
To Add a Node:

1. Navigate to the **Network** > **Site** > **Nodes.**



Add Node window pops-up.

2. Click **Add new.**



Click + to add site.

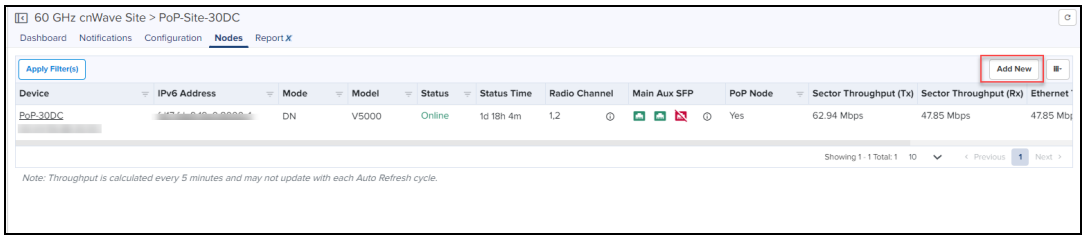
Adding the Node allows the user to create the different Nodes as shown below:

- PoP Node
- DN
- CN

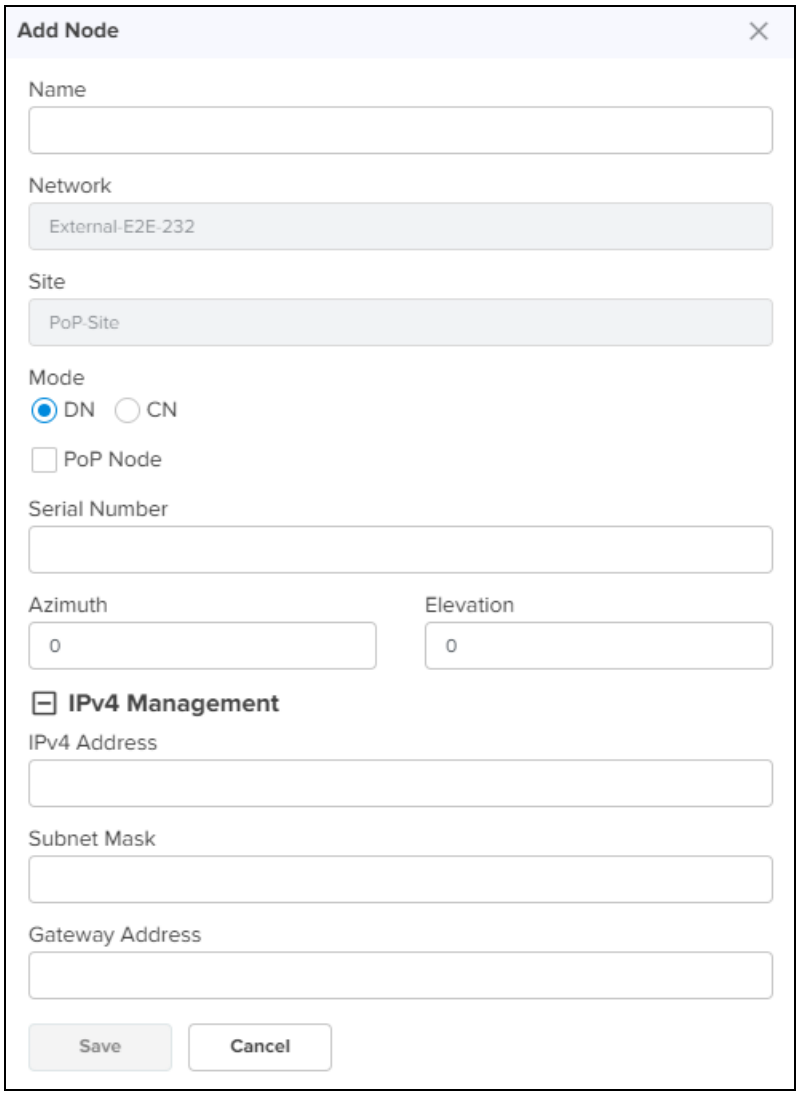
PoP Node configuration

To add a PoP Node:

1. Navigate to the **Network** > **Site** > **Nodes.**
2. Click **Add New.**



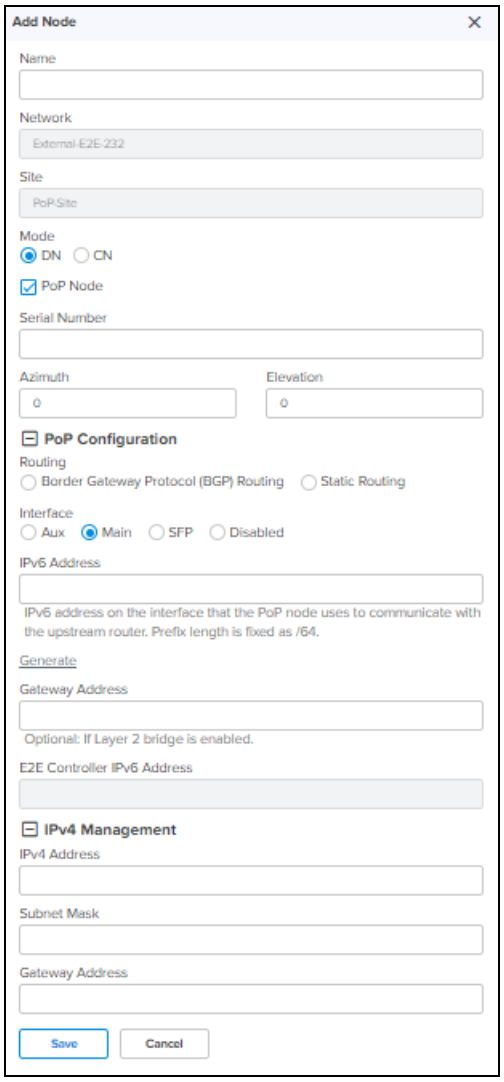
3. **Add Node** window pops-up.



4. Enter the **PoP Name**, select the Mode **DN.**
5. Enable **PoP Node**.

	NOTE: Once the PoP Node is enabled user needs to select the **Routing** and **Interface** details.

6. Enter the **Serial Number** .
7. Enter the **Azimuth** and **Elevation**.
8. In the **PoP Configuration** select **BGP** or **Static Routing**.
9. In **Interface** select **Aux** or **Main** or **SFP** or **Disabled**.



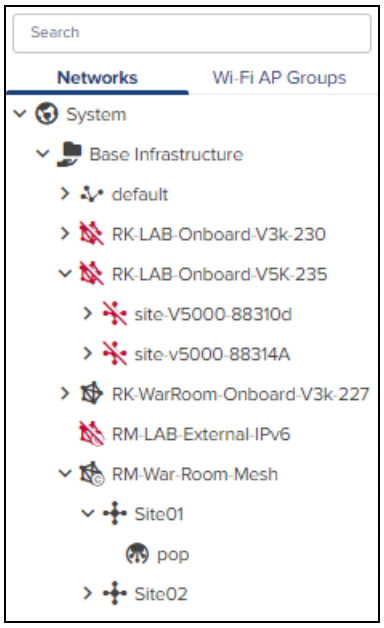
10. Enter the **IPv6** and **Gateway Addresses.**

	NOTE: Generate IPv6 provides **Seed Prefix** in CIDR format from which subnet prefixes are allocated to all DNs and CNs (e.g. fdce:b00c:cafe:ba00::/56)

11. In IPv4 Management, enter the **IPv4 Address, Subnet Mask** and **Gateway Address**.
12. Click **Save.**

	NOTE: Once the PoP Node is configured, **PoP(s) Onboarding Config.json** file gets downloaded automatically, which can be used to import and configure in the PoP Node UI.

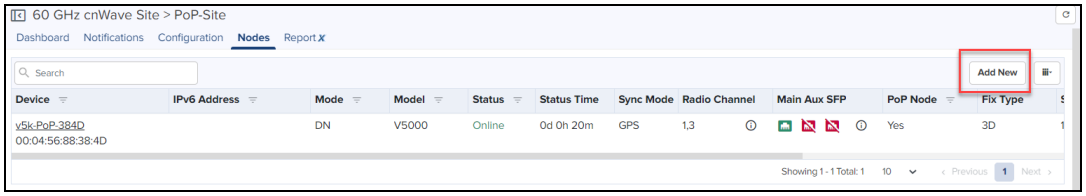
Once the **PoP** node is configured it gets listed under the **Site.**



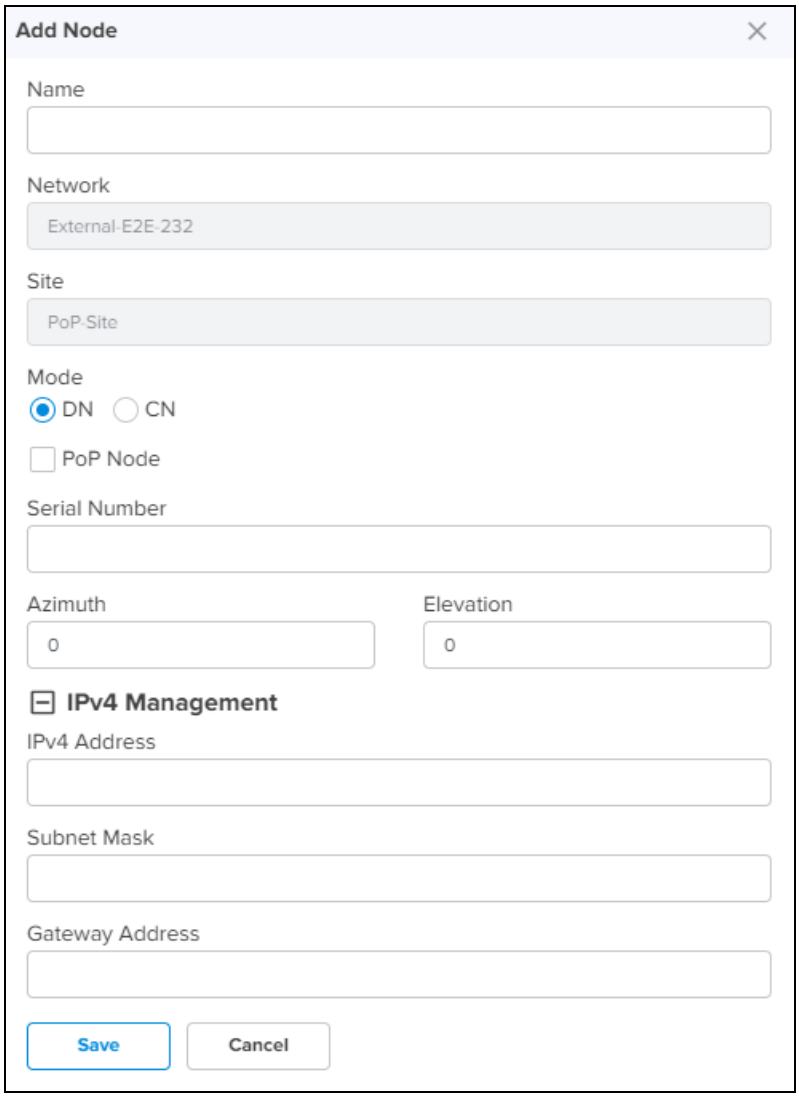
DN/CN Node configuration

To add DN/CN node:

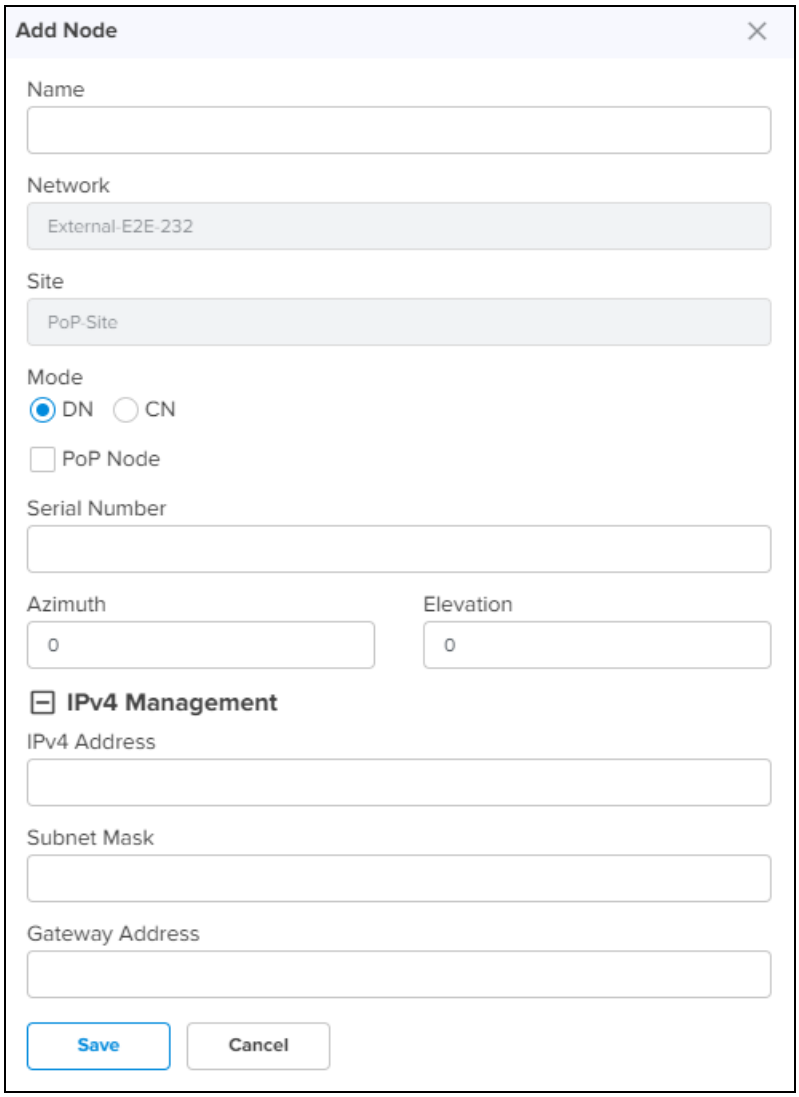
1. Navigate to the **Network** > **Site** > **Nodes.**
2. Click **Add New.**



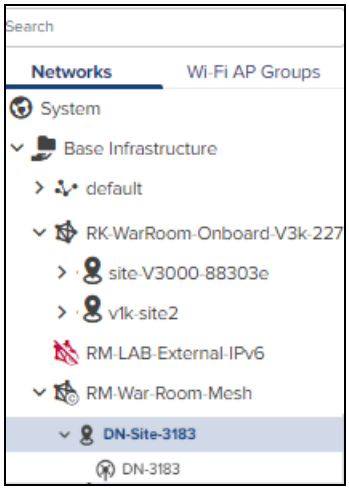
3. **Add Node** window pops-up.



4. Enter the **Node Name**, select the Mode **DN** or **CN.**
5. Enter the **Serial Number**.
6. Enter the **Azimuth** and **Elevation**.



7. In IPv4 Management enter the **IPv4 Address, Subnet Mask** and **Gateway Address**.
8. Click **Save.**
9. Once the **DN/CN** node is configured, it gets listed under the Site**.**



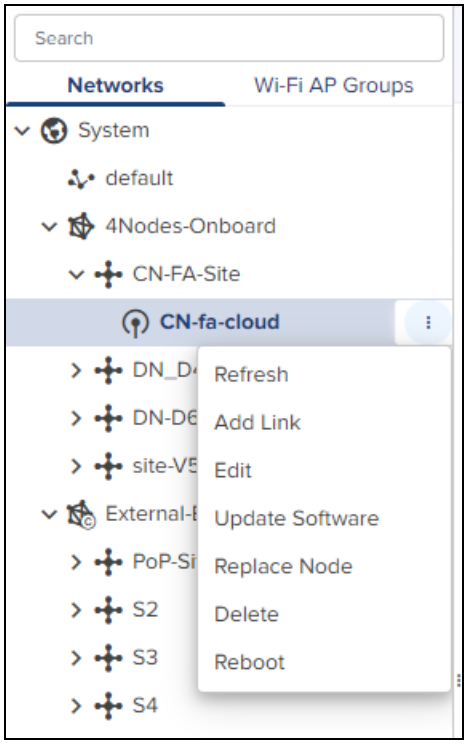
Replace Node

Replace Node allows to replace the existing faulty nodes with new nodes along with the configuration and links of existing faulty nodes.

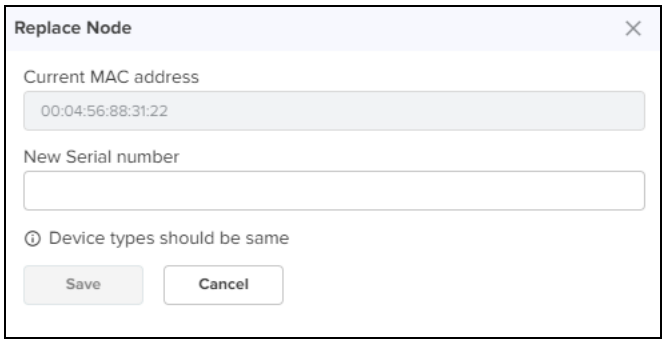
	NOTE: New node should be replaced with same model as existing node.

To replace Node:

1. Navigate to **Node** tree menu and select the node.



2. Click ⋮ icon and Select **Replace Node** from the drop-down.
3. **Replace Node** window pops-up.



4. Enter the **New Serial number.**
5. Click **Save**.

PoP Node

Once the PoP node is configured it displays the monitoring panel of the PoP node.

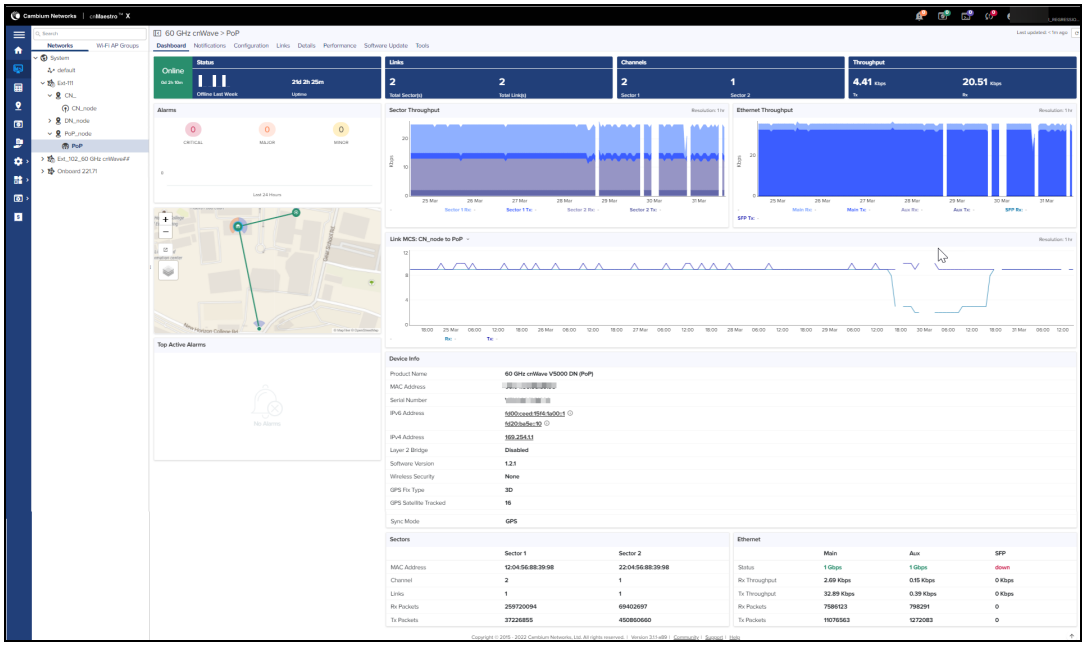
Dashboard

Dashboard pages can be customized for each device type and aggregation level. The PoP node dashboard section displays the **Status, Links, Channels, Throughput, Sector Throughput (Sector 1 and Sector 2), Ethernet Throughput (Main, Aux, SFP)**, **Alarms, Top Active Alarms, Link MCS, Device Info, Sectors, and Ethernet**.

NOTE:

- Sector Throughput (sector1) for V3000, V2000 and V1000.
- Sector Throughput (sector1 and sector2) for V5000.
- Ethernet Throughput graph with Main for V1000.
- Ethernet Throughput graph with Main, Aux, SFP for V5000 and V3000.
- Ethernet Throughput graph with Main and Aux for V2000.

Figure 281 PoP Node Dashboard

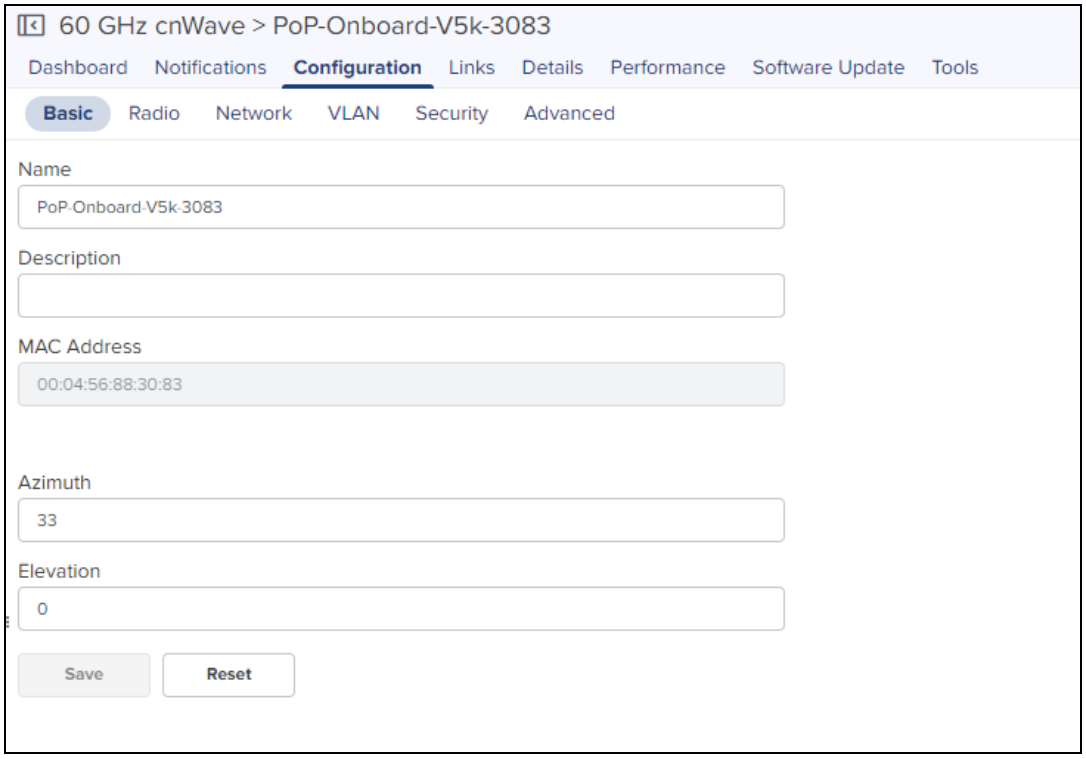


Configuration

Basic

It displays the basic details of PoP node such as **Name, Description, MAC Address, Azimuth,** and **Elevation**. It also allows to edit the name of the node.

Figure 282 Basic

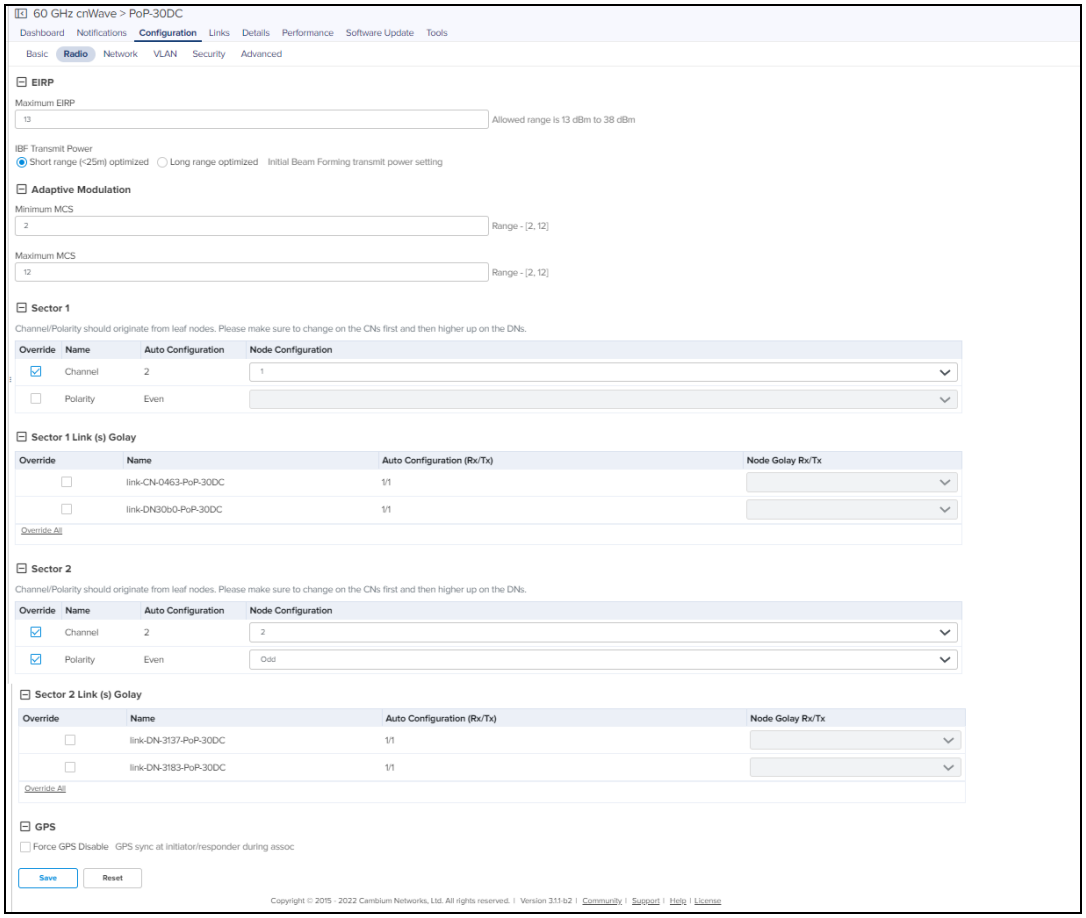


Radio

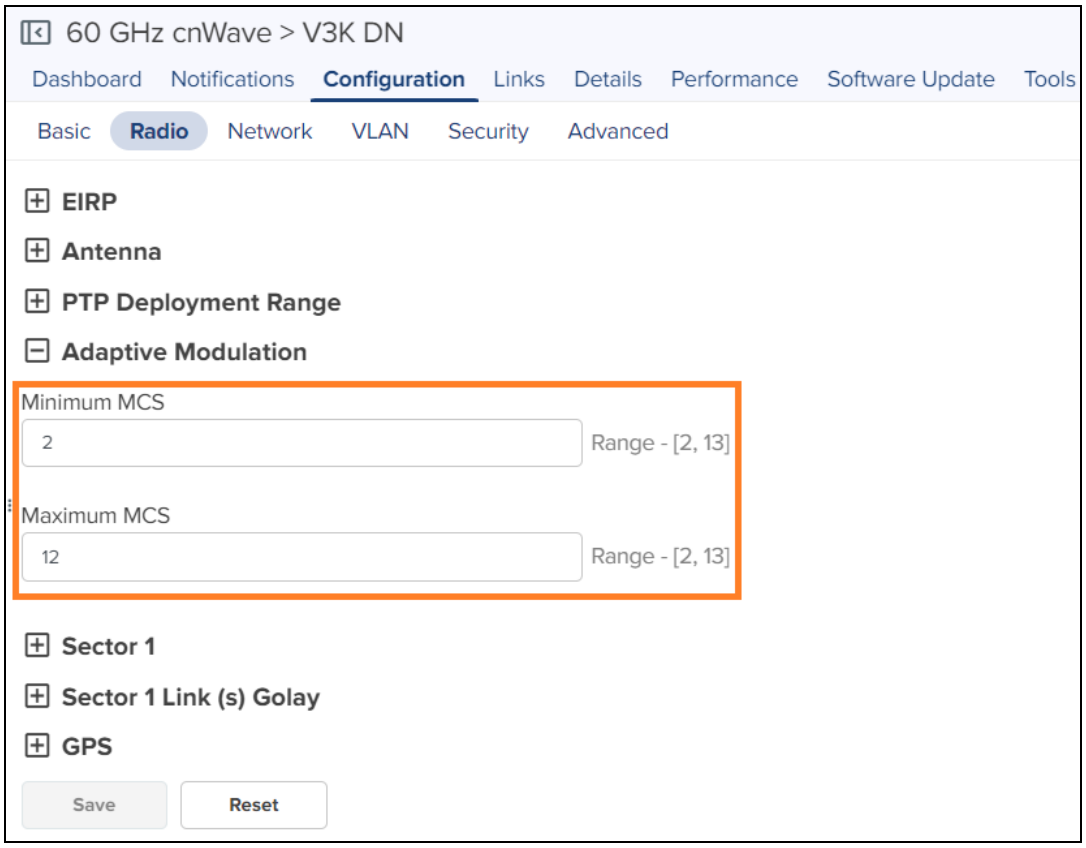
It allows the user to configure the **EIRP**, **Adaptive Modulation**, **Sectors (channels, Polarity and Link(s) Golay)**, and **GPS**.

	NOTE: Antenna and PTP deployment Range options is available only for v3000.

Figure 283 Radio



For V3000, MCS 13 is supported as seen the following UI:

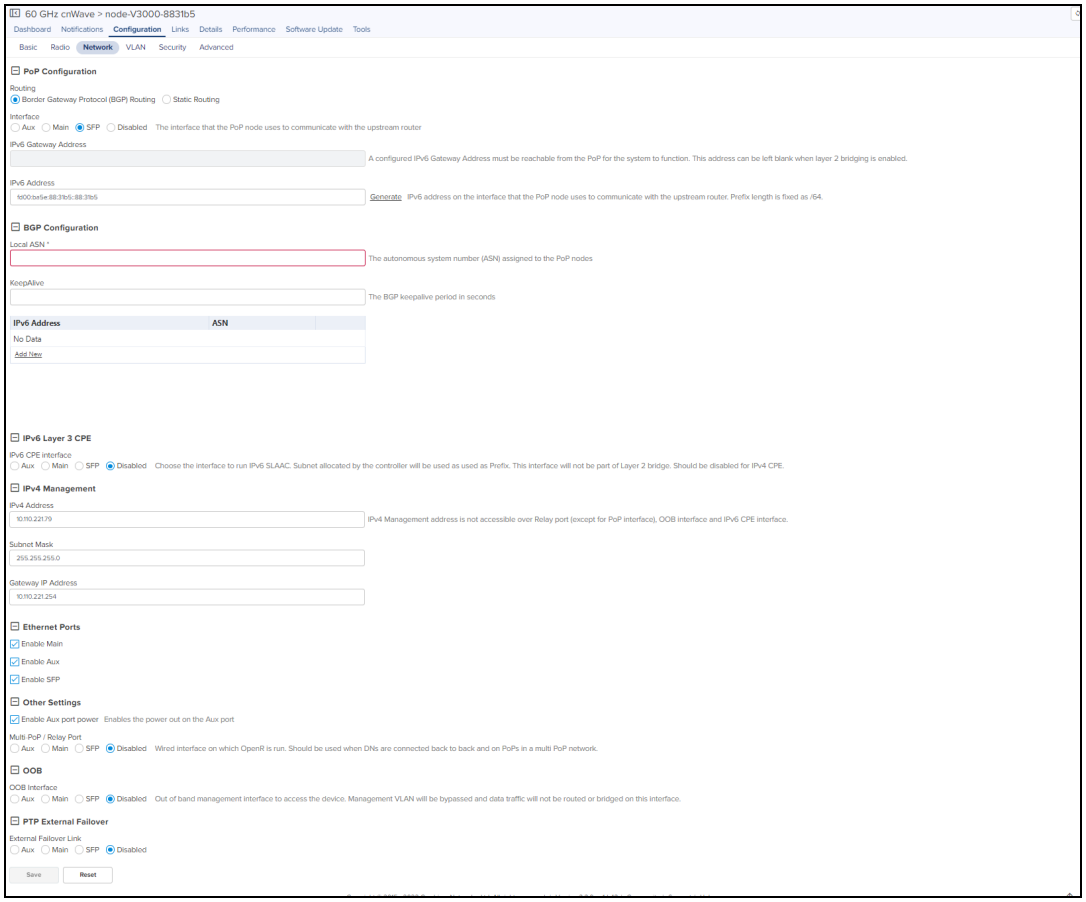


Network

Network tab allows the user for the **PoP configuration**, **E2E Controller Configuration**, **BGP Configuration**, **IPv6 Layer 3 CPE**, **IPv4 Management, OOB**, **Other Settings (Multi-PoP or Relay Port, Enable Aux port power), PTP External Failover**, **Ethernet Ports,** and **1G SFP.**

	NOTE: When Layer 2 Bridge is enabled in E2E Controller, Layer 2 Bridge option will be available in PoP Network Configuration

Figure 284 Networks

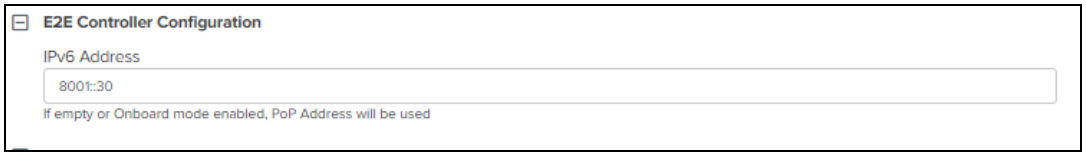


Configure the Network as shown below:

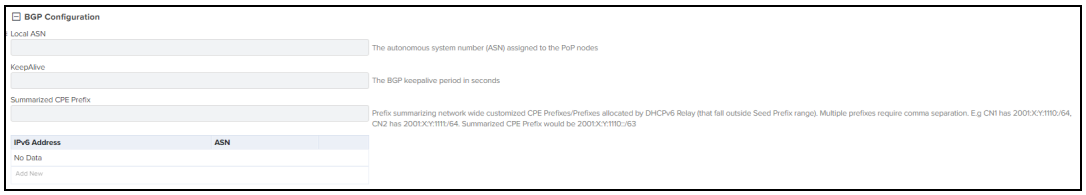
1. Navigate to the **Configuration** > **Network.**
2. In **PoP Configuration:**

    - Select the appropriate option in **Routing** and **Interface**.
    - Enter the **IPv6 Address.**
    - Enter **IPv6 Gateway Address** its optional.

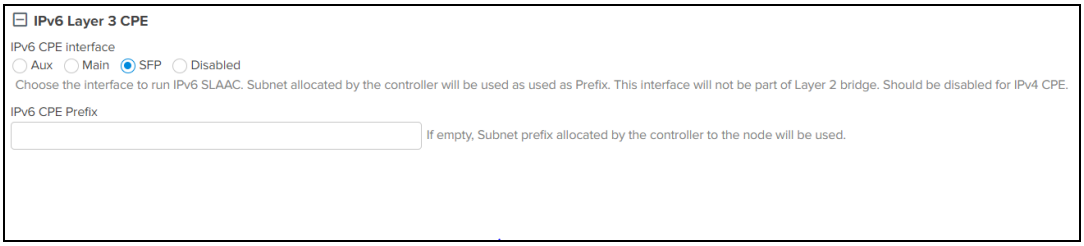
3. In **E2E Controller Configuration**, enter the **IPv6 Address.**



4. In BGP Configuration add IPv6 Address.



5. In **IPv6 Layer 3 CPE**
    - Select **IPv6 CPE interface** as Aux, Main, or SFP.
    - Enter **IPv6 CPE Prefix.**

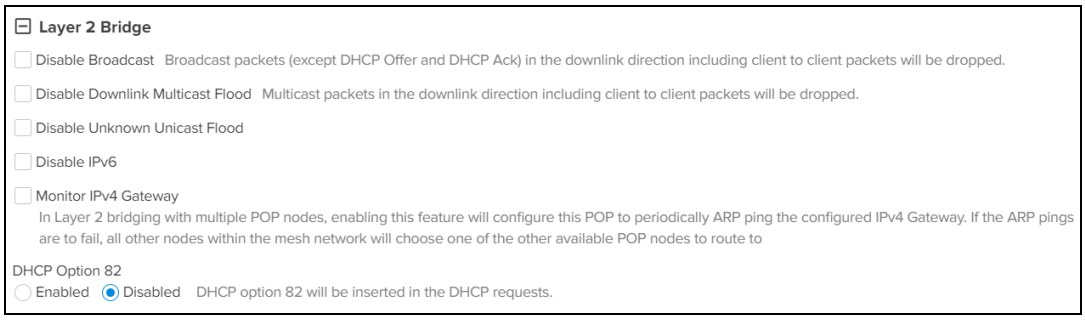


6. In **IPv4 Management**:
    - Enter **IPv4 Address.**
    - Enter **Subnet Mask**.
    - Enter **Gateway IP Address**.

7. In **Ethernet Ports** enable the appropriate option **Main** or **Aux** or **SFP.**
8. In **Layer 2 bridge** enable the appropriate options such as:
    - Disable Broadcast Broadcast packets (except DHCP Offer and DHCP Ack) in the downlink direction including client to client packets will be dropped.
    - Disable Downlink Multicast Flood - Multicast packets in the downlink direction including client to client packets will be dropped
    - Disable Unknown Unicast Flood
    - Disable IPv6
    - Monitor PoP Interface Layer 2 tunnels will failover to next best PoP when the backhaul interface of this PoP is down.

	**NOTE:** The configuration is applicable only when static routing is used and IPv4 gateway is configured..

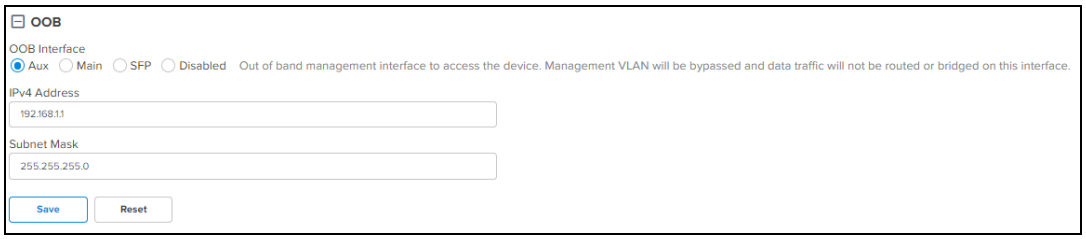
- Insert DHCP Option 82



9. In **Other Settings** enable **Enable Aux port power** and **Multi-PoP / Relay Port**.

10. In **OOB Interface** enable the appropriate option **Main** or **Aux** or **SFP.**

- Enter **IPv4 Address.**
- Enter **Subnet Mask**.



11. Click **Save.**

	NOTE: Once the configuration is updated successfully in cnMaestro, the same parameters needs to be entered in the UI of the **PoP Node GUI**.

VLAN

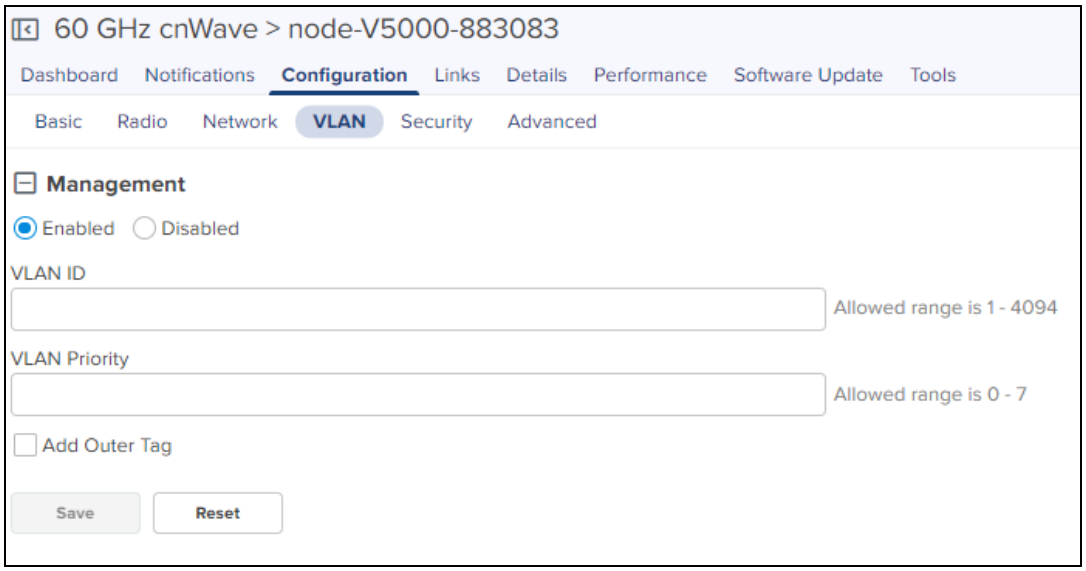
	NOTE: From Software Update Version 1.1 of all nodes, supports configuration of the VLAN Management and Ports.

Virtual Local Area Networks (VLANs) is a broadcast domain in a Layer 2 network. A broadcast domain is the set of all devices that will receive broadcast frames originating from any device within the set and traffic will be tagged when transporting over wireless.

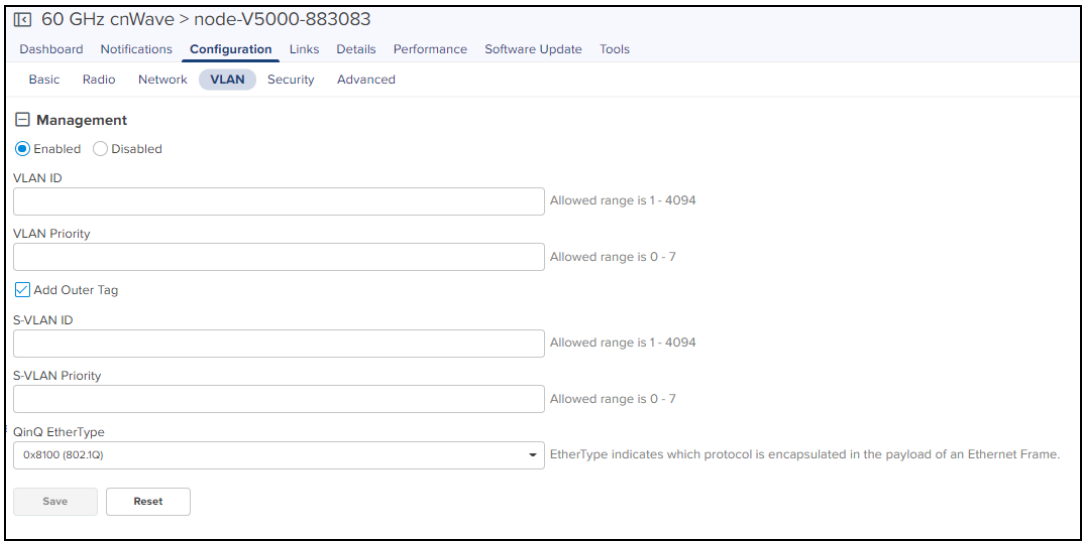
	NOTE: Only PoP node Management VLAN can be configured, if Layer 2 Bridge is not enabled in **E2E Network > Configuration > Basic** page. Node running version 1.0.1: • When Layer2 bridge is disabled, Only PoP node Management VLAN ID can be configured. • When Layer2 bridge is enabled, all nodes Management VLAN ID can be configured. Node running version 1.1: • When Layer2 bridge is disabled, Only PoP node Management VLAN ID, Priority with Outer Tag can be configured. • When Layer2 bridge is enabled, all node management VLAN and ports can be configured.

To add a Management VLAN:

1. Navigate to **Configuration > VLAN.**
2. Click Enabled.



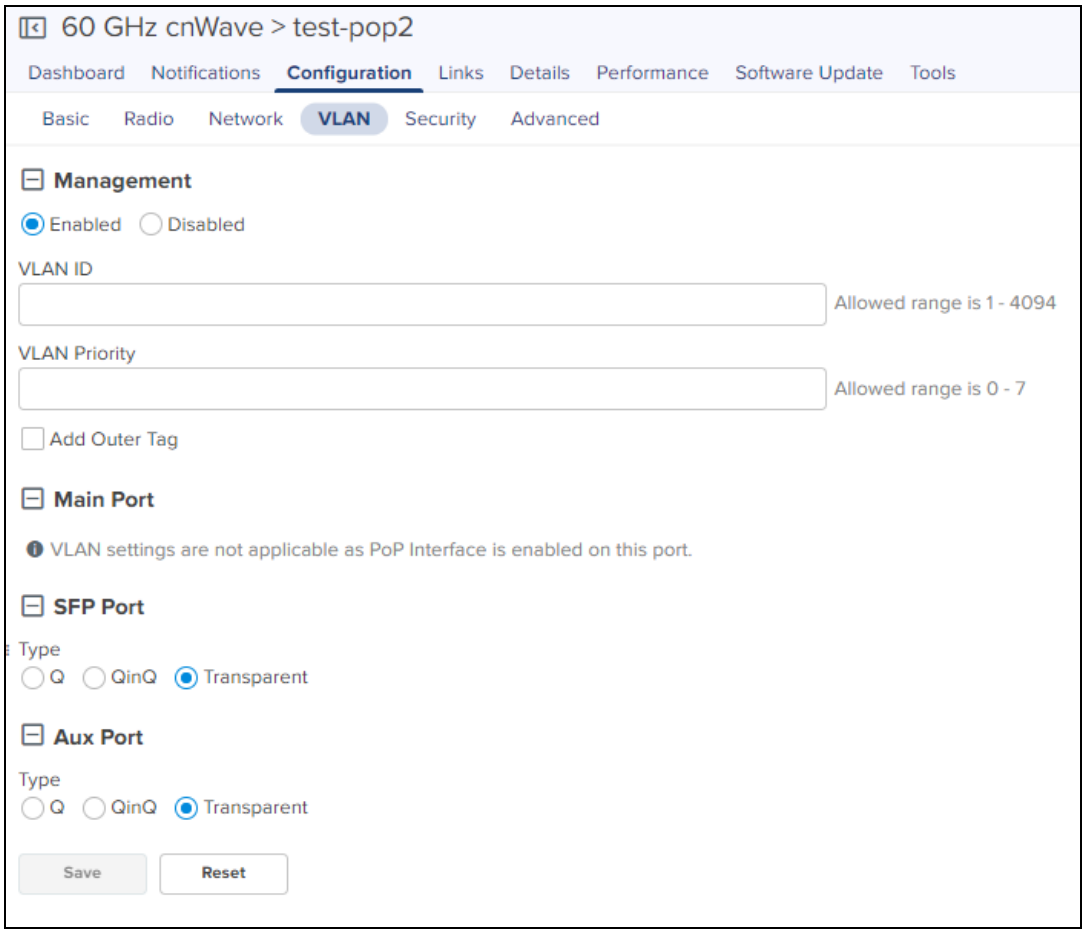
3. Enter the **VLAN ID** and **VLAN Priority**.
4. Enable **Add Outer Tag**.



5. Enter **S-VLAN ID**.
6. Enter **S-VLAN Priority.**
7. Enter **QinQ EtherType.**
8. Click **Save.**

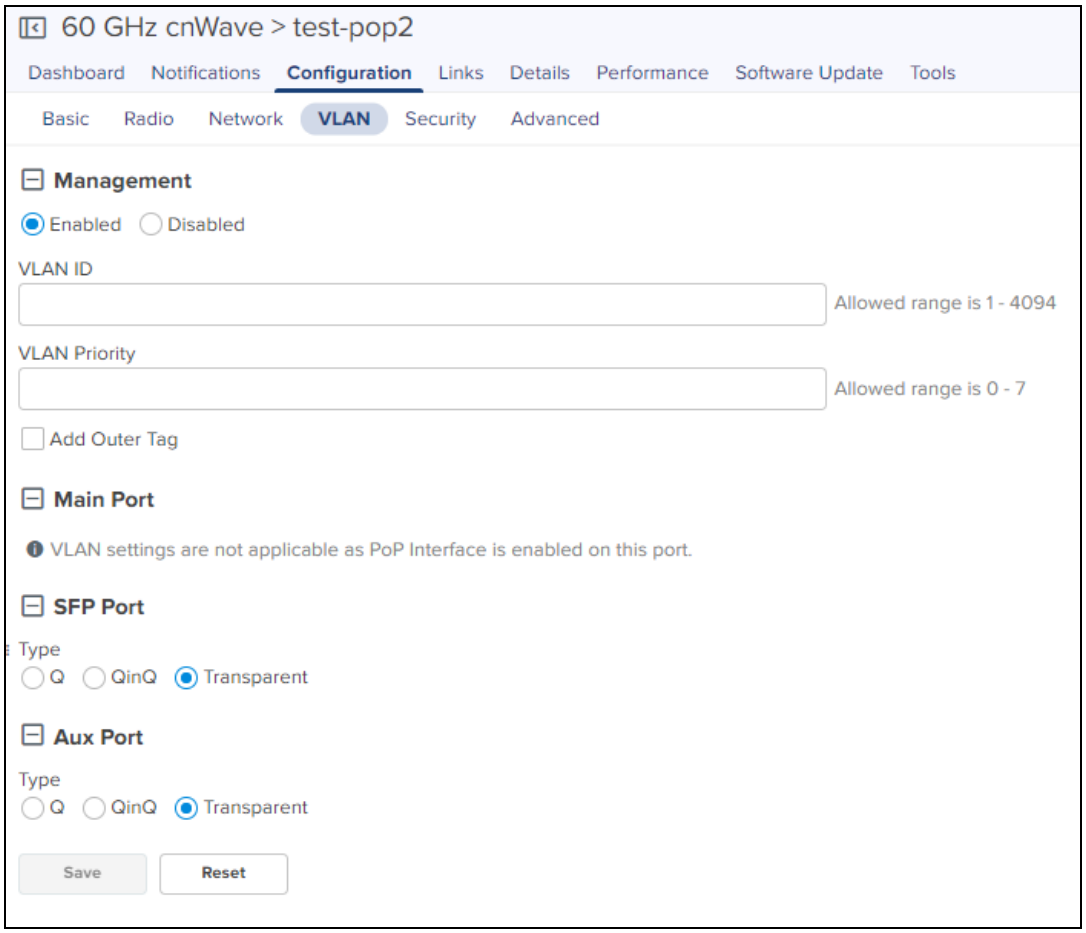
If Layer 2 Bridge is enabled in **60 GHz cnWave Network > Configuration > Basic** page. User can configure Management VLAN and Ports of PoP node, DN and CN.

	NOTE: VLAN settings are not applicable if Relay Port, SFP Port, or Aux Port is enabled on Network page.

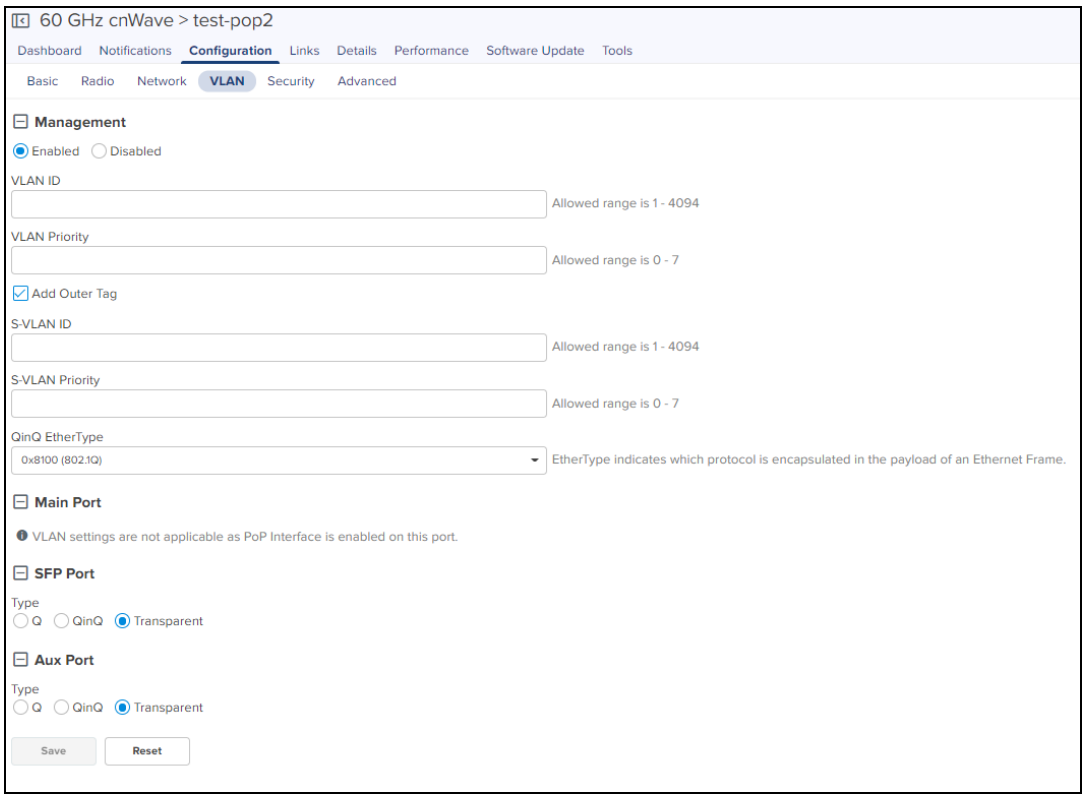


To add a VLAN:

1. Navigate to **Configuration > VLAN.**
2. Click Enabled.



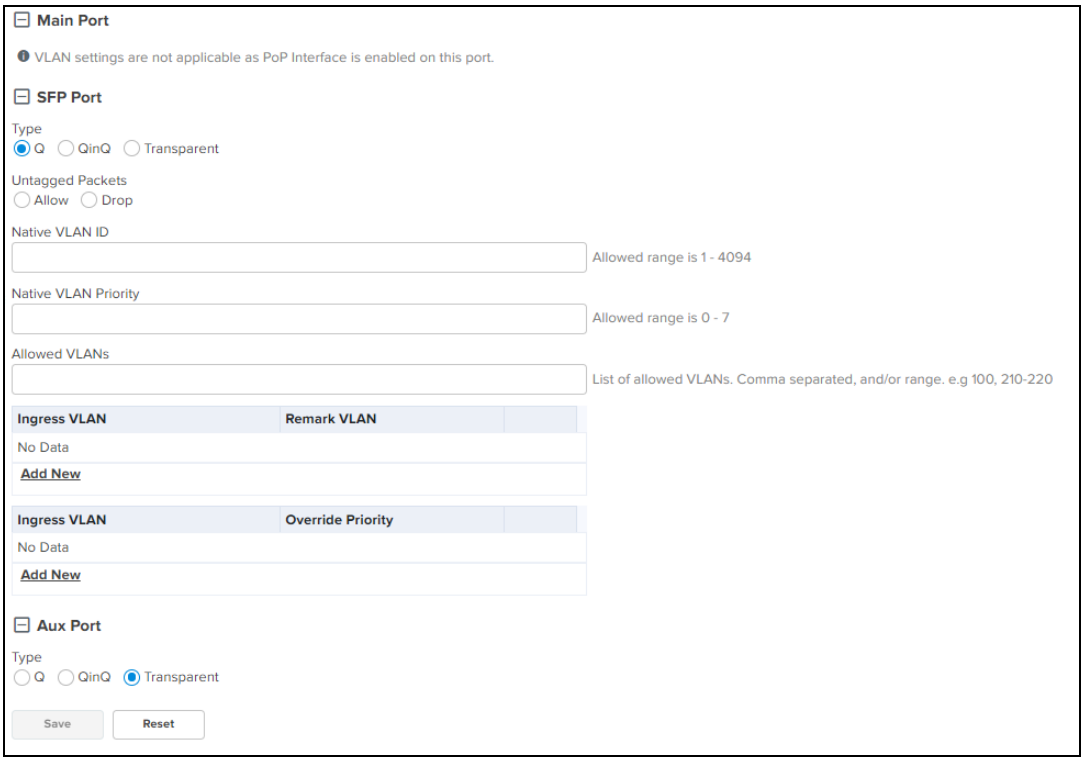
3. Enter the **VLAN ID** and **VLAN Priority**.
4. Enable **Add Outer Tag**.



5. Enter **S-VLAN ID**.
6. Enter **S-VLAN Priority.**
7. Enter **QinQ EtherType.**

	NOTE: VLAN settings configuration of Main Port, SFP Port, or Aux Port is similar.

8. Select Port **Q** or **QinQ** types.
   a. If user selects **Q type** perform as follows:



   - Select **Untagged Packets** Allow or Drop.
   - Enter **Native VLAN ID.**
   - Enter **Native VLAN Priority**.
   - Enter **Allowed VLANs**.
   - To add new **VLAN Remarking.**

   - Click Add New

- Enter **Ingress VLAN** and **Remark VLAN**.
- Click **Save**.

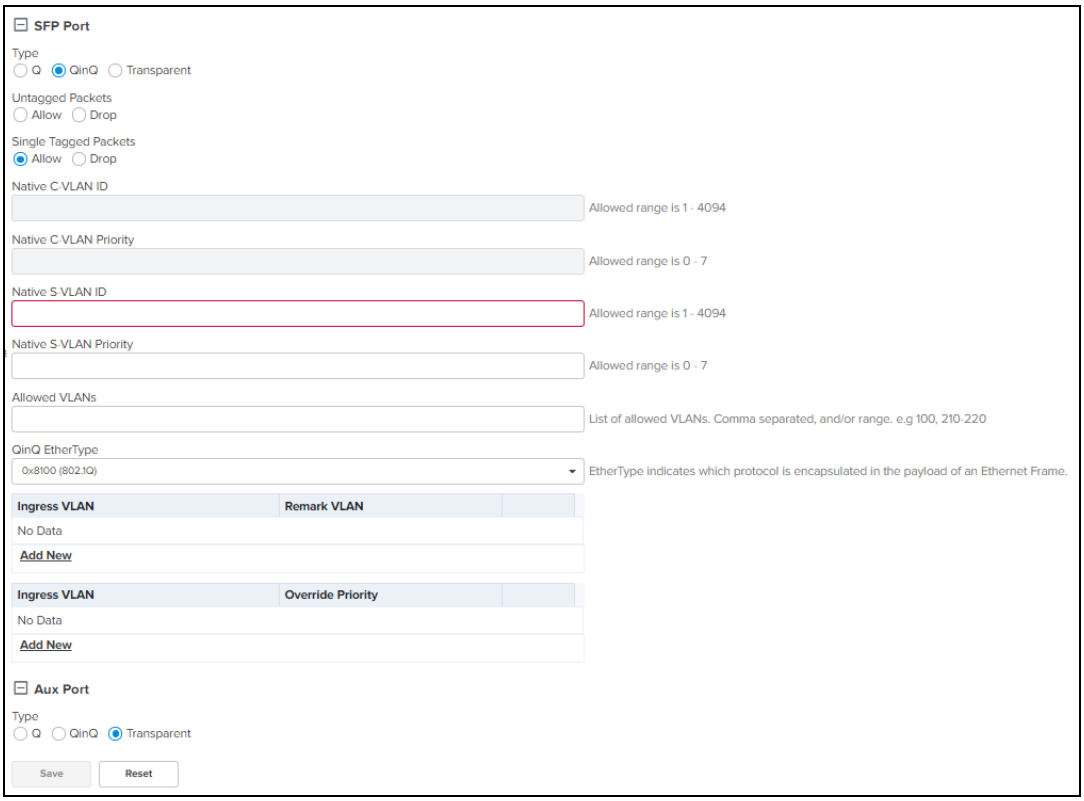
- To add new **VLAN Priority Override**.

- Click **Add New**.

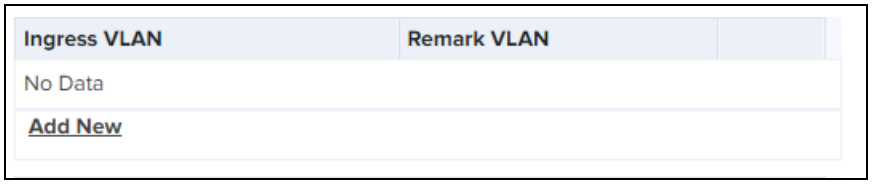
- Enter **Ingress VLAN** and **Remark VLAN**.
- Click **Save**.

- Click **Save**.

b. If user selects **QinQ** type perform as follows:



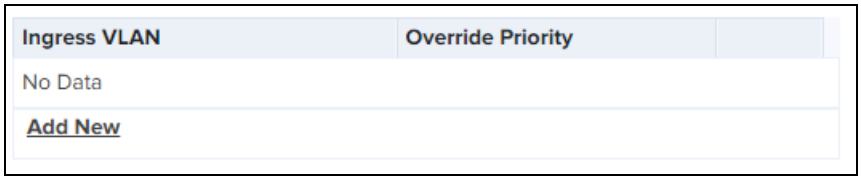
- In **Untagged Packets** select **Allow** or **Drop.**
- In **Single Tagged Packets** select **Allow** or **Drop.**
- Enter **Native C-VLAN ID.**
- Enter **Native C-VLAN Priority**.
- Enter **Native S-VLAN ID**.
- Enter **Native S-VLAN Priority**.
- Enter **Allowed VLANs**.
- Enter **QinQ EtherType**.
- To add new **VLAN Remarking.**



- Click Add New

- Enter **Ingress VLAN** and **Remark VLAN**.
- Click **Save**.

- To add new **VLAN Priority Override**.



- Click **Add New**.

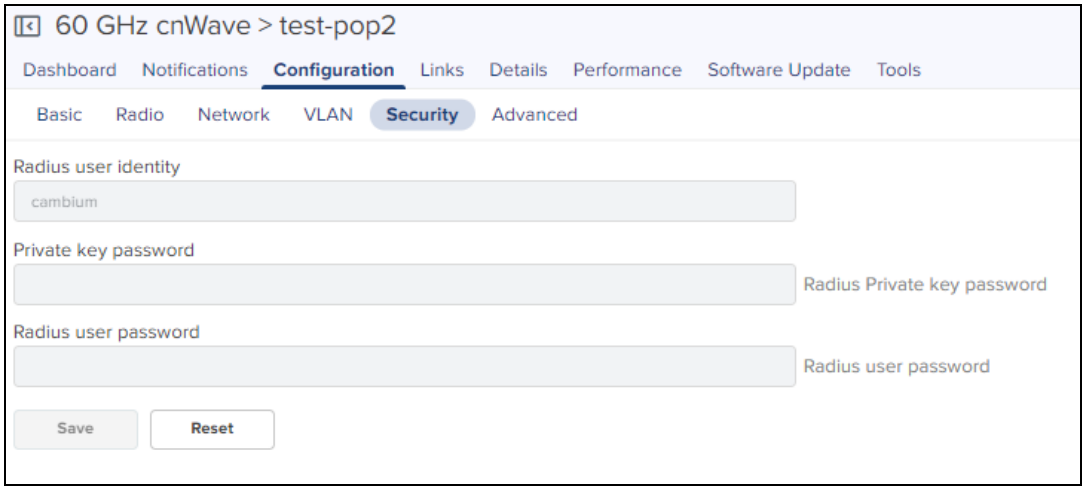
- Enter **Ingress VLAN** and **Remark VLAN**.
- Click **Save**.

- Click **Save**.

Security

Security tab allows to reset the identity and password of the Radius user.

Figure 285 Security



Advanced

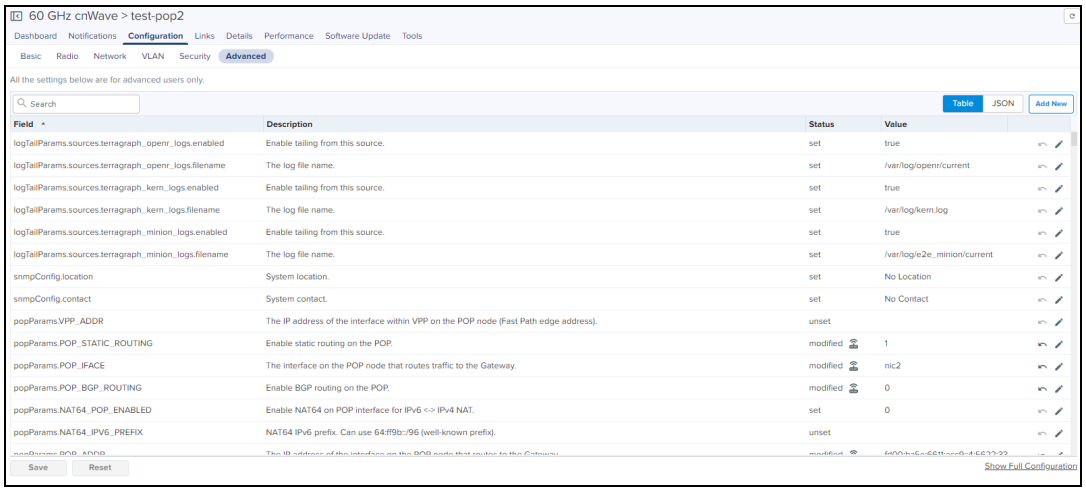
Advanced tab allows the advanced user to edit the settings of the Table and JSON format of the PoP Nodes.

Table

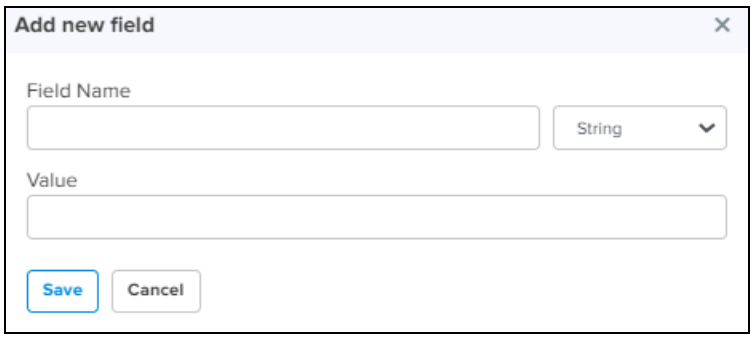
In the **Table** user can view and edit **Field Name** and **Value**. You can sort field name in alphabetical order.

To add a field:

1. Navigate to **Configuration** > **Advanced.**
2. Click **Add New.**



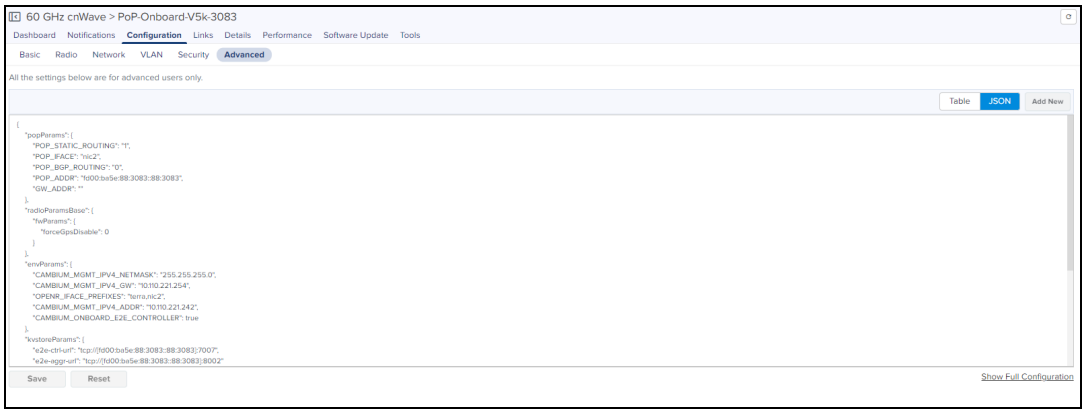
3. Enter the **Field Name** and **Value.**



4. Click **Save.**

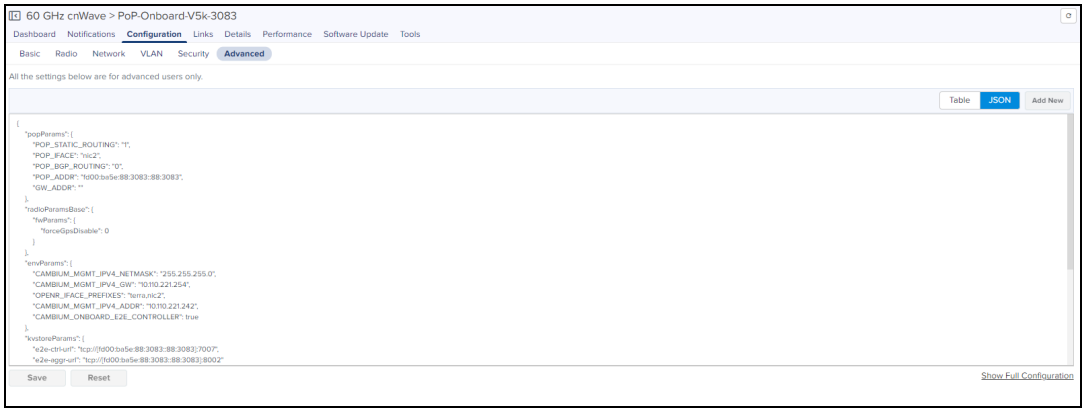
JSON

JSON allows advanced user to download or view the JSON format.



To download the file:

1. Navigate to **Configuration** > **Advanced** > **JSON.**



2. Click **Show Full Configuration.**

View Device Existing Configuration window pops up.

3. Click **Download**.

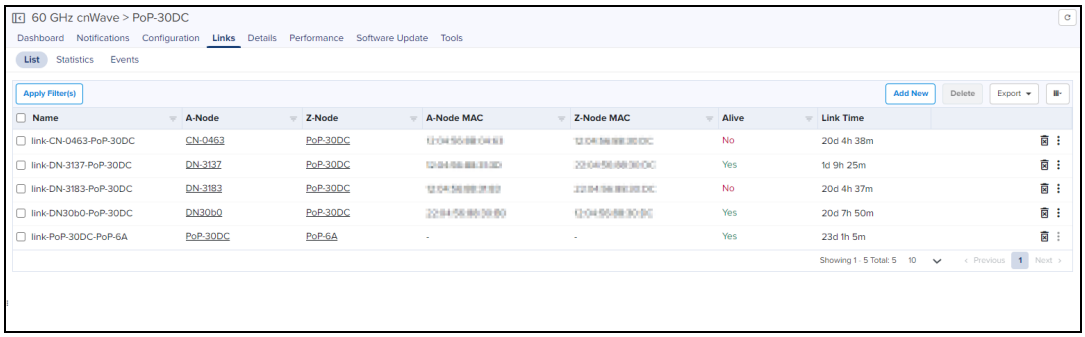
Links

Links provide the details about the links between nodes, statistics and events of the links in the E2E Network.

List

List provide the details about the links of the nodes and also provides the option to create a new link. User can delete the links in bulk by selecting the particular links. It also allows to export or import link details.

Figure 286 List



For more details to add a link and delete a link in the network refer List section.

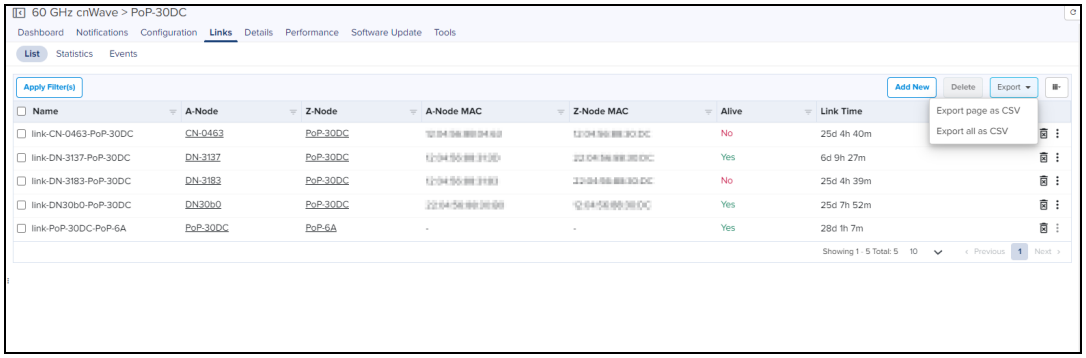
	NOTE: By default A Node is selected as node, when adding new link in the network.

Export List

Export list allow the user to export the PoP links list.

To export the links :

1. Navigate to **Links** > **List** > select **Export.**



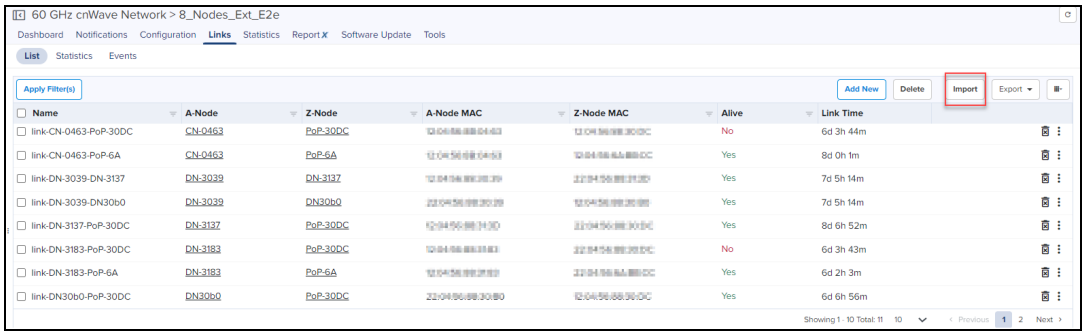
2. It exports .csv file format as shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	LINK_NAME	A_NODE_I	A_NODE_I	Z_NODE_N	Z_NODE_N	LINK_TYPE	ALIVE	IGNITION_	DISTANCE	AZIMUTH	BACKUP_C	IGNITION_	TIMESTAMP		
2	Link Name	A node nai	Sector 1/2	Z node nai	Sector 1/2	Wireless o	Yes/No	Ignition At	Distance b	Azimuth (D	Yes/No	Enabled/D	Timestamp		
3	link-CN-fa-cloud-D4	CN-fa-clou	12:04:56:8	D4	22:04:56:8	Wireless	Yes	16	996	54.9	No	Enabled	2021-07-23T02:49:06.317Z		
4	link-D4-PoP-Onboard-V5k-3083	D4	12:04:56:8	PoP-Onbo	22:04:56:8	Wireless	Yes	0	988	158.8	No	Enabled	2021-07-23T02:49:06.317Z		
5	link-DN-D6-PoP-Onboard-V5k-3083	DN-D6	12:04:56:8	PoP-Onbo	12:04:56:8	Wireless	Yes	0	979	105.2	No	Enabled	2021-07-23T02:49:06.317Z		

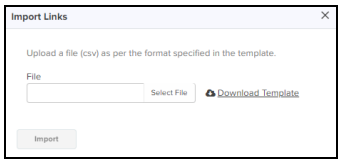
Import List

Import list allow the user to import the PoP links list.

1. Navigate to **Links**> **List** > select **Import.**



Import Links window appears.



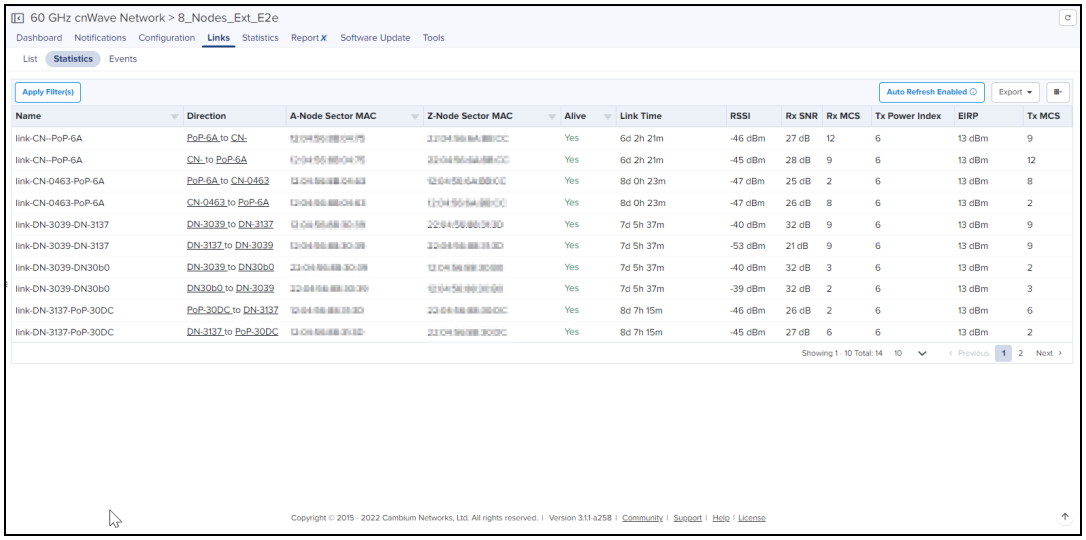
2. Click **Download Template** to download the .CSV format file.

	A	B	C	D	E
1	A_NODE_NAME	A_NODE_MAC	Z_NODE_NAME	Z_NODE_MAC	LINK_TYPE
2	A node name of the device	Sector 1/2 MAC Address	Z node name of the device	Sector 1/2 MAC Address	Wireless or Wired
3	POP		DN1		wireless
4	DN1		CN1		wireless
5	DN1		CN2		wired
6					
7					

3. Select the file and click **Import**.

Statistics

Links Statistics pages provides details of **Basic:** Name, Direction, A-Node, Z-Node Alive Link Time Type Distance Azimuth, Rx Golay, Tx Golay **Detailed Statistics**: A-Node Sector MAC, Z-Node Sector MAC, RSSI, Rx Airtime%, Rx Beam Azimuth Angle, Rx Beam Elevation Angle, Rx SNR, Rx MCS, Rx PER, Rx Scan Beams, Rx Throughput, Tx Airtime%, Tx Beam Azimuth Angle, Tx Beam Elevation Angle, Tx Power Index, EIRP, Tx MCS, Tx PER, Tx Scan Beams, Rx Errors, Rx Frames, Tx Errors, Tx Frames, Tx Throughput, Rx Time, Tx Time, and Link Fade Margin links created with PoP node, generally in a page format.

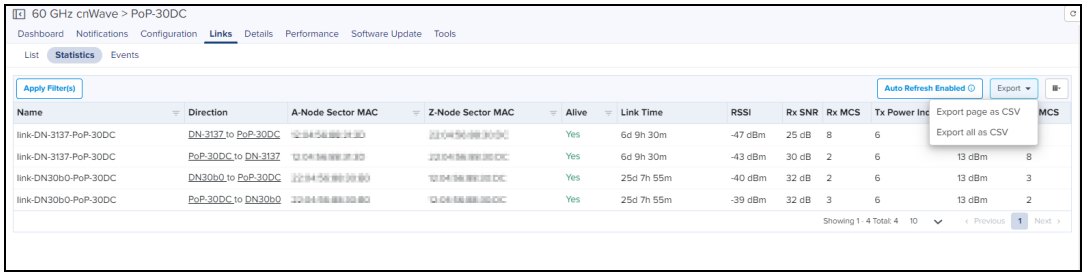


Export Statistics

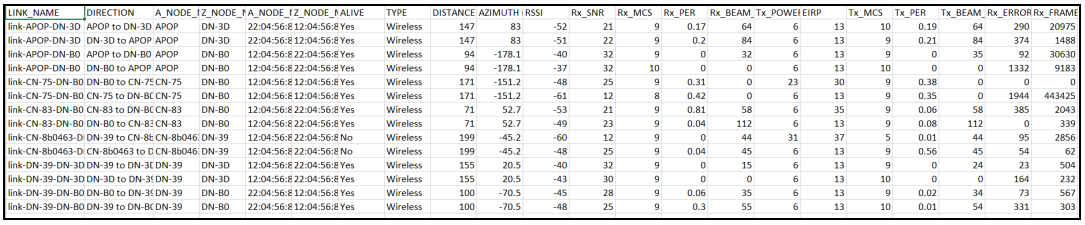
Export list allow the user to export the PoP links Statistics.

To export the Statistics :

1. Navigate to **Links > Statistics >** select **Export.**



2. It exports .csv file format as shown below.



LINK_NAME	DIRECTION	A_NODE_I	Z_NODE_I	A_NODE_I	Z_NODE_I	ALIVE	TYPE	DISTANCE	AZIMUTH	RSSI	Rx_SNR	Rx_MCS	Rx_PER	Rx_BEAM_	Tx_POWEI	EIRP	Tx_MCS	Tx_PER	Tx_BEAM_	Rx_ERROR	Rx_FRAME
link-APOP-DN-3D	APOP to DN-3D	APOP	DN-3D	22:04:56:8	12:04:56:8	Yes	Wireless	147	83	-52	21	9	0.17	64	6	13	10	0.19	64	290	20975
link-APOP-DN-3D	DN-3D to APOP	APOP	DN-3D	22:04:56:8	12:04:56:8	Yes	Wireless	147	83	-51	22	9	0.2	84	6	13	9	0.21	84	374	1488
link-APOP-DN-B0	APOP to DN-B0	APOP	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	94	-178.1	-40	32	9	0	32	6	13	9	0	35	92	30630
link-APOP-DN-B0	DN-B0 to APOP	APOP	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	94	-178.1	-37	32	10	0	0	6	13	10	0	0	1332	9183
link-CN-75-DN-B0	DN-B0 to CN-75	CN-75	DN-B0	12:04:56:8	12:04:56:8	Yes	Wireless	171	-151.2	-48	25	9	0.31	0	23	30	9	0.38	0	0	0
link-CN-75-DN-B0	CN-75 to DN-B0	CN-75	DN-B0	12:04:56:8	12:04:56:8	Yes	Wireless	171	-151.2	-61	12	8	0.42	0	6	13	9	0.35	0	1944	443425
link-CN-83-DN-B0	CN-83 to DN-B0	CN-83	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	71	52.7	-53	21	9	0.81	58	6	35	9	0.06	58	385	2043
link-CN-83-DN-B0	DN-B0 to CN-83	CN-83	DN-B0	12:04:56:8	22:04:56:8	Yes	Wireless	71	52.7	-49	23	9	0.04	112	6	13	9	0.08	112	0	339
link-CN-8b0463-D	DN-39 to CN-8b0463	CN-8b046	DN-39	12:04:56:8	22:04:56:8	No	Wireless	199	-45.2	-60	12	9	0	44	31	37	5	0.01	44	95	2856
link-CN-8b0463-D	CN-8b0463 to D	CN-8b046	DN-39	12:04:56:8	22:04:56:8	No	Wireless	199	-45.2	-48	25	9	0.04	45	6	13	9	0.56	45	54	62
link-DN-39-DN-3D	DN-39 to DN-3D	DN-39	DN-3D	12:04:56:8	22:04:56:8	Yes	Wireless	155	20.5	-40	32	9	0	15	6	13	9	0	24	23	504
link-DN-39-DN-3D	DN-3D to DN-39	DN-39	DN-3D	12:04:56:8	22:04:56:8	Yes	Wireless	155	20.5	-43	30	9	0	0	6	13	10	0	0	164	232
link-DN-39-DN-B0	DN-B0 to DN-39	DN-39	DN-B0	22:04:56:8	12:04:56:8	Yes	Wireless	100	-70.5	-45	28	9	0.06	35	6	13	9	0.02	34	73	567
link-DN-39-DN-B0	DN-39 to DN-B0	DN-39	DN-B0	22:04:56:8	12:04:56:8	Yes	Wireless	100	-70.5	-48	25	9	0.3	55	6	13	10	0.01	54	331	303

Events

Events provide the details of link availability, hourly link availability in percentage, link availability in different time lines, and distance of the link.

Figure 287 Link Events

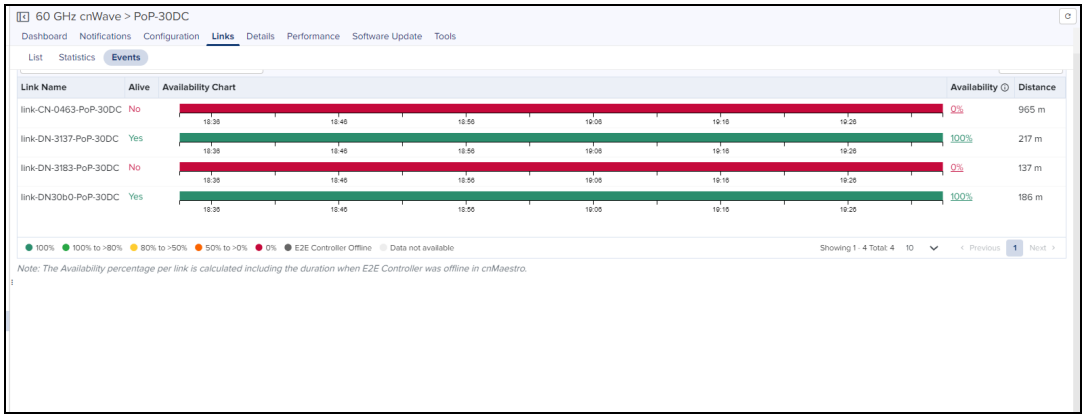


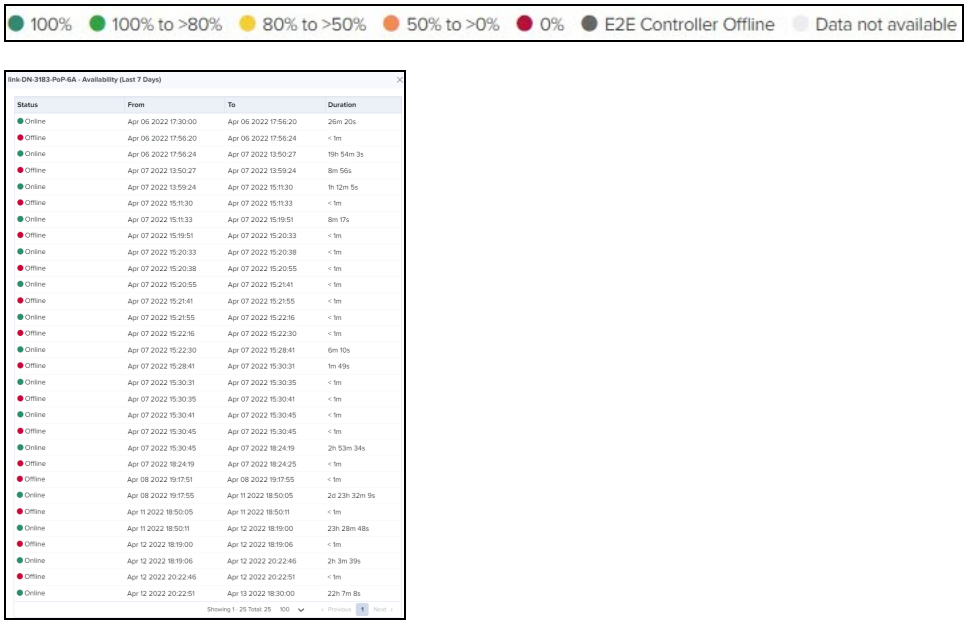
Table 71: Link > Events fields

Field	Description
Link Name	Name of the link.
Alive	Status of the link (Yes or No).
Availability Chart	Displays the link availability based on time range selected from the drop-down.When you hover the mouse on the Availability Chart, the link availability is shown as described: 1. If you select time range as **Last 1 Hour**, then link availability for every 5 minutes is displayed. 2. If you select time range other than **Last 1 Hour**, then link availability for every 1 hour is displayed.

Table 71: Link > Events fields

Field	Description
	• Hover on the link to see the hourly availability as shown in Figure 271. • Clicking on percentage link availability displays pop-up window as shown in Figure 272 • Link availability is presented in different colors in the chart as shown in Figure 270
Availability Percentage	Availability of link is shown in percentage in the Availability column, as shown in Figure 271.
Distance	Distance of the link in meters.

Figure 288 Link Availability in Percentage



Availability percentage per link is calculated, including the duration, when E2E Controller goes Offline in cnMaestro.

Figure 289 Link Availability

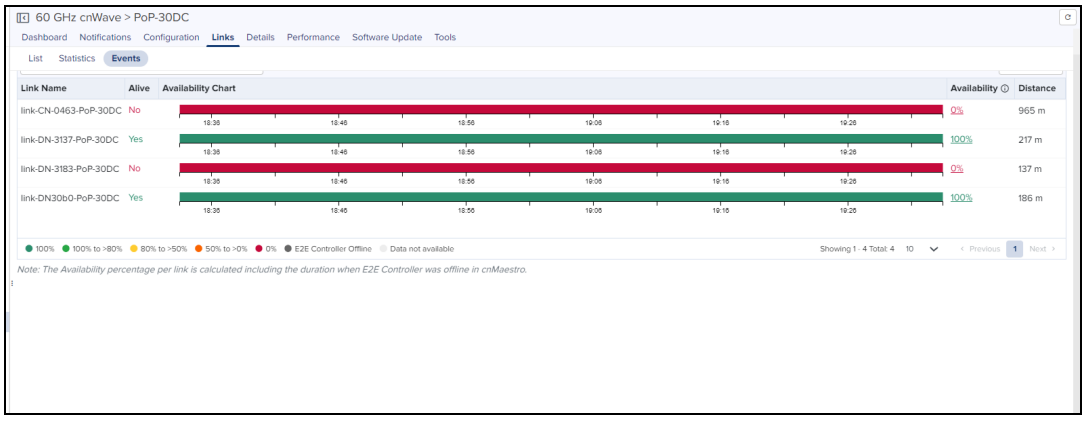
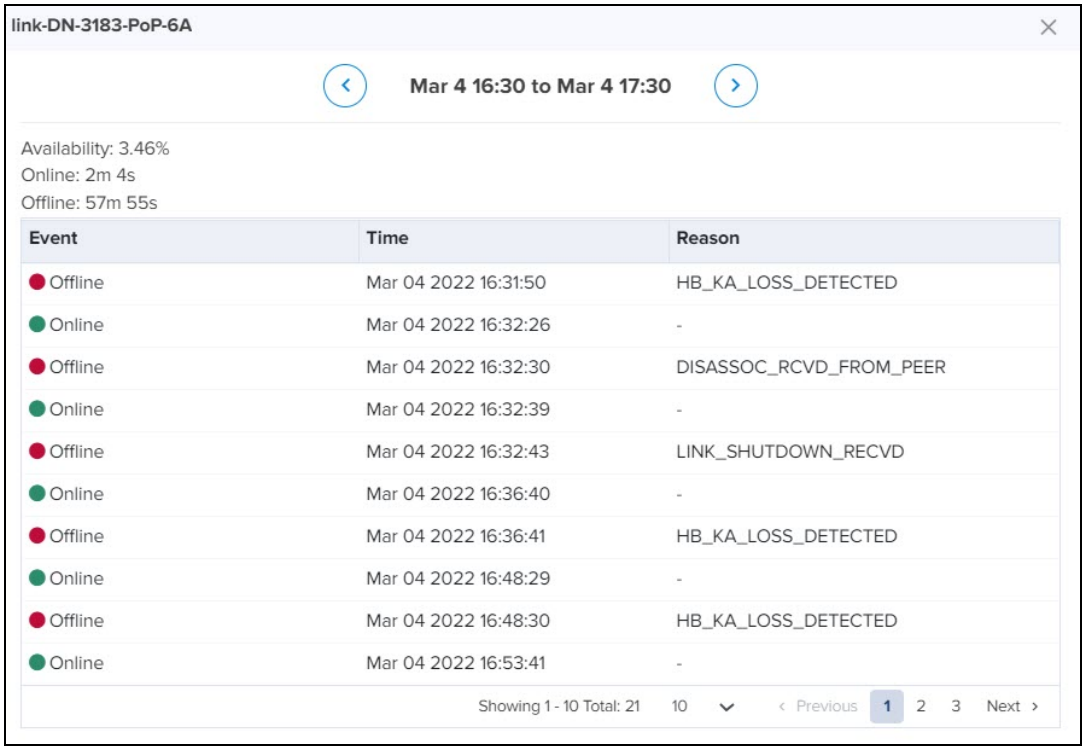


Figure 290 Link Status



Events details are available for Last 1 hour, Last 6 hours, Last 12 hours, Last 24 Hours, Last 2 days, Last 4 days, and Last 7 days.

	NOTE: Event details for **Custom Range** and **Last 30 days** are available only for cnMaestro X users.

Details

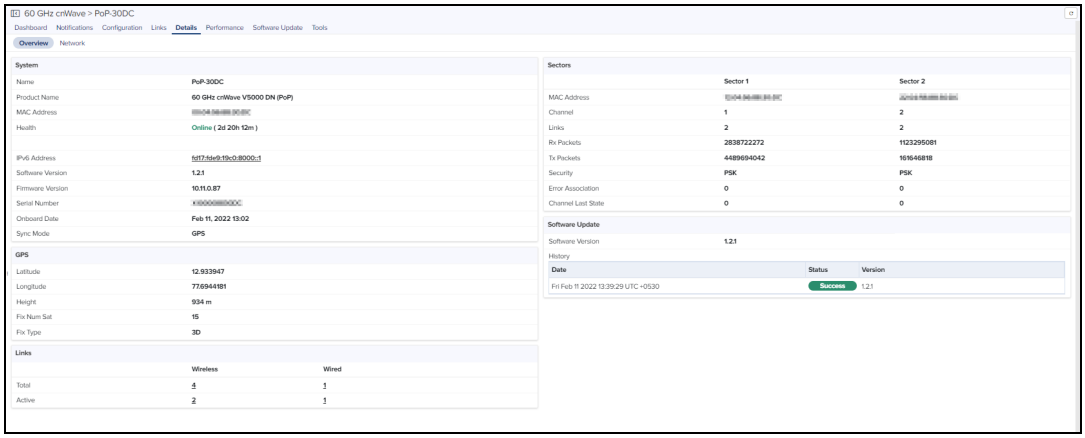
Details page provides the following device information:

- Overview
- Network

Overview

Overview page provides the device details and it also details of the last 3 software update history.

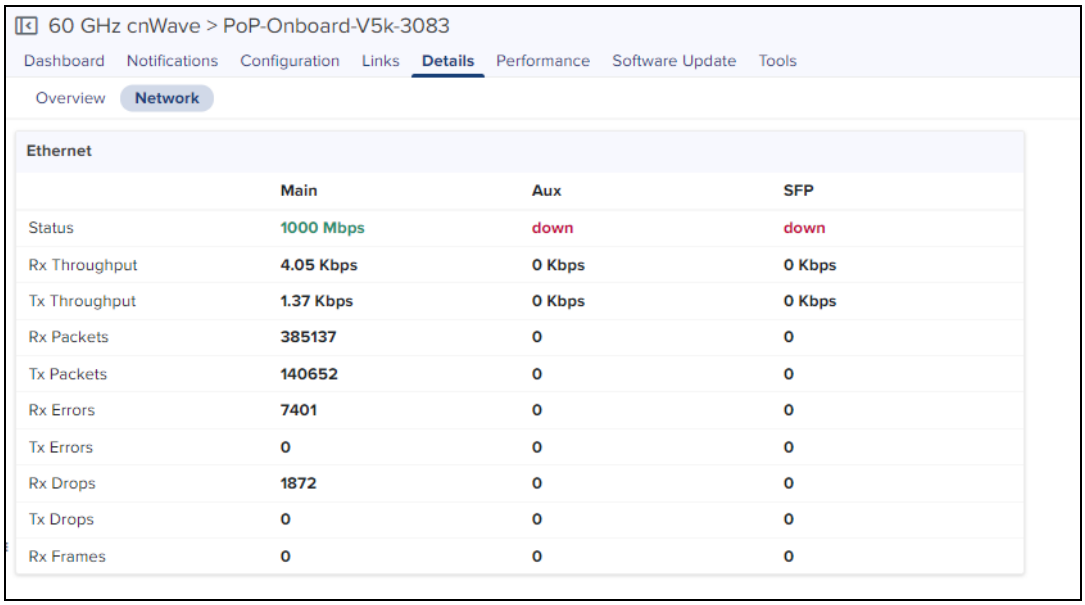
Figure 291 Details Overview Page



Network

Network page provides the **Ethernet** details of **Main, Aux**, and **SFP**.

Figure 292 Details Network Page



Tools

In Tools page, you can view the **Status**, **Debug,** details and **Remote Command** results of the device.

Status

In **Status** tab you can view the status of the device:

- Critical alarms
- Download Tech Support File
- Online or Offline
- Restart minion
- Reboot the device.

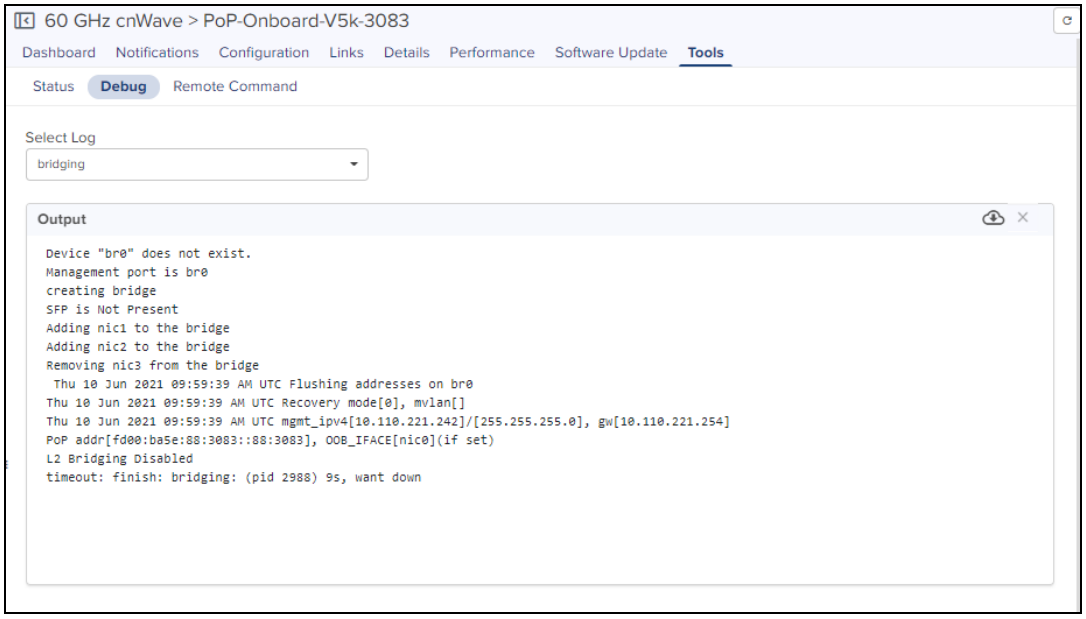
Debug

In **Debug** tab user view or download the PoP logs by executing the following log commands:

- Bridging
- pop-config
- e2e_minion
- openr
- exabgp
- cnAgent (available for Onboard PoP device)

To view the logs:

1. Navigate to **Tools > Debug**.
2. Select the required log name from the **Select Log** drop-down list box.



- Click the download icon to download the generated output.
- Click the clear ✕ icon to clear the generated output.

Remote Command

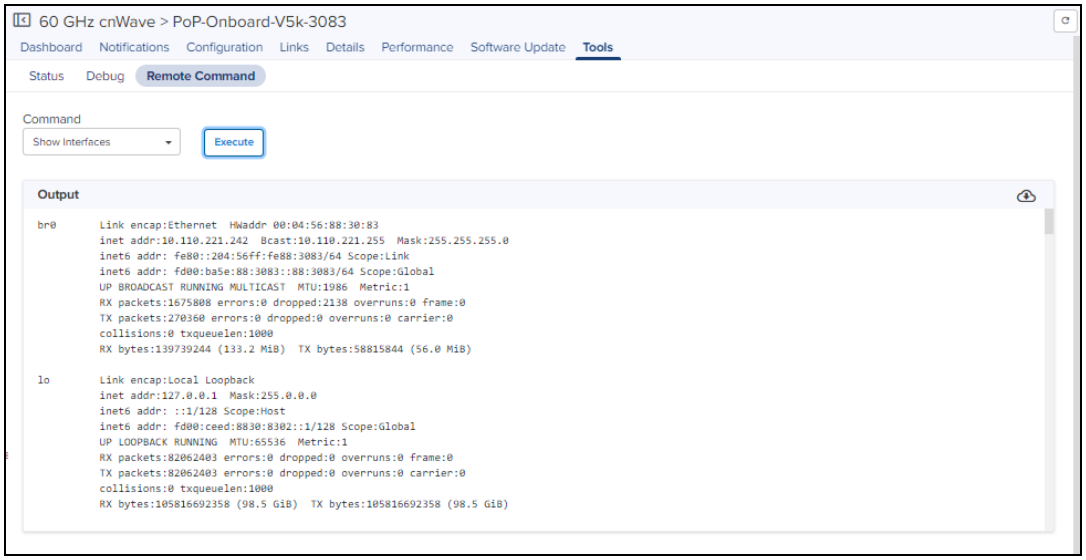
In **Remote command** tab user view or download Command logs by executing the following commands:

- Show Interfaces
- Show Routes
- Show OpenR Adjacencies
- Show OpenR Prefixes
- Show SFP Power Details (applicable for V5000 and V3000)
- Show IPv4 neighbors
- Show IPv6 neighbors
- Show Wired Device State Changes
- Ping

To Execute the command:

1. Navigate to **Tools > Remote Command**.
2. Select the required command from the **Command** drop-down list box.
3. Click **Execute.**

The output for the selected critera appears as shown:



- Click the download icon to download the generated output.
- Click the clear ✕ icon to clear the generated output.

DN/CN Node

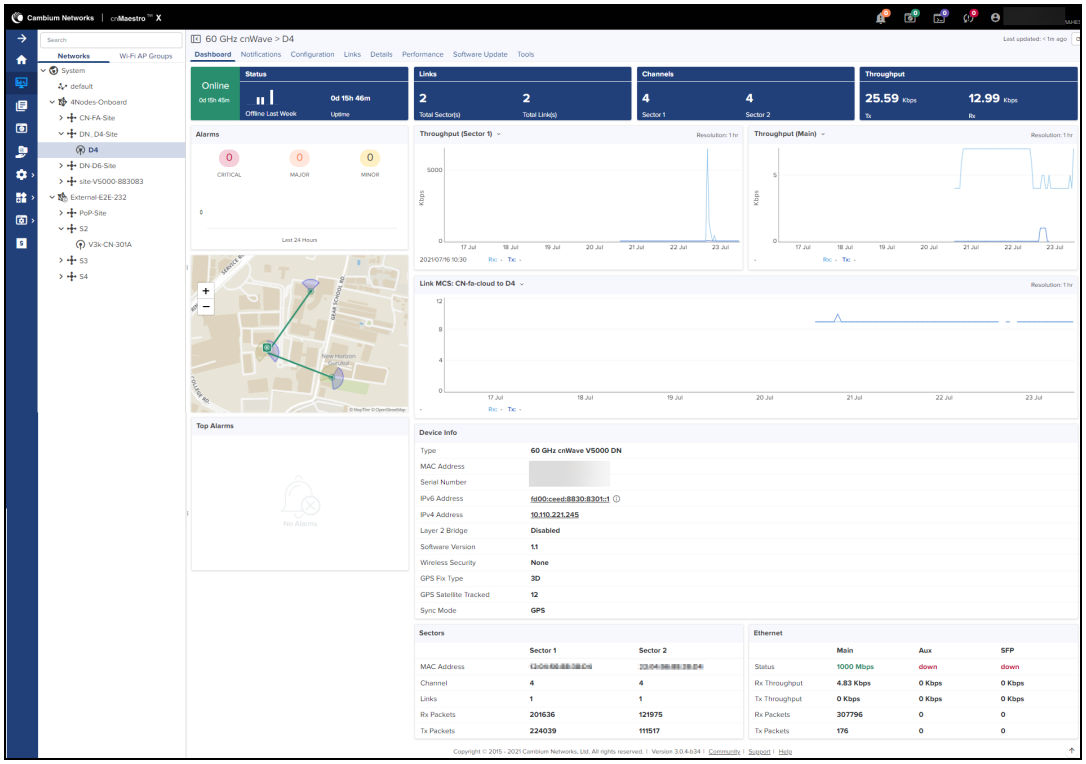
To create a new site, refer to Site.

To create a node, refer to DN/CN.

Dashboard

Dashboard pages are customized for each device type and aggregation level. The DN/CN node dashboard section displays the **Status, Links, Channels, Throughput, Sector Throughput (Sector 1 and Sector 2), Ethernet Throughput (Main, Aux, SFP)**, **Alarms, Top Active Alarms, Link MCS, Device Info, Sectors, and Ethernet**.

Figure 293 DN/CN Node Dashboard



Configuration

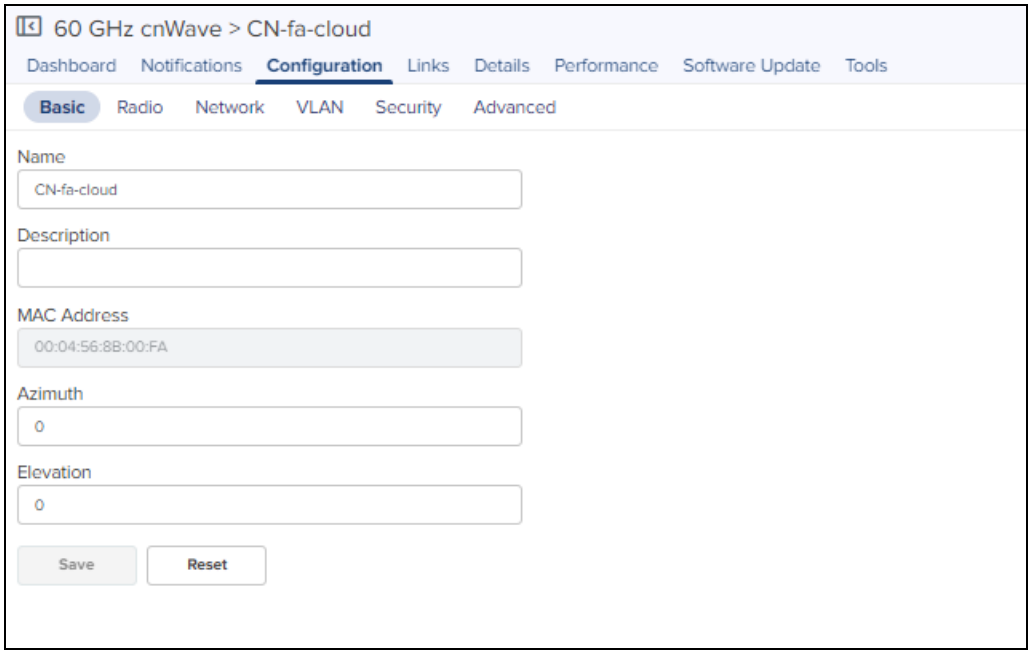
Configuration page allows the user to configure the following details of CN/DN:

- Basic
- Radio
- Network
- VLAN
- Security
- Advanced

Basic

It allows to configure and reset the basic details of DN/CN node such as Name, Description, MAC Address, Azimuth, and Elevation. It also allows to edit the name of the node.

Figure 294 Basic

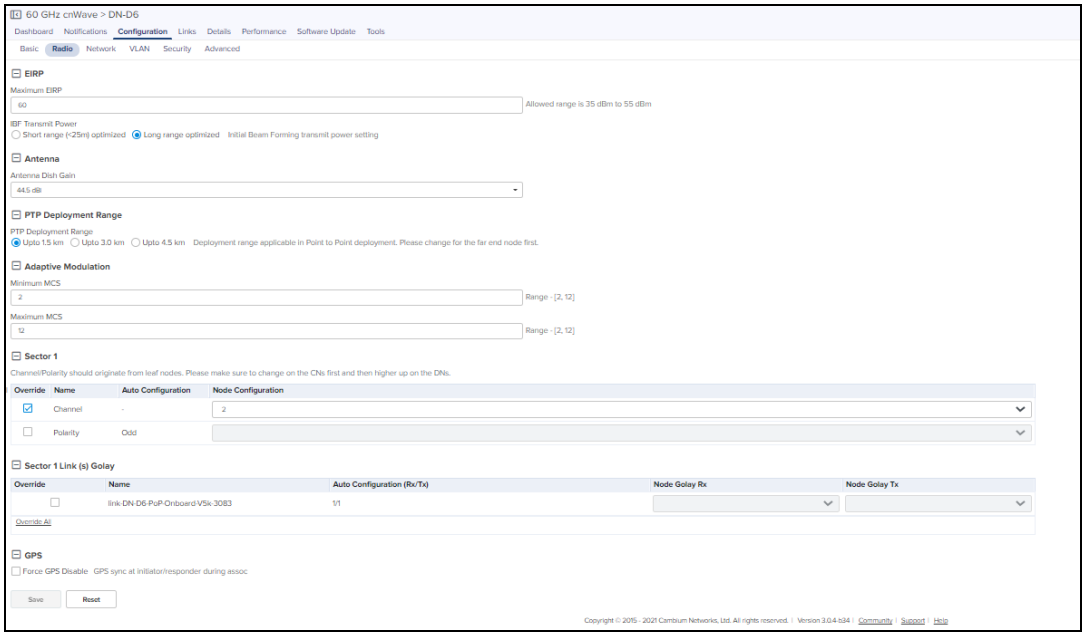


Radio

	NOTE: GPS option is not enabled for v1000.

It allows the you to configure the **EIRP**, **Adaptive Modulation**, **Sectors (channels, Polarity and Link(s) Golay),** and **GPS**.

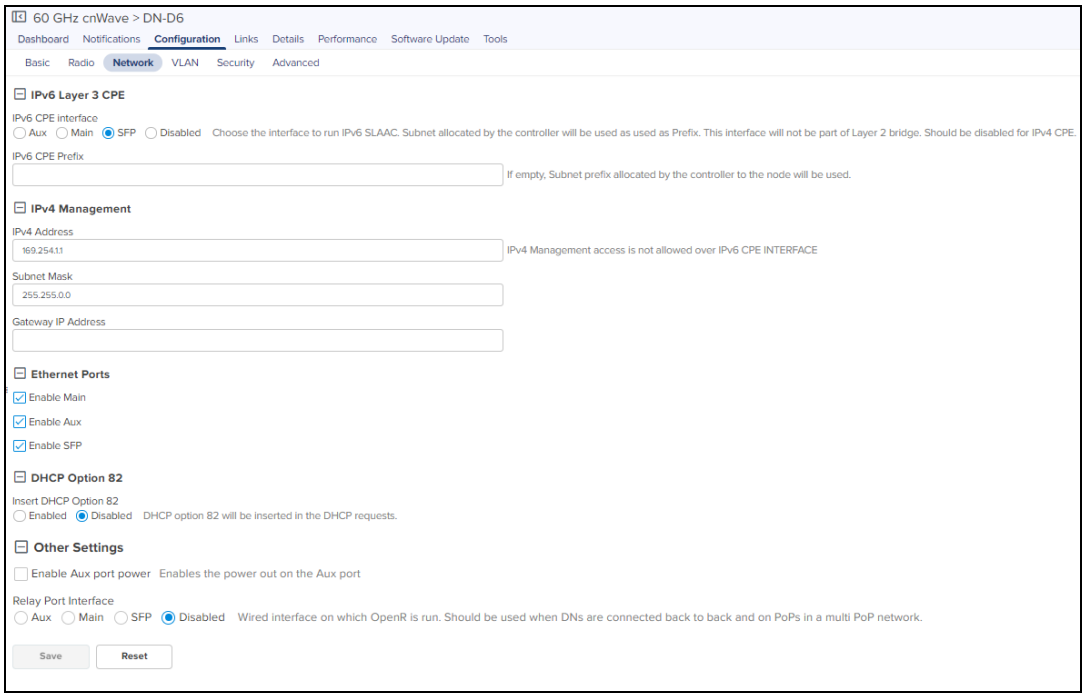
Figure 295 Radio



Network

Network tab allows the user to edit the **Layer 3 CPE, IPv4 Management**, **Ethernet Ports, PTP External Failover**, and **Other Settings.**

Figure 296 Network



VLAN

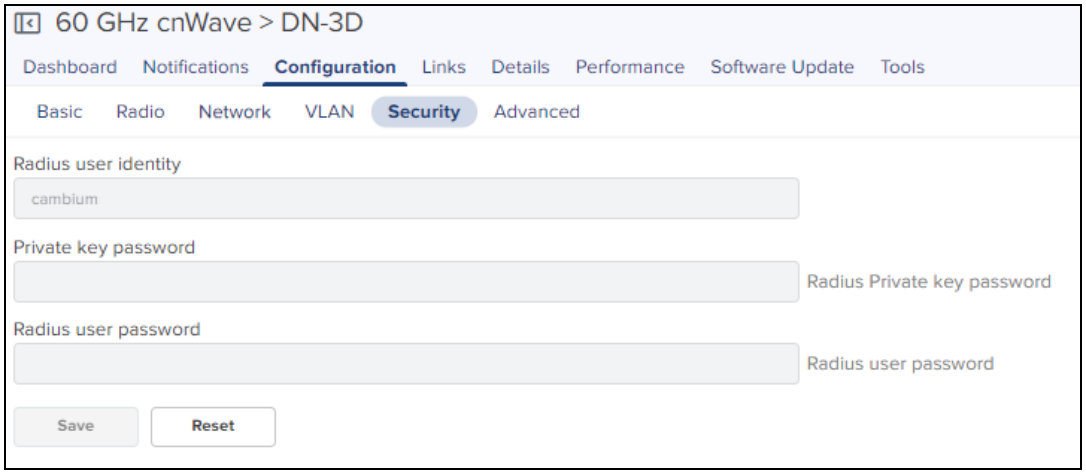
VLAN configuration of CN/DN is same as PoP Node VLAN as shown above.

	NOTE: Enable Layer 2 Bridge in **60 GHz cnWave > Configuration > Basic** page to configure the CN/DN VLAN.

Security

Security tab allows to reset the identity and password of the Radius user.

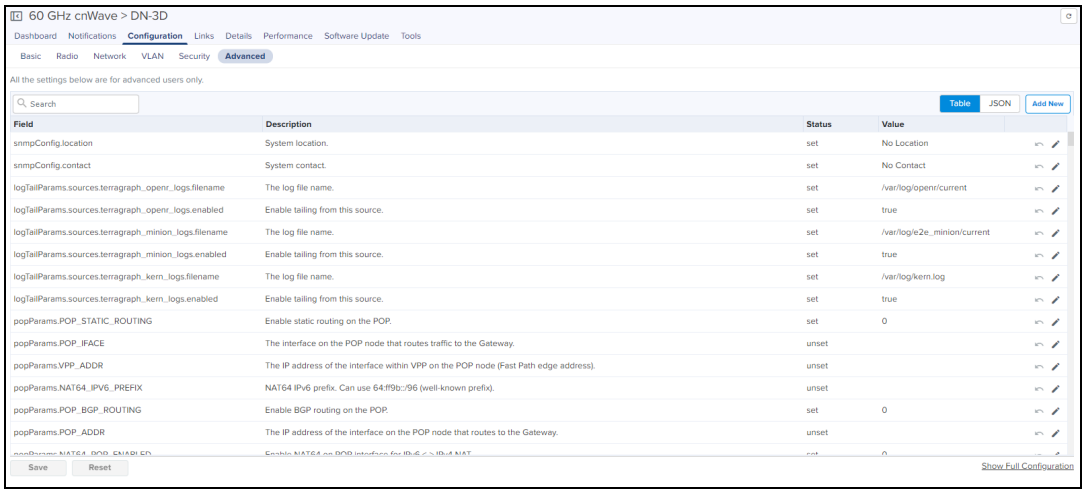
Figure 297 Security



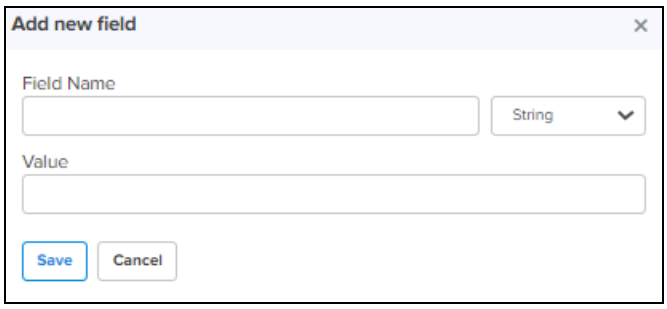
Advanced

Advanced tab allows the advanced user to set Field Name and Value.

1. Navigate to **Configuration** > **Advanced.**
2. Click **Add New.**



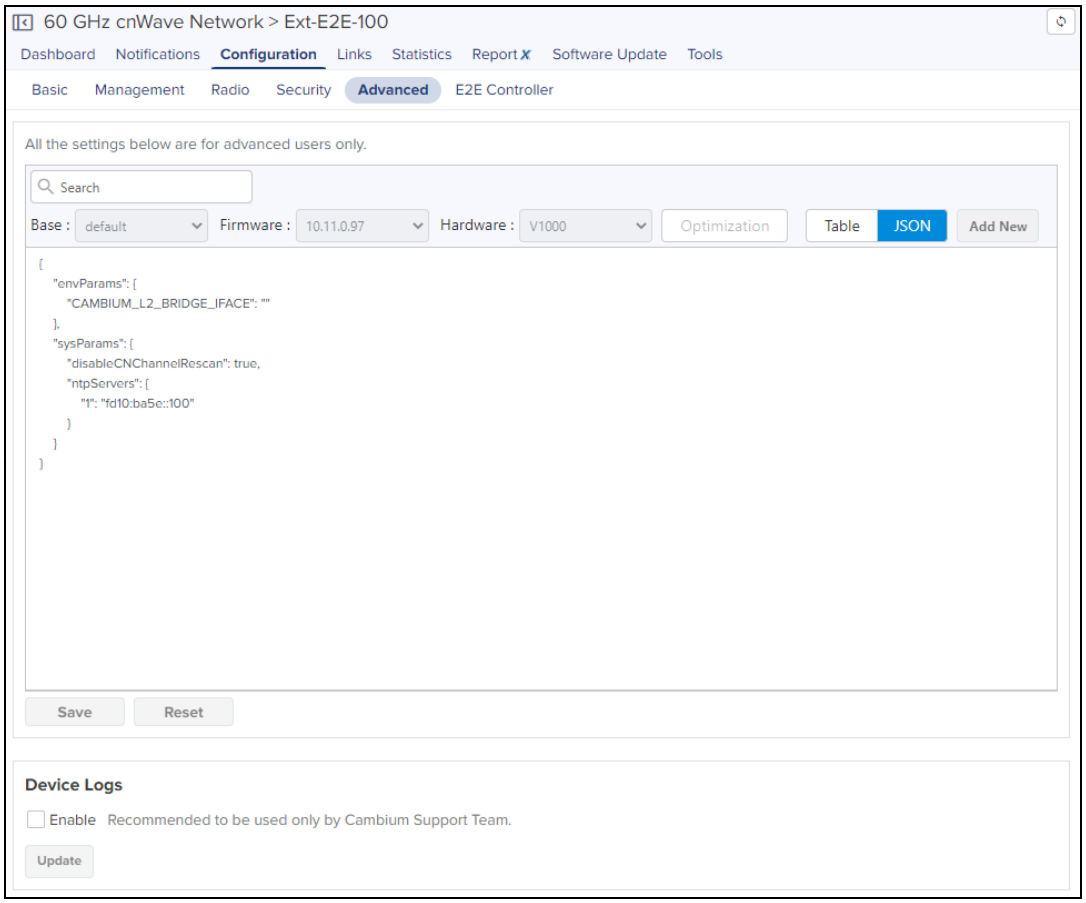
3. Enter the **Field Name** and **Value.**



4. Click **Save.**

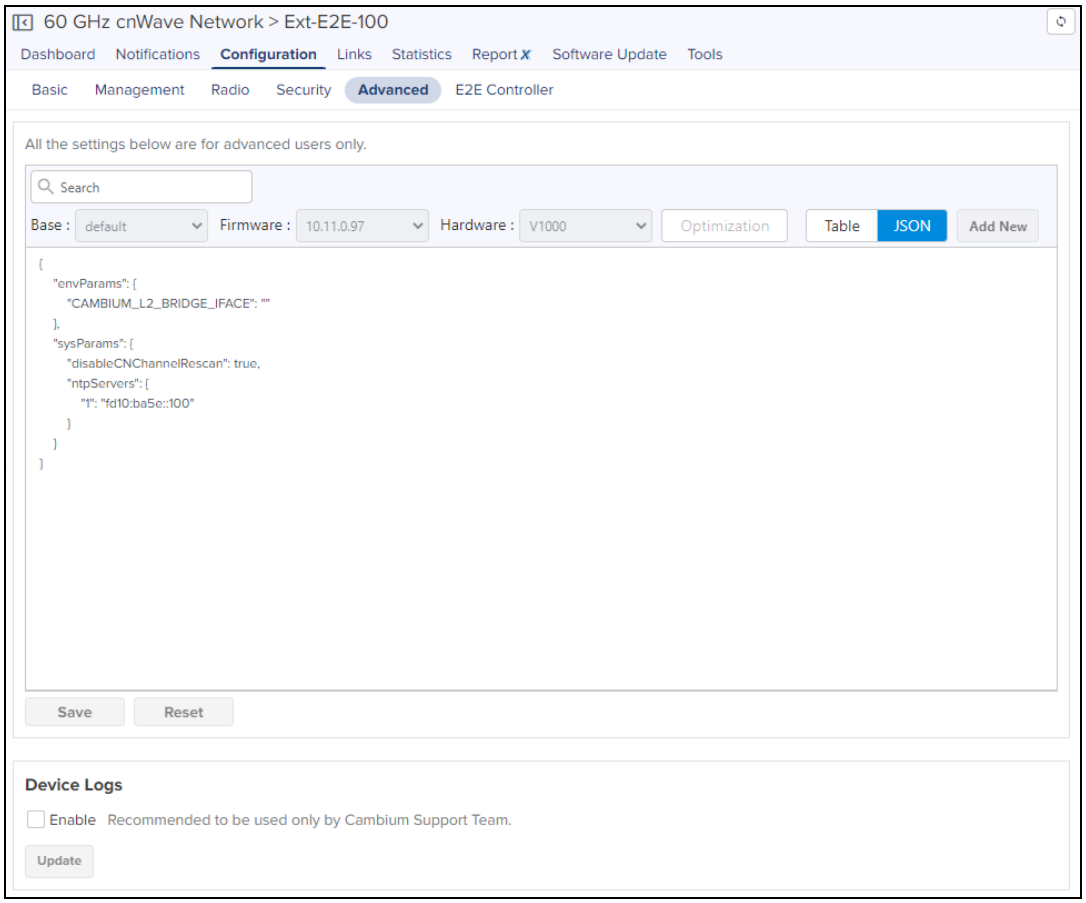
JSON

JSON allows Adavanced user to view the JSON format.

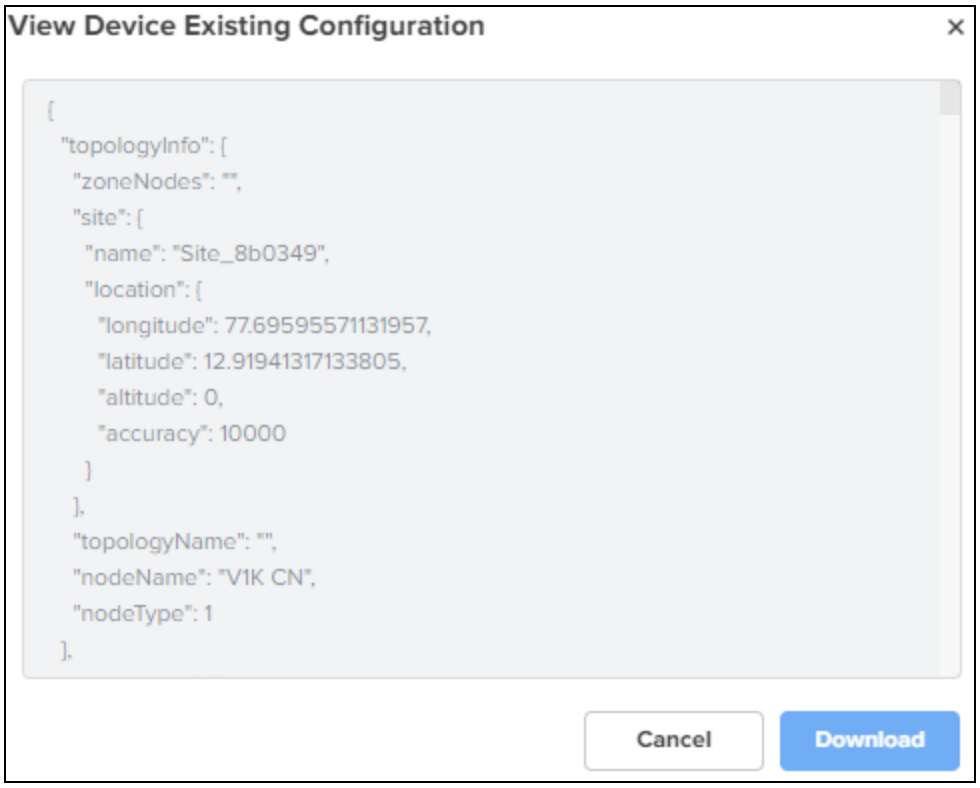


To download the file, perform the following steps:

1. Navigate to **Configuration** > **Advanced > JSON.**



2. Click **Show Full Configuration.**
3. **View Device Existing Configuration** pops up.



4. Click **Download**.

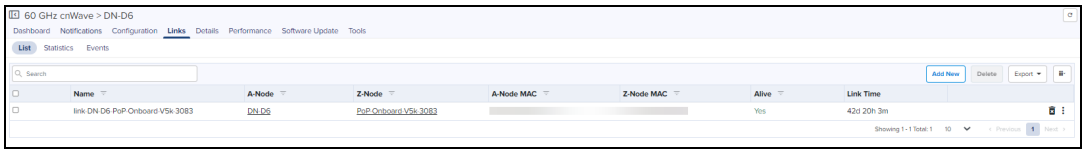
Links

Links provide the details about links of the node and also provides the option to create a new link. User can delete the links in bulk by selecting the particular devices.

List

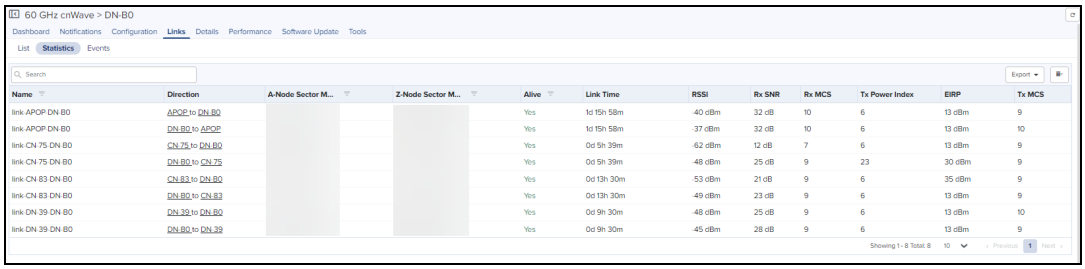
List provide the details about the links of the node and also provides the option to create a new link. User can delete the links in bulk by selecting the particular link.

Figure 298 List



Statistics

Links Statistics pages provides details of **Basic:** Name, Direction, A-Node, Z-Node Alive Link Time Type Distance Azimuth, Rx Golay, Tx Golay **Detailed Statistics**: A-Node Sector MAC, Z-Node Sector MAC, RSSI, Rx Airtime%, Rx Beam Azimuth Angle, Rx Beam Elevation Angle, Rx SNR, Rx MCS, Rx PER, Rx Scan Beams, Rx Throughput, Tx Beam Azimuth Angle, Tx Power Index, EIRP, Tx MCS, Tx PER, Tx Scan Beams, Rx Errors, Rx Frames, Tx Errors, Tx Frames, Rx Time, Tx Airtime%, Tx Beam Azimuth Angle, Tx Beam Elevation Angle, Tx Throughput, Tx Time, and Link Fade Margin links created with DN/CN node, in a page format.



Events

Events provide the details of link availability, hourly link availability in percentage, link availability in different time lines, and distance of the link.

Figure 299 Events

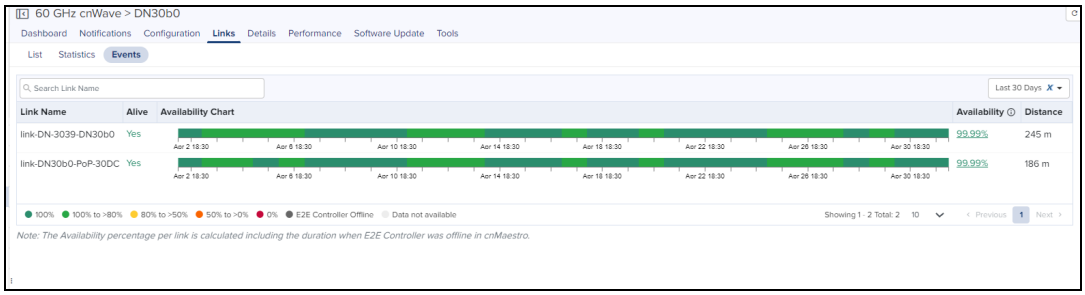
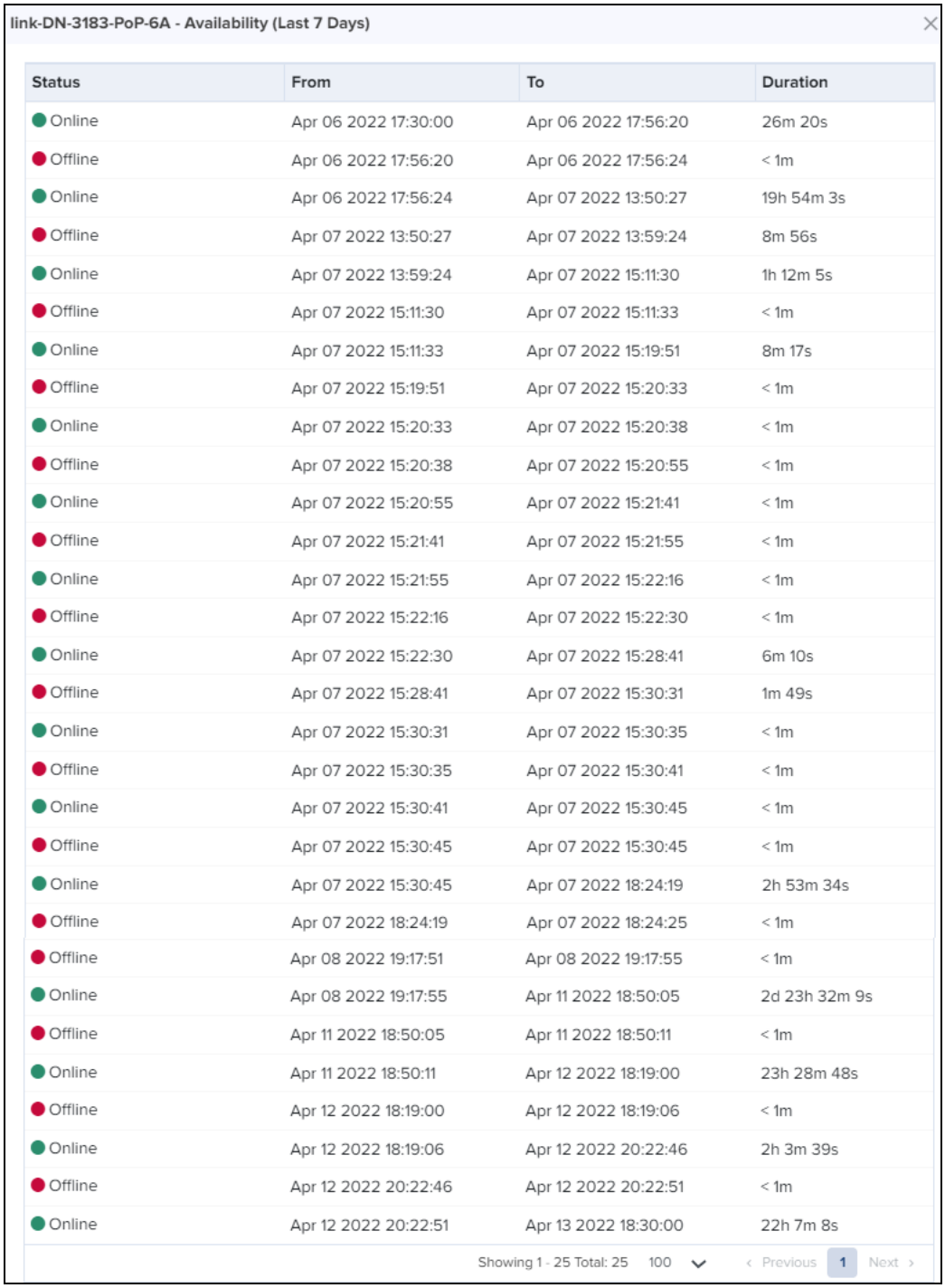


Table 72: Events fields

Field	Description
Link Name	Name of the link.
Alive	Status of the link (Yes or No).
Availability Chart	Displays the link availability based on time range selected from the drop-down.When you hover the mouse on the Availability Chart, the link availability is shown as described: 1. If you select time range as **Last 1 Hour**, then link availability for every 5 minutes is displayed. 2. If you select time range other than **Last 1 Hour**, then link availability for every 1 hour is displayed. • Hover on the link to see the hourly availability as shown in Figure 271. • Clicking on percentage link availability displays pop-up window as shown in Figure 272 • Link availability is presented in different colors in the chart as shown in Figure 270
Availability Percentage	• Clicking on percentage for the complete timeline link availability displays pop-up window as shown in Figure 301. • Availability of link is shown in percentage in the Availability column as shown in Figure 271.
Distance	Distance of the link in meters.

Figure 300 Link Availability in Percentage

Figure 301 Link Availability details



Status	From	To	Duration
Online	Apr 06 2022 17:30:00	Apr 06 2022 17:56:20	26m 20s
Offline	Apr 06 2022 17:56:20	Apr 06 2022 17:56:24	< 1m
Online	Apr 06 2022 17:56:24	Apr 07 2022 13:50:27	19h 54m 3s
Offline	Apr 07 2022 13:50:27	Apr 07 2022 13:59:24	8m 56s
Online	Apr 07 2022 13:59:24	Apr 07 2022 15:11:30	1h 12m 5s
Offline	Apr 07 2022 15:11:30	Apr 07 2022 15:11:33	< 1m
Online	Apr 07 2022 15:11:33	Apr 07 2022 15:19:51	8m 17s
Offline	Apr 07 2022 15:19:51	Apr 07 2022 15:20:33	< 1m
Online	Apr 07 2022 15:20:33	Apr 07 2022 15:20:38	< 1m
Offline	Apr 07 2022 15:20:38	Apr 07 2022 15:20:55	< 1m
Online	Apr 07 2022 15:20:55	Apr 07 2022 15:21:41	< 1m
Offline	Apr 07 2022 15:21:41	Apr 07 2022 15:21:55	< 1m
Online	Apr 07 2022 15:21:55	Apr 07 2022 15:22:16	< 1m
Offline	Apr 07 2022 15:22:16	Apr 07 2022 15:22:30	< 1m
Online	Apr 07 2022 15:22:30	Apr 07 2022 15:28:41	6m 10s
Offline	Apr 07 2022 15:28:41	Apr 07 2022 15:30:31	1m 49s
Online	Apr 07 2022 15:30:31	Apr 07 2022 15:30:35	< 1m
Offline	Apr 07 2022 15:30:35	Apr 07 2022 15:30:41	< 1m
Online	Apr 07 2022 15:30:41	Apr 07 2022 15:30:45	< 1m
Offline	Apr 07 2022 15:30:45	Apr 07 2022 15:30:45	< 1m
Online	Apr 07 2022 15:30:45	Apr 07 2022 18:24:19	2h 53m 34s
Offline	Apr 07 2022 18:24:19	Apr 07 2022 18:24:25	< 1m
Offline	Apr 08 2022 19:17:51	Apr 08 2022 19:17:55	< 1m
Online	Apr 08 2022 19:17:55	Apr 11 2022 18:50:05	2d 23h 32m 9s
Offline	Apr 11 2022 18:50:05	Apr 11 2022 18:50:11	< 1m
Online	Apr 11 2022 18:50:11	Apr 12 2022 18:19:00	23h 28m 48s
Offline	Apr 12 2022 18:19:00	Apr 12 2022 18:19:06	< 1m
Online	Apr 12 2022 18:19:06	Apr 12 2022 20:22:46	2h 3m 39s
Offline	Apr 12 2022 20:22:46	Apr 12 2022 20:22:51	< 1m
Online	Apr 12 2022 20:22:51	Apr 13 2022 18:30:00	22h 7m 8s

Availability percentage per link is calculated including the duration when E2E Controller was Offline in cnMaestro.

Figure 302 Link Availability

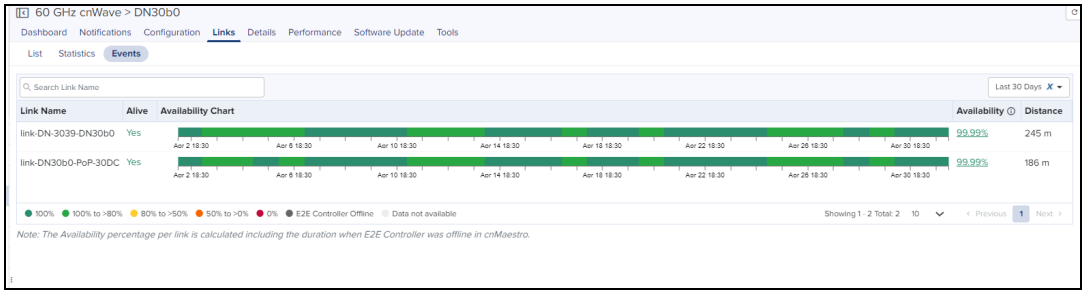
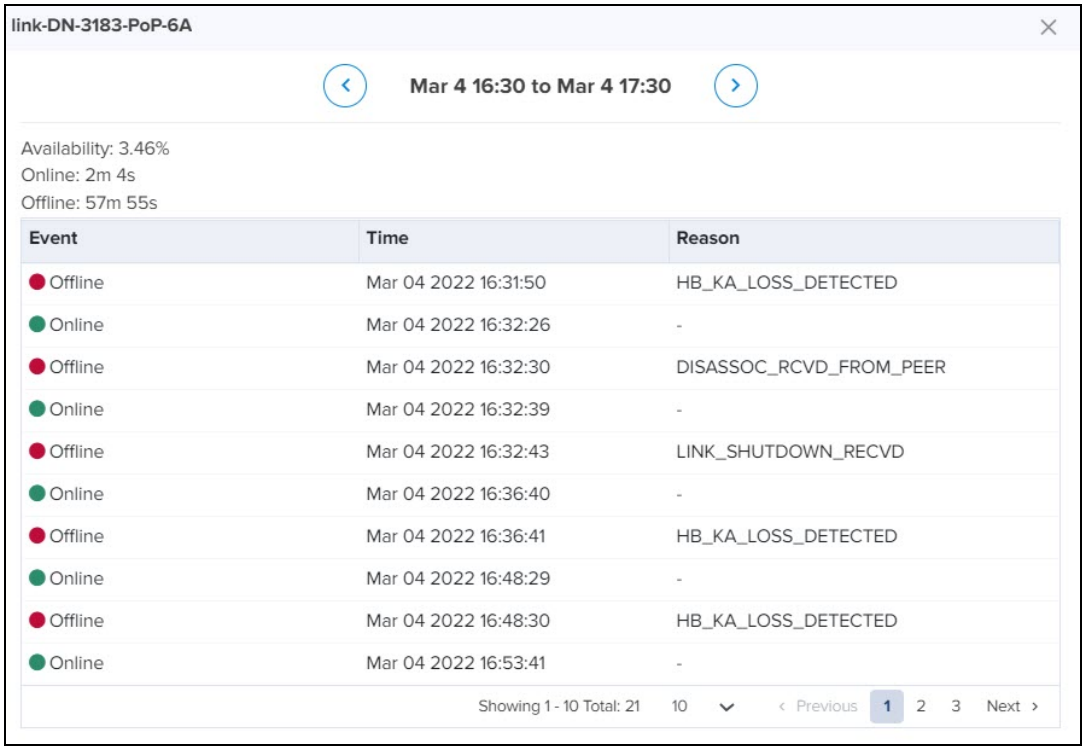


Figure 303 Link Status



Events details are available for Last 1 hour, Last 6 hours, Last 12 hours, Last 24 Hours, Last 2 days, Last 4 days, and Last 7 days.

	NOTE: Event details for **Custom Range** and **Last 30 days** is available only for cnMaestro X users.

Tools

In Tools page you can view the **Status** and **Debug** details of the device.

Status

In **Status** tab you can view the status of the device:

- Critical alarms
- Download Tech Support File
- Online or Offline
- Reboot the device.

- Restart Minion
- Factory reset

Debug

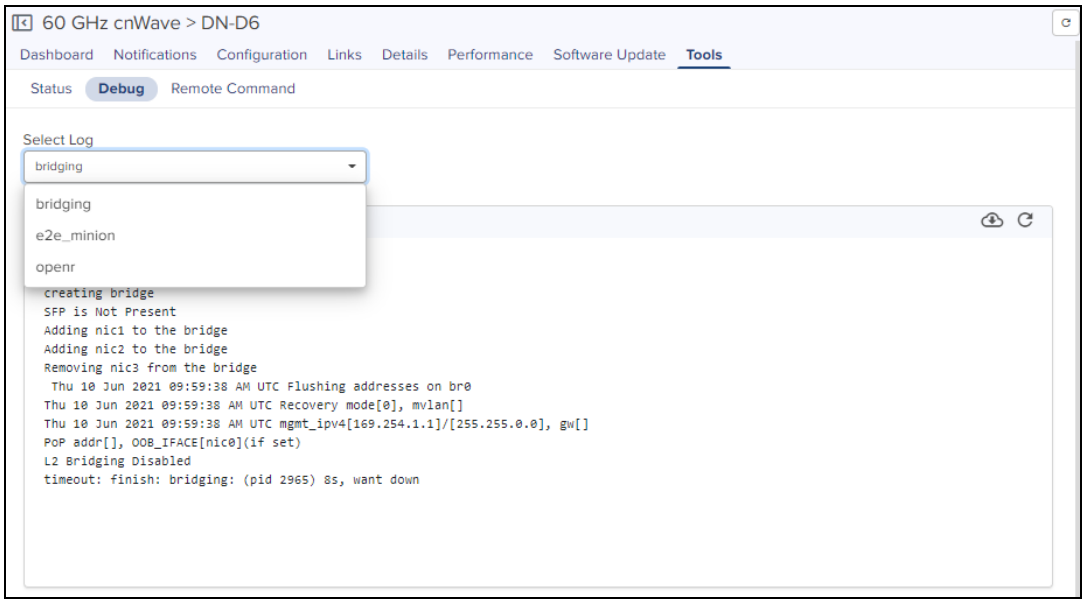
In **Debug** tab, you can view or download the DN or CN logs by executing the following log commands:

- Bridging
- e2e_minion
- openr

To view the logs:

1. Navigate to **Tools > Debug**.
2. Select the required log name from the **Select Log** drop-down list box.

The output for the selected critera appears as shown:



- Click the download icon to download the generated output.
- Click the clear ✕ icon to clear the generated output.

Remote Command

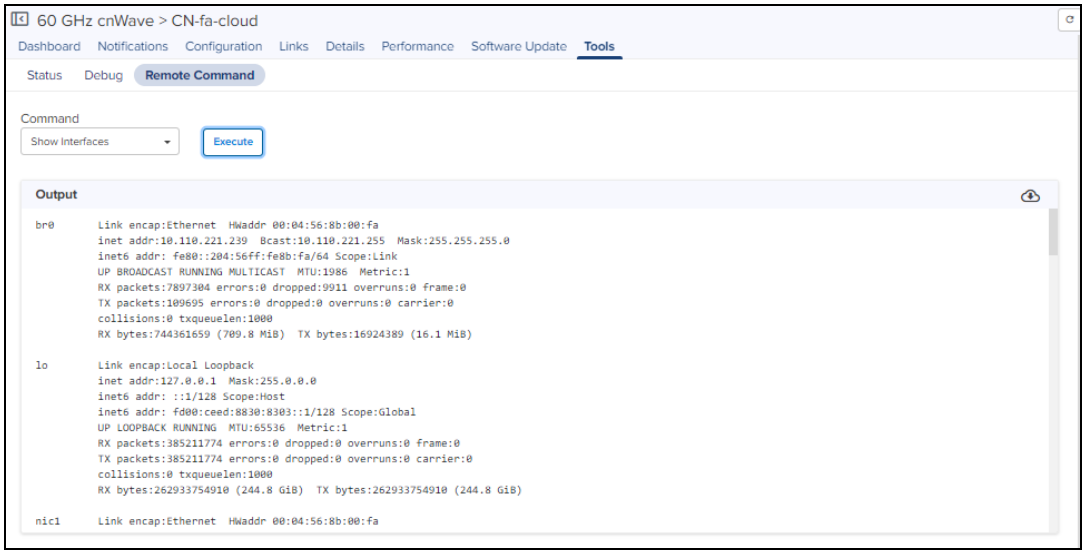
In **Remote command** tab, you can view and download Command logs by executing the following commands:

- Show Interfaces
- Show Routes
- Show OpenR Adjacencies
- Show OpenR Prefixes
- Show SFP Power Details (applicable for V5000 an V3000)
- Show IPv4 neighbors
- Show IPv6 neighbors
- Show Wired Device State Changes
- Ping

To Execute the command:

1. Navigate to **Tools > Remote Command**.
2. Select the required command from the **Command** drop-down.
3. Click **Execute.**

The output for the selected critera appears as shown:



- Click the download icon to download the generated output.
- Click the clear ✕ icon to clear the generated output.

Managing NSE 3000 using cnMaestro

NSE 3000 is managed using the cloud-hosted cnMaestro (a management solution from Cambium Networks).

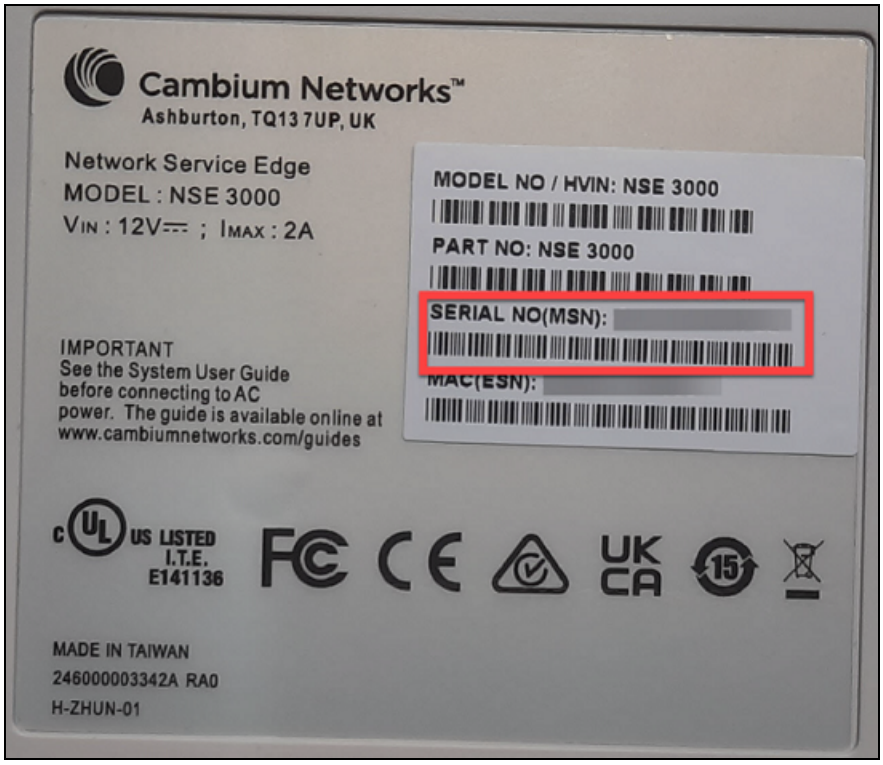
This section covers the following topics:

- Claiming an NSE device associated with a site
- Configuring NSE 3000
- Configuring WAN in the device UI

Claiming an NSE device associated with a site

A device manufacturer serial number (MSN) is required to claim an NSE device. You can find the device MSN at the bottom of the device as shown in Figure 304.

Figure 304 MSN of the NSE device

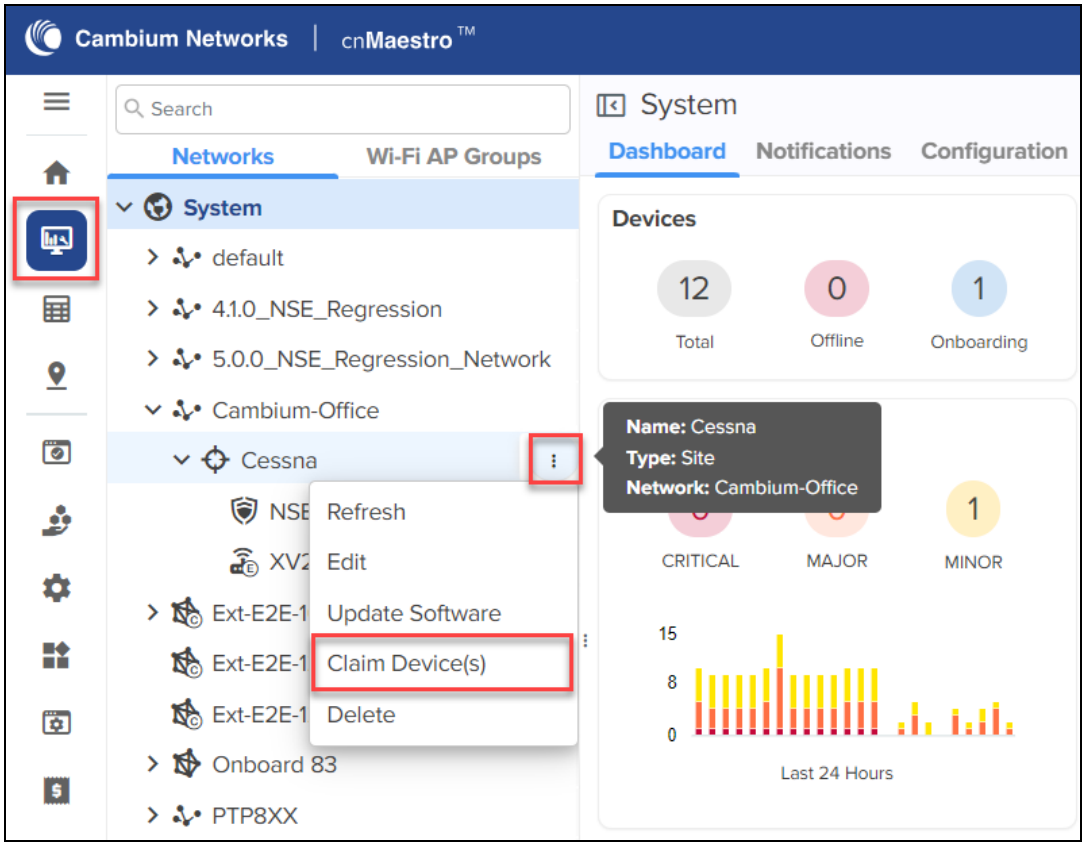


To claim an NSE device that is associated with a site, complete the following steps:

1. From the home page, navigate to **Monitor and Manage**.

   The **System** page appears, as shown in Figure 305.

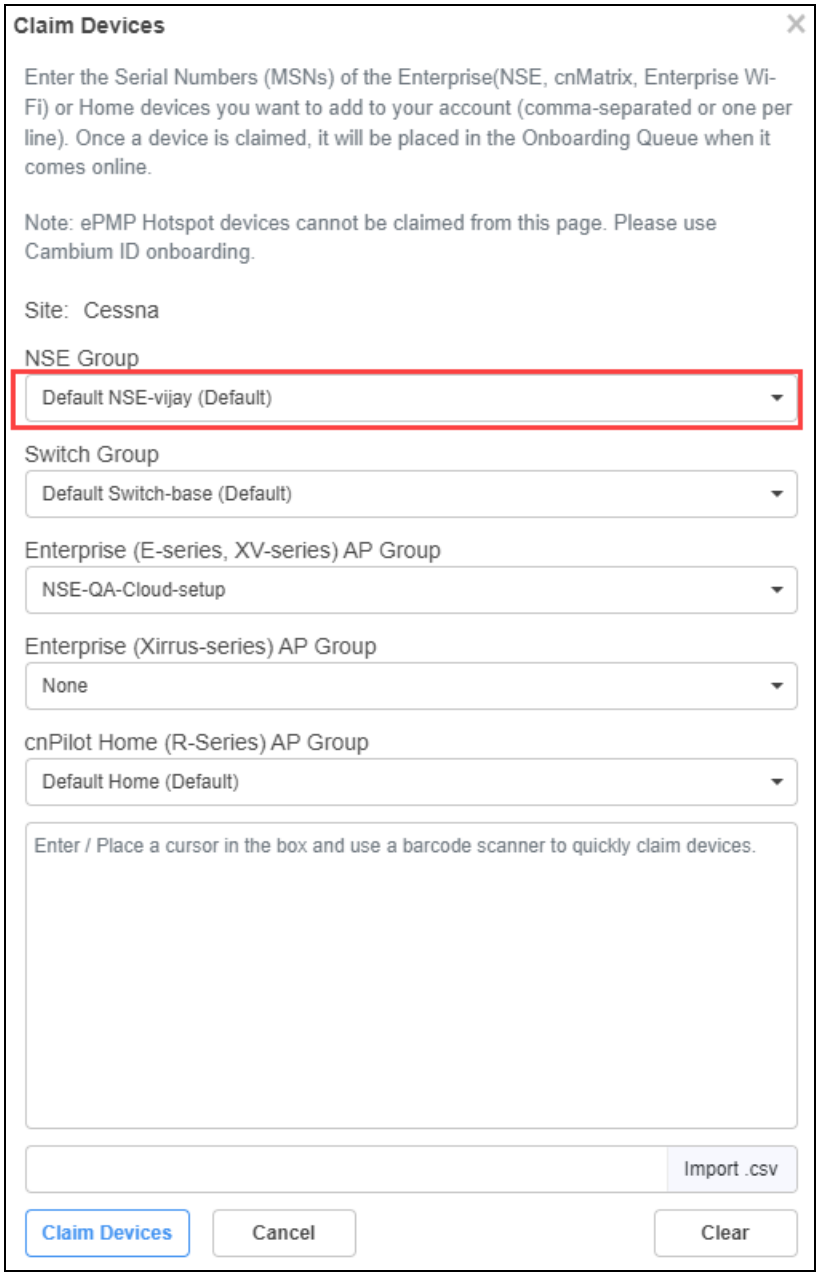
Figure 305 The System page



2. On the left panel, in the **Networks** section, expand the site panel.
3. Click the actions icon and select **Claim Device(s)**.

   The **Claim Devices** window appears, as shown in Figure 306.

Figure 306 The Claim Devices window



4. From the **NSE Group** drop-down list, select the required group.

	NOTE: The selected NSE group is automatically pushed to the device while onboarding.

5. In the **Enter** field, enter the MSN of the NSE device.
6. Click **Claim Devices**.

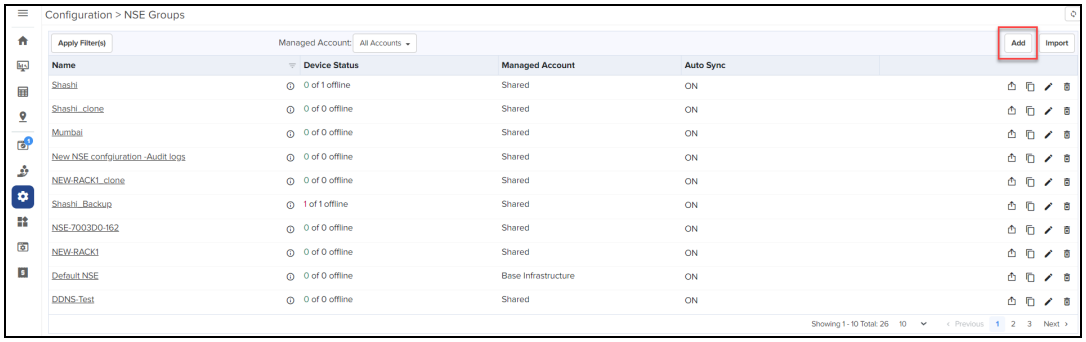
   The NSE device that is associated with a site is claimed successfully.

Configuring NSE 3000

To configure NSE 3000 devices, create configuration profiles called NSE Groups.

To create and configure a new NSE 3000 group, navigate to **Configuration** > **NSE Groups** and click **Add**.

Figure 307 Creating NSE groups



For a new NSE group, you must configure parameters using the following tabs:

- Basic
- Management
- Network
- Groups
- WAN
- Firewall
- DNS
- Threat Protection
- VPN
- User-Defined Overrides

Basic

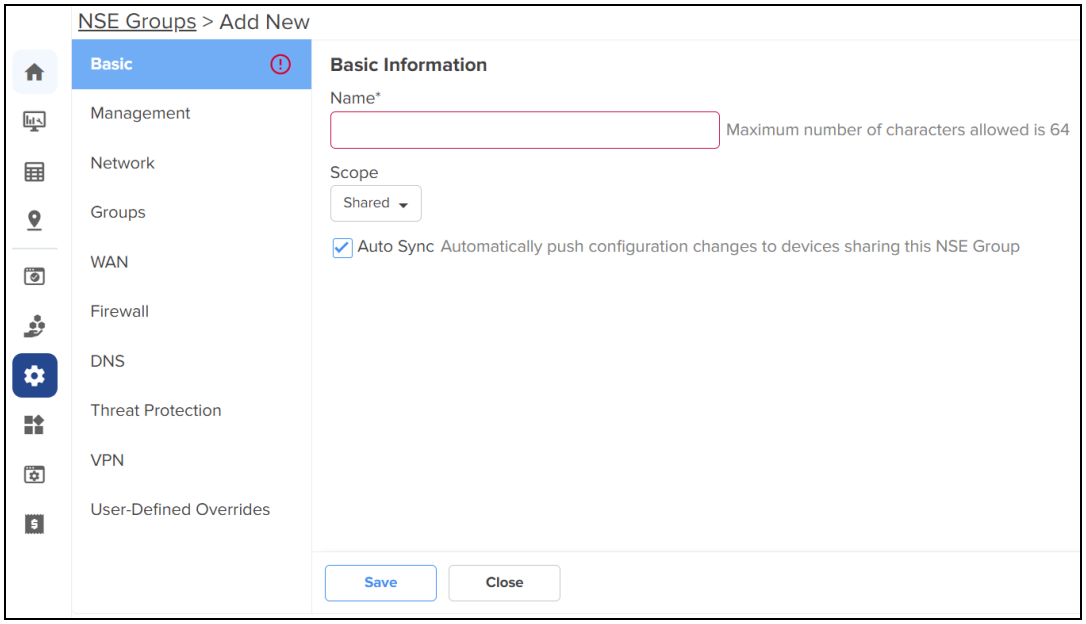
Using the **Basic** tab, you can configure basic group information, such as group name and group scope. You have the option to enable automatic synchronization of the configuration changes for devices associated with the NSE group.

To configure parameters on the **Basic Information** page, complete the following steps:

1. Navigate to **Configuration** > **NSE Groups** and click **Add.**

   The **Basic Information** page appears, as shown in Figure 308.

Figure 308 The Basic Information page



2. Configure the parameters, as described in Table 73.

Table 73: Parameters on the Basic Information page

Parameter	Description
Name	Name for the NSE group. This parameter allows a maximum of 64 characters. This is a mandatory parameter.
Scope	Scope determines the availability of the NSE group across different tenant accounts. By default, the following options are supported: • **Shared -** Configured NSE group will be available to other tenant accounts. • **Basic Infrastructure -** Configured NSE group will be available only to the Basic Infrastructure user. Other tenant accounts will not have access to the NSE group.
Auto Sync	Specifies whether the configuration changes made to the NSE group are automatically applied to all devices associated with the group. By default, auto sync is enabled.

3. Click **Save**.

Management

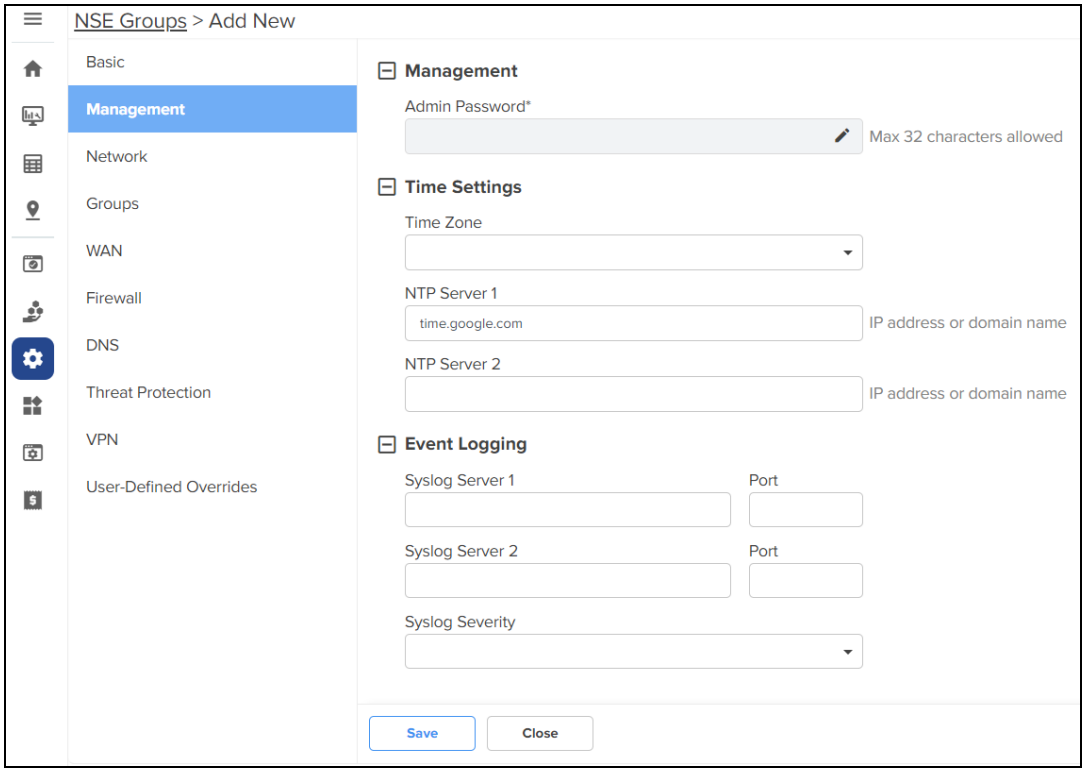
Using the **Management** tab, you can configure the profile-related parameters such as time settings and event logging.

To configure parameters on the **Management** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **Management** tab.

   The **Management** page appears, as shown in Figure 309.

Figure 309 The Management page



2. Configure the parameters, as described in Table 74.

Table 74: Parameters on the Management page

Parameter	Description
On the Management page, there are **Management**, **Time Settings**, and **Event Logging** sections.	
Management	
Admin Password	The password used to authenticate the NSE 3000 users who access through SSH or web. This parameter allows a maximum of 32 characters. This is a mandatory parameter. **Note**: Click the edit icon to reset the password.
Time Settings	
Time Zone	The time zone based on the installation location of the device. Select an appropriate time zone from the drop-down list to ensure that the device clock is synchronized with the wall clock time.

Parameter	Description
NTP Server 1	The IPv4 address or domain name of the primary Network Time Protocol (NTP) server.
NTP Server 2	The IPv4 address or domain name of the secondary or a backup NTP server.
Event Logging	
Syslog Server 1	The IPv4 address or the domain name of the syslog server 1.
Port	The port number of the syslog server 1 to which the syslog messages are sent. Supported values: 1 to 65535.
Syslog Server 2	The IPv4 address or the domain name of the syslog server 2.
Port	The port number of the syslog server 2 to which the syslog messages are sent. Supported values: 1 to 65535.
Syslog Severity	The logs with the selected severity level that must be forwarded to the server. The following options are supported: • **Emergency (Level 0)** • **Alert (Level 1)** • **Critical (Level 2)** • **Error (Level 3)** • **Warning (Level 4)** • **Notice (Level 5)** • **Info (Level 6)** • **Debug (Level 7)**

3. Click **Save**.

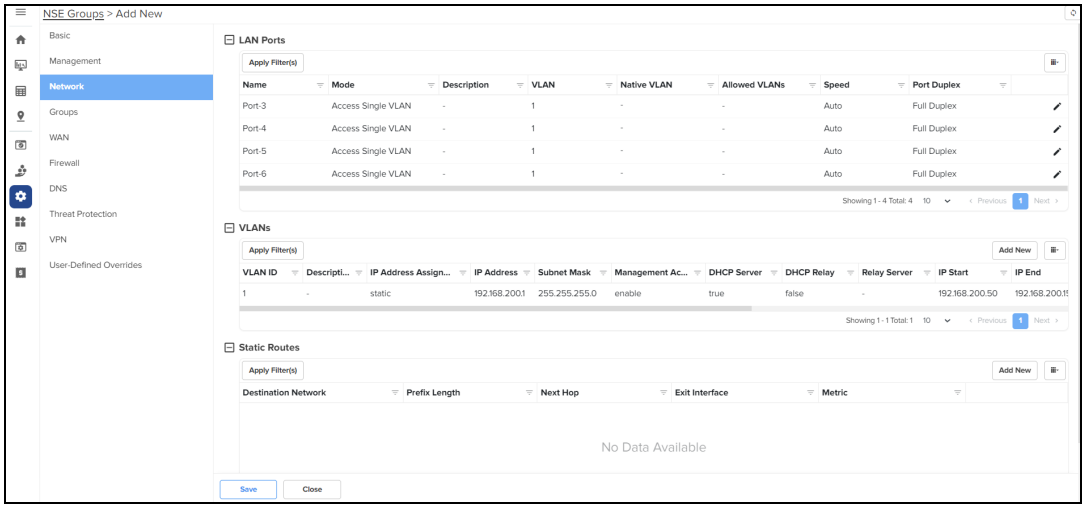
Network

Using the **Network** tab, you can configure LAN ports, VLANs, and static routes.

To configure parameters on the **Network** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **Network** tab.
   The **Network** page appears, as shown in Figure 310.

Figure 310 The Network page



2. Configure the parameters, as described in Table 75.

Table 75: Parameters on the Network page

Parameter	Description
On the Network page, there are **LAN Ports**, **VLANs**, and **Static Routes** sections.	
LAN Ports Click the edit icon to modify the configuration of the corresponding LAN port as shown in Figure 311, and click **Update** to apply the changes.	
Name	Name of the LAN port. This parameter cannot be modified.
Mode	The VLAN mode of the port. The following options are supported: • **Access Single VLAN**: An access port which places all traffic on its configured VLAN and only passes untagged traffic. • **Trunk Multiple VLANs**: A trunk port which allows the selected port to accept or pass 802.1Q tagged traffic.
Description	A brief description of the LAN port.
VLAN	This parameter is applicable only when the **Mode** parameter is set to **Access Single VLAN**. By default, VLAN value is 1. VLAN value can be in the range: 1 to 4094 This is a mandatory parameter.

Parameter	Description
Native VLAN	Indicates that the traffic on the native VLAN is untagged. This parameter is applicable only when the **Mode** parameter is set to **Trunk Multiple VLANs**. The Native VLAN value can be in the range: 1 to 4094 This is a mandatory parameter.
Tag the native VLAN	This parameter is applicable only when the **Mode** parameter is set to **Trunk Multiple VLANs**. When **Tag the native VLAN** parameter is enabled, the native VLAN traffic is tagged with 802.1Q.
Allowed VLANs	This parameter is applicable only when the **Mode** parameter is set to **Trunk Multiple VLANs**. This parameter supports a range or comma-separated list of VLANs. Example: 1-3 or 4, 10, 22
Link Speed Advertisement	Indicates the port speed that must be configured for advertisement. Default: Auto The following options are supported: • **Auto** • **10 Mbps** • **100 Mbps** • **1000 Mbps**
Port Duplex	Specifies the mode of port communication. The following options are supported: • **Full Duplex** • **Half Duplex**
Port Speed	Specifies the port speed. Default: Auto The following options are supported: • **Auto** • **10 Mbps** • **100 Mbps** • **1000 Mbps**
Shutdown	Enables or disables the port. By default, this parameter is disabled.
VLANs	

Parameter	Description
Note: You can configure up to 16 VLANs. To add a new VLAN, click **Add New**. The **Add New VLAN** window appears, as shown in Figure 312. To edit an existing VLAN configuration, click the edit icon and modify the parameters in the **Edit VLAN** window. Finally, click **Update** to apply the changes.	
VLAN ID	Indicates the VLAN ID. The VLAN ID value can be in the range: 1 to 4094 This is a mandatory parameter.
Description	Displays the user-configured description for the VLAN.
IP Address	IPv4 address that is assigned to the VLAN. This is a mandatory parameter.
Subnet Mask	Subnet mask that is assigned to the VLAN. This is a mandatory parameter.
Management Access	Indicates whether the management access is enabled or disabled. By default, this parameter is enabled.
Enable Rate Limit	Indicates whether the rate limit is enabled or disabled. By default, this parameter is disabled. When you select the **Enable Rate Limit** check box, the **Rate Limit** parameter appears.
Rate Limit	Specifies the rate of requests sent or received. This parameter appears only when you enable the **Enable Rate Limit** parameter. This parameter supports only integer values. This is a mandatory parameter.
DHCP mode	The following options are supported: • **None** • **DHCP Server -** When you select this option, the DHCP server-related parameters appear. • **DHCP Relay -** When you select this option, the **Relay Server IP address** parameter appears.
DHCP Server In addition to the below parameters, you must also configure the parameters in the **DHCP Options** and **MAC Binding List** sections, as shown in Figure 313.	

Parameter	Description
Start IP address	Starting IPv4 address in the range. This is a mandatory parameter.
End IP address	Ending IPv4 address in the range. This is a mandatory parameter.
Primary DNS	The primary DNS server for clients on the network. If the DNS server option is enabled on the NSE, the IPv4 address configured for the VLAN can be provided as the DNS server for the network.
Secondary DNS	The secondary DNS server for clients on the network.
Domain	The DNS search domain for the network.
Lease Time	The DHCP lease expiry time for the DHCP pool (in Days, Hours, and Minutes). This is a mandatory parameter.
DHCP Options NSE allows configuration of standard and custom DHCP options. To add a new DHCP option, click **Add New**. The **Add New DHCP Option** window appears, as shown in Figure 314. To edit an existing DHCP option, click the edit icon and modify the parameters in the **Edit DHCP Option** window. Finally, click **Update** to apply the changes.	
Option	The following DHCP options are supported: • **Log server(7)** • **Domain name(15)** • **NTP server(42)** • **Vendor specific information(43)** • **Vendor class identifier(60)** • **TFTP server name(66)** • **Boot file name(67)** • **Proxy auto config(252)** • **Custom** This is a mandatory parameter.
Code	A value for the code. This parameter allows a maximum value of 254.

Parameter	Description
	This is a mandatory parameter.
Type	The following options are supported: • **Text** • **IP Address** • **Integer** This is a mandatory parameter.
Value	A value in ASCII. This is a mandatory parameter.
MAC Binding List For every DHCP pool configured, the user can bind the client MAC address with an IPv4 address from the network. This enables the client to obtain the same IPv4 address whenever they connect to the NSE device. Following parameters are required to create the binding list: • MAC address of the client • IPv4 address from the configured pool When you set **MAC** and **IP address** fields and click **Add**, the binding of MAC and IP address is added. **Note**: Upto 200 MAC to IP address bindings are supported per DHCP pool. **Note**: When you bind, the binding IP address should be outside the DHCP pool range. To add a new MAC binding, click **Add New**. The **Add New MAC Binding** window appears, as shown in Figure 315. To edit an existing MAC binding, click the edit icon and modify the parameters in the **Edit MAC Binding** window. Finally, click **Update** to apply the changes.	
MAC	The MAC address of the client. This is a mandatory parameter.
IP Address	The IPv4 address that must be assigned to the client. This is a mandatory parameter.
Description	Displays the user-configured description.
Import	Imports the MAC bindings. **Note**: The CSV file that you import must be in the three-column format, for example, MAC, IP address, and Description. To import MAC bindings, click **Import**. The **Import MAC Bindings** window

Parameter	Description
	appears, as shown in Figure 316.
Replace existing list	Indicates whether the imported bindings will overwrite the existing list or append to the list. • If enabled, the imported bindings will overwrite the existing list • If disabled, the imported bindings will append to the existing list. By default, this parameter is enabled.
Export	Exports the configured bindings list. The following options are supported: • **Export all as CSV** • **Export page as CSV** To export MAC bindings, click **Export**. The export options appear, as shown in Figure 317.
DHCP Relay	Indicates whether the DHCP relay unicasts the DHCP request to an external DHCP server. This is a mandatory parameter.
Relay Server IP address	IPv4 address of the external DHCP server. This is a mandatory parameter.
Static Routes To add a new route, click **Add New**. The **Add New Route** window appears, as shown in Figure 318. To edit an existing route, click the edit icon and modify the parameters in the **Edit Route** window. Finally, click **Update** to apply the changes.	
Destination Network	The IPv4 address of the destination network. This is a mandatory parameter.
Prefix Length	The prefix length for the network address. This parameter supports integer values and a maximum value of 32. This is a mandatory parameter.

Parameter	Description
Next Hop	The next hop IPv4 address for the route. This is a mandatory parameter.
Exit Interface	The exit interface through which the next hop is reachable. The following options are supported: • WAN-1 • WAN-2 • VLAN-1 • VLAN-10 • VLAN-20 • VLAN-30 This is a mandatory parameter.
Metric	The metric for the route.

Figure 311 The Edit Port window

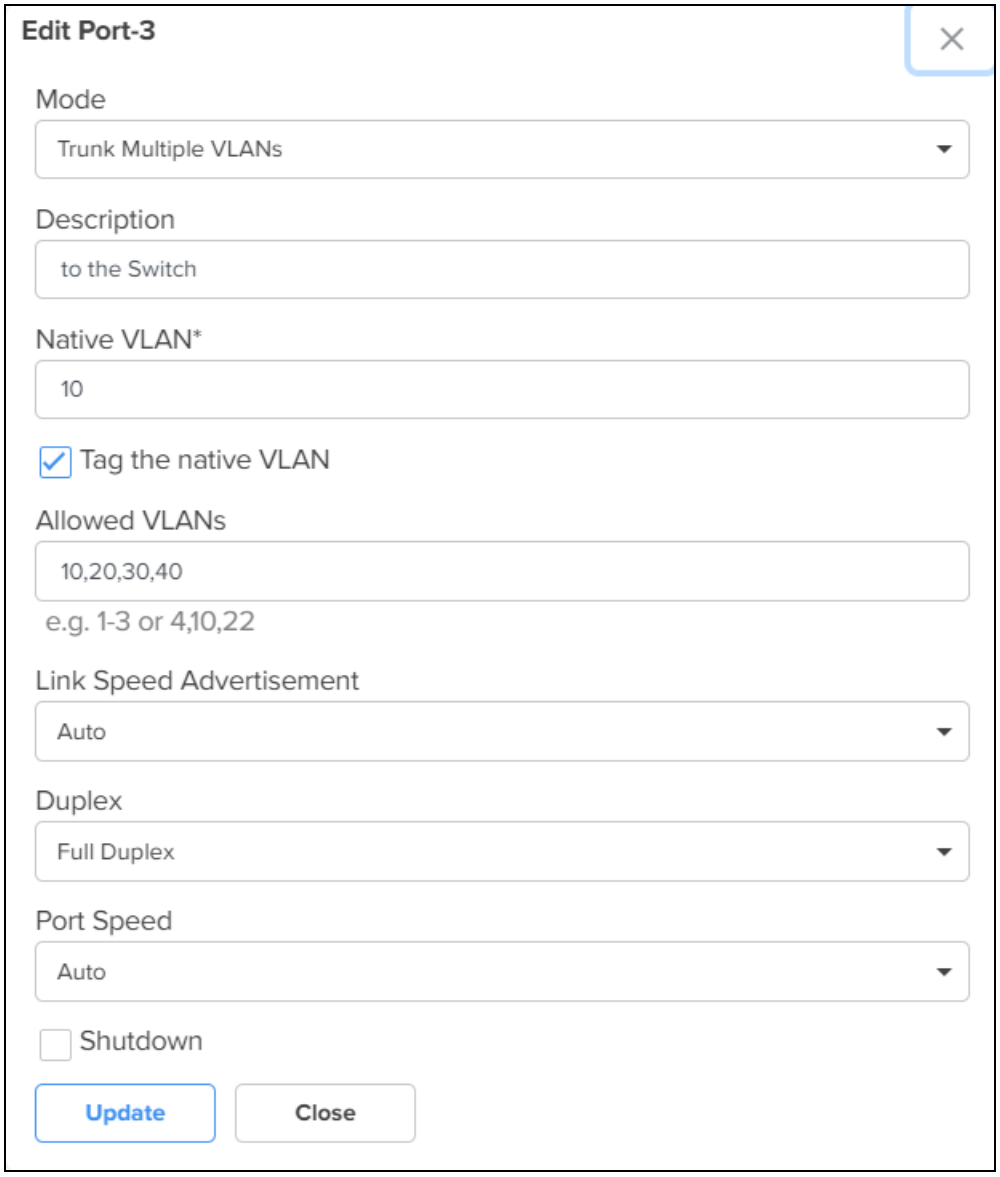


Figure 312 The Add New VLAN window

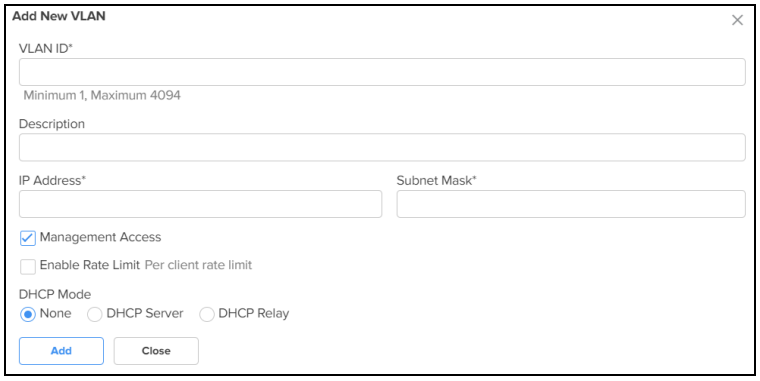


Figure 313 DHCP Options and MAC Binding List

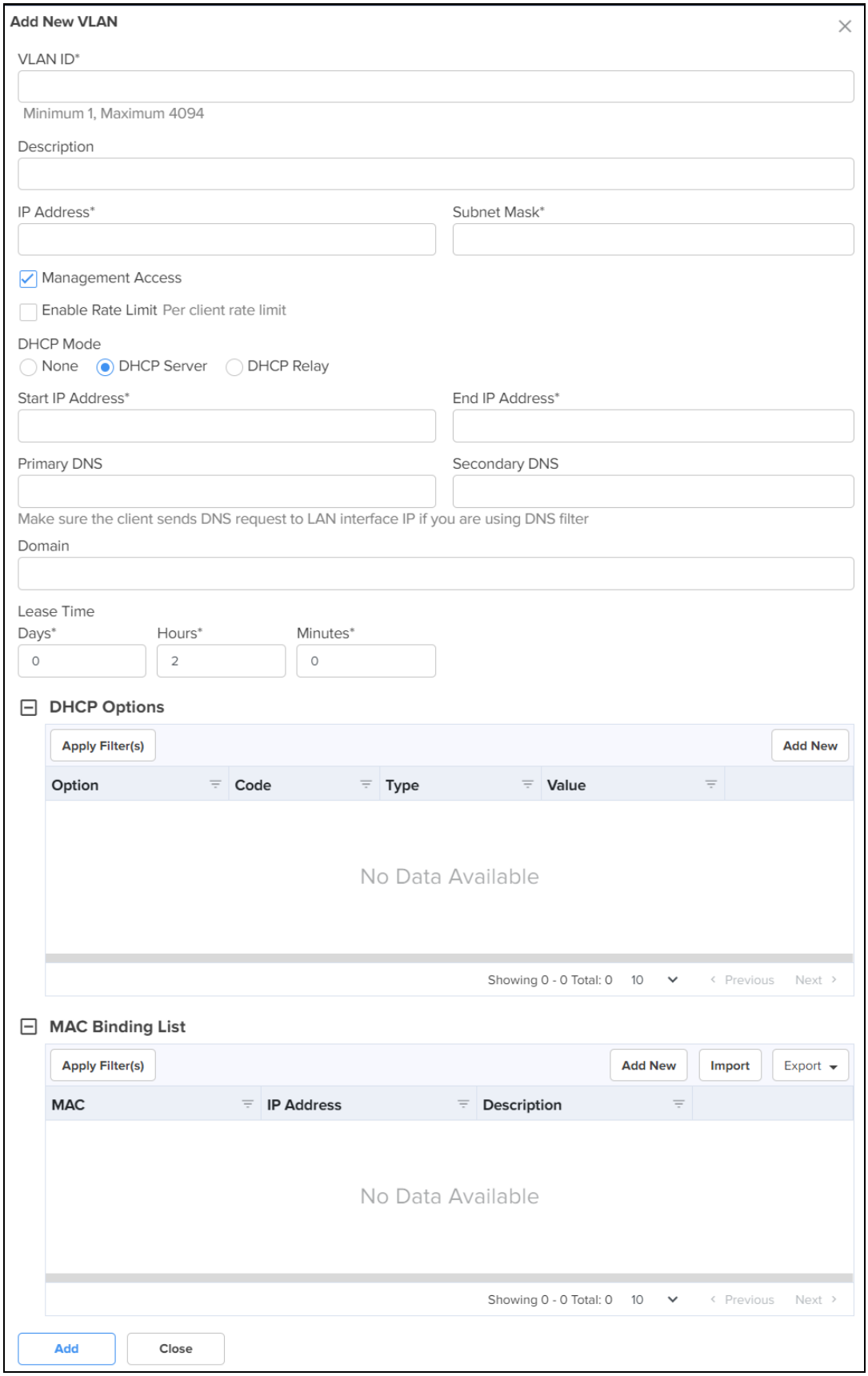


Figure 314 The Add New DHCP Option window

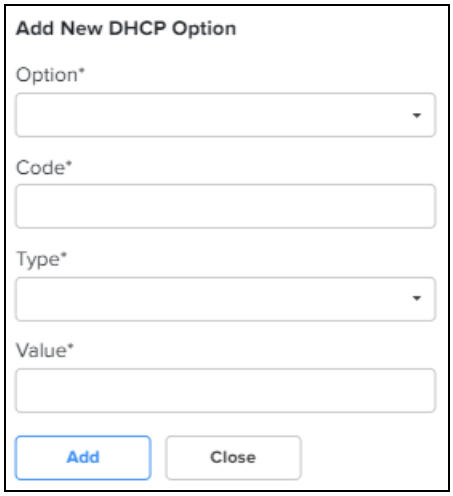


Figure 315 The Add New MAC Binding window

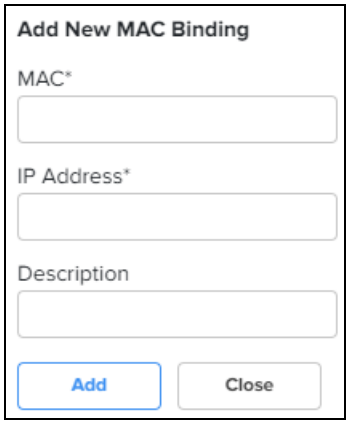


Figure 316 The Import option in MAC Binding List

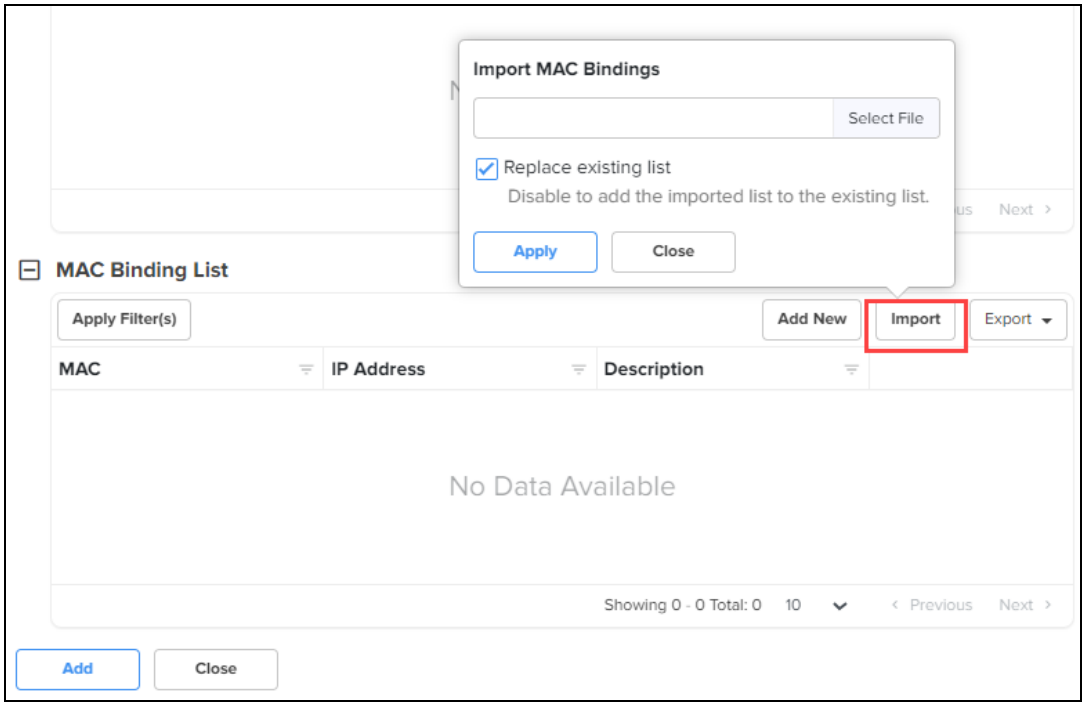


Figure 317 The Export option in MAC Binding List

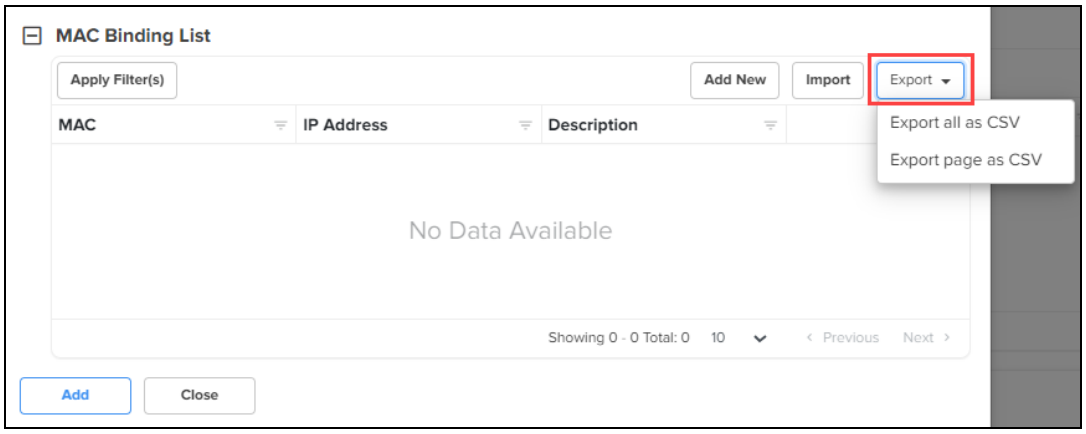
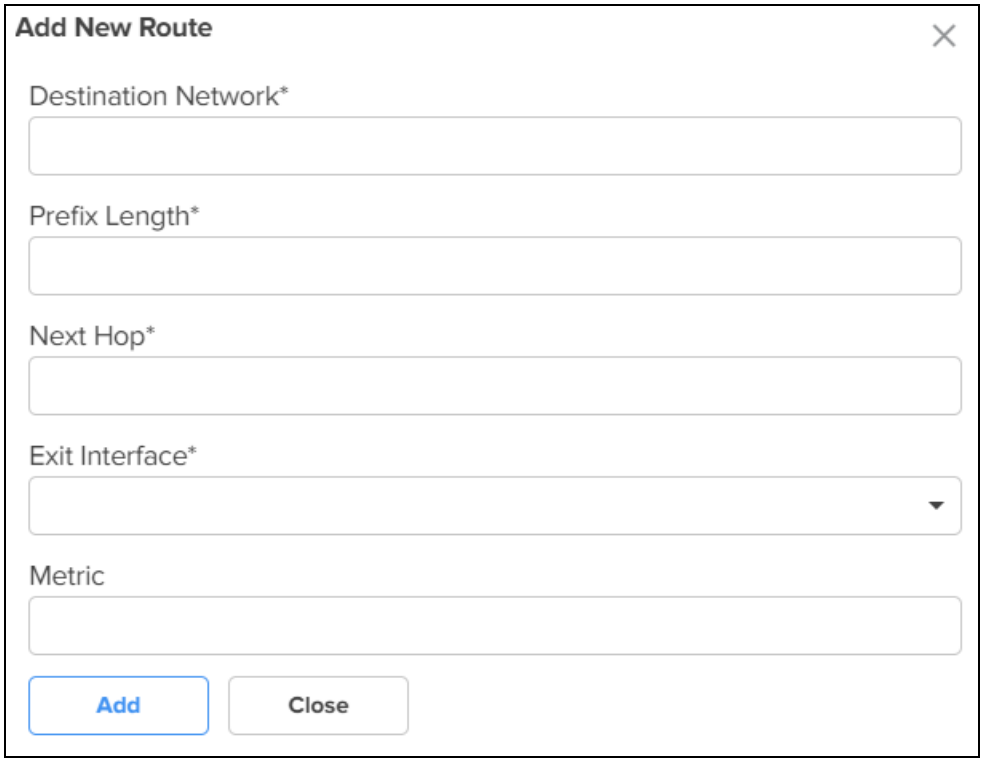


Figure 318 The Add New Route window



3. Click **Save**.

Groups

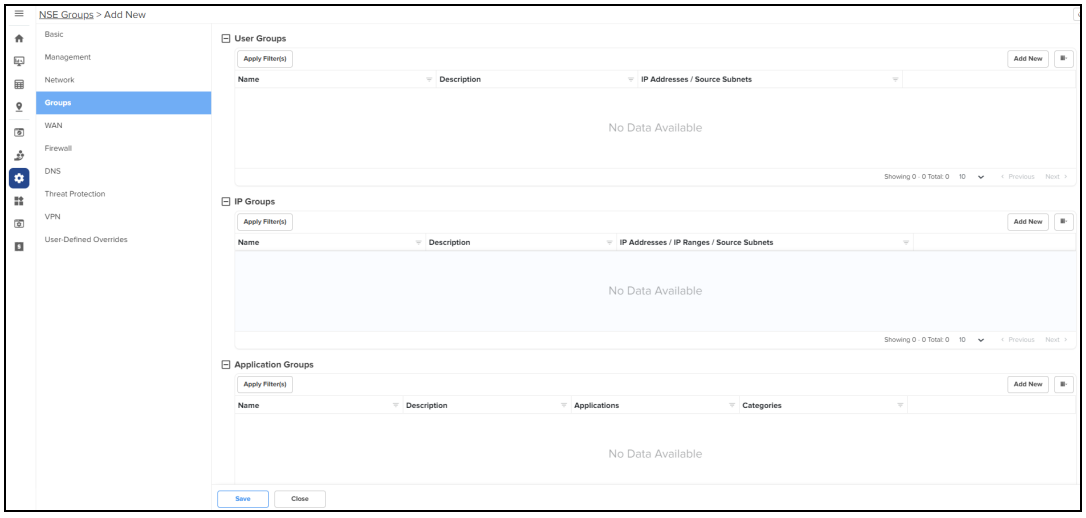
Using the **Groups** tab, you can configure user groups, IP groups, and application groups.

To view the **Groups** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **Groups** tab.

   The **Groups** page appears, as shown in Figure 319.

Figure 319 The Groups page



2. Configure the parameters, as described in Table 76.

Table 76: Parameters on the Groups page

Parameter	Description
On the Groups page, there are **User Groups**, **IP Groups**, and **Application Groups** sections.	
User Groups User groups are used to group locally configured networks and these groups can be used to associate with policies, especially application rules or DNS rules. To add a new user group, click **Add New**. The **Add User Group** window appears, as shown in Figure 320. To edit a user group, click the edit icon and modify the parameters in the **Edit User Group** window. Finally, click **Update** to apply the changes.	
Name	Name for the user group. This is a mandatory parameter.
Description	Description for the user group.
IP Addresses/Source Subnets	IPv4 addresses or source subnets for the user group. This is a mandatory parameter.
IP Groups IP groups are used to group networks originating from the WAN, and can be used to attach port forwarding rules. To add a new IP group, click **Add New**. The **Add IP Group** window appears, as shown in Figure 321. To edit an IP group, click the edit icon and modify the parameters in the **Edit IP Group** window. Finally, click **Update** to apply the changes.	
Name	Name for the IP group.
Description	Description for the IP group.
IP Addresses/IP Ranges/Source Subnets	IPv4 addresses, IP ranges, or source subnets for the IP group. This is a mandatory parameter.
Application Groups Application groups are used to group applications by using application names or categories, which can then be attached to a policy for permitting or denying access. To add a new application group, click **Add New**. The **Add New Application Group** window appears, as shown in Figure 322. To edit an application group, click the edit icon and modify the parameters in the **Edit Application Group** window. Finally, click **Update** to apply the changes.	
Name	Name for the application group.

Parameter	Description
Description	Description for the application group.
Applications To add applications to the application group, select the required application(s) from the drop-down list and click **Add New**. The selected applications are added in the **Name** list.	
Application Name	Applications for the new application group.
Categories To include categories for the new application group, select the required categories.	
Categories	Categories for the new application group.

Figure 320 The Add User Group window

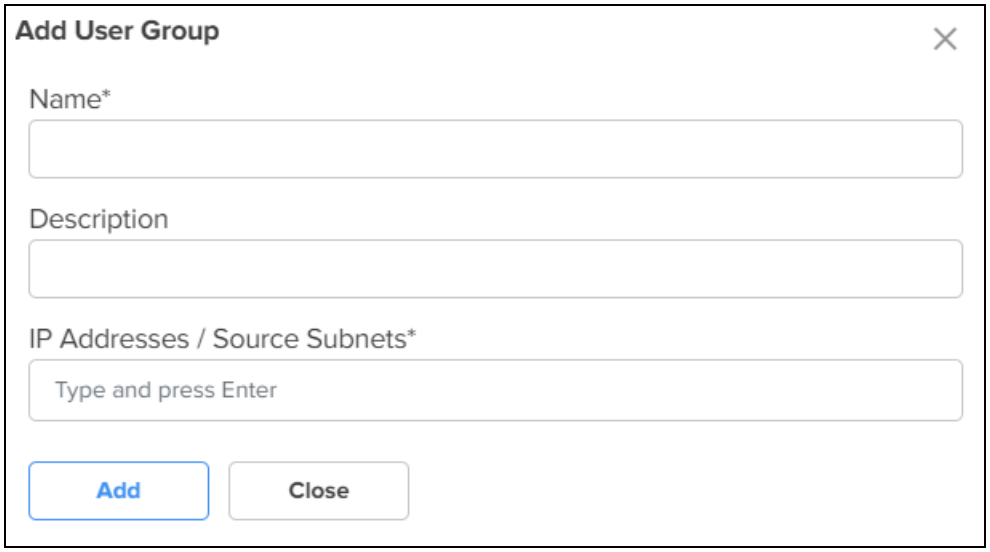


Figure 321 The Add IP Group window

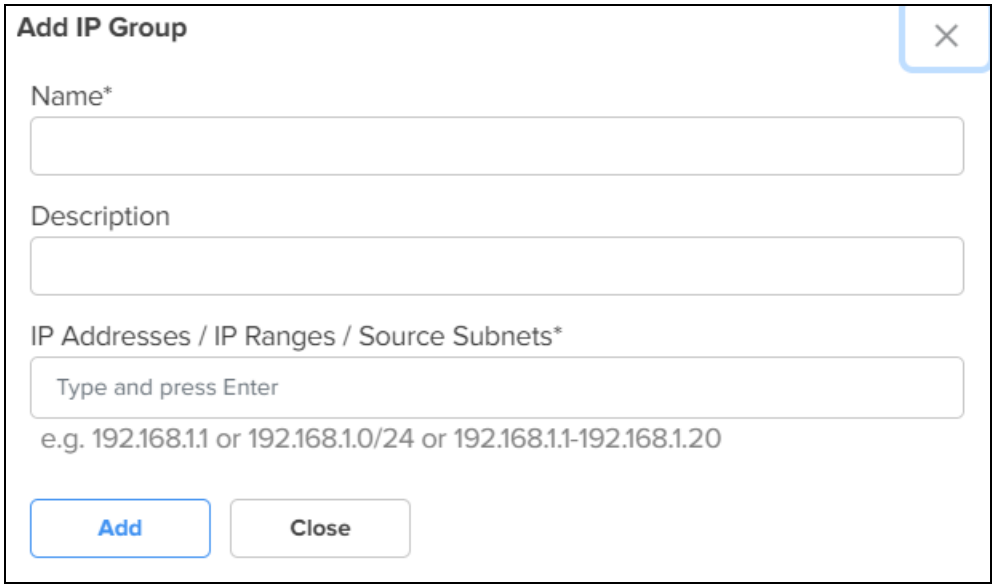
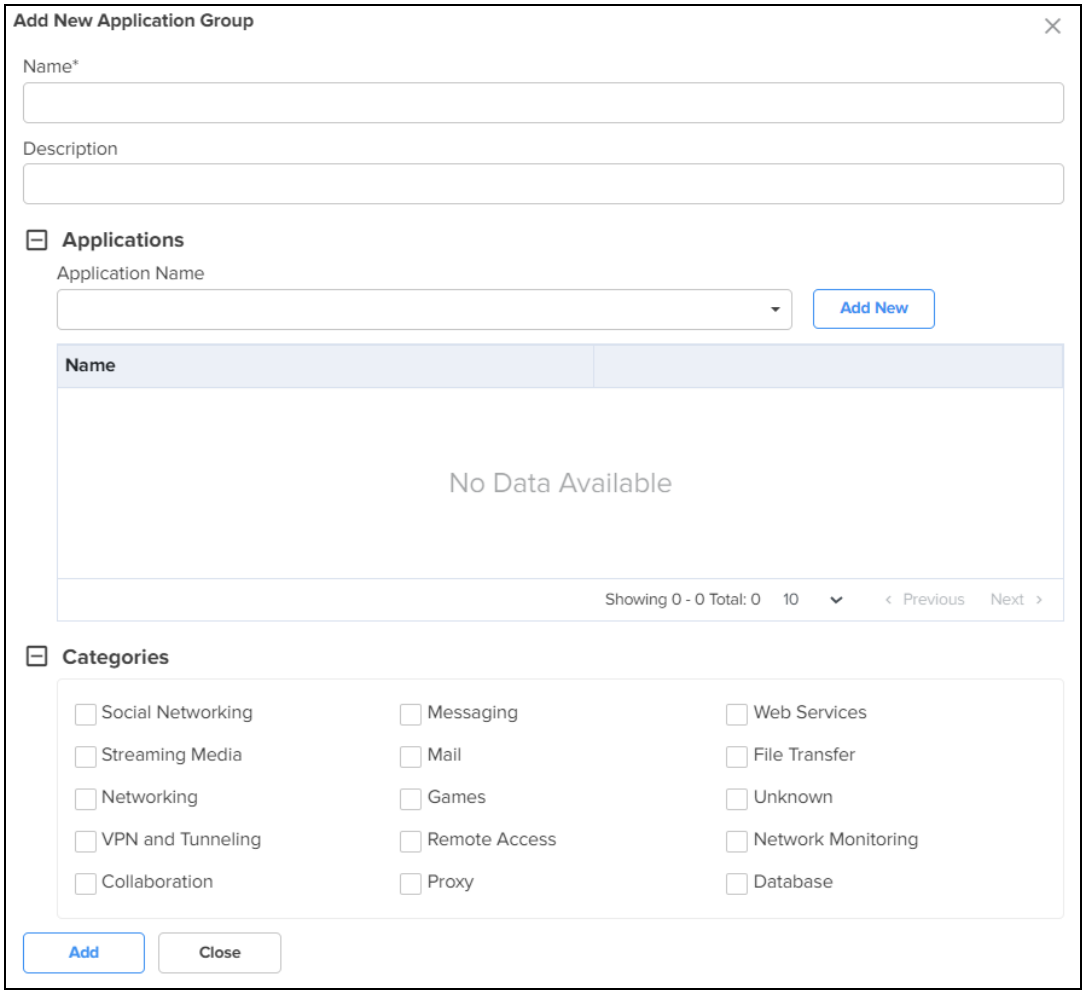


Figure 322 The Add New Application Group window



3. Click **Save**.

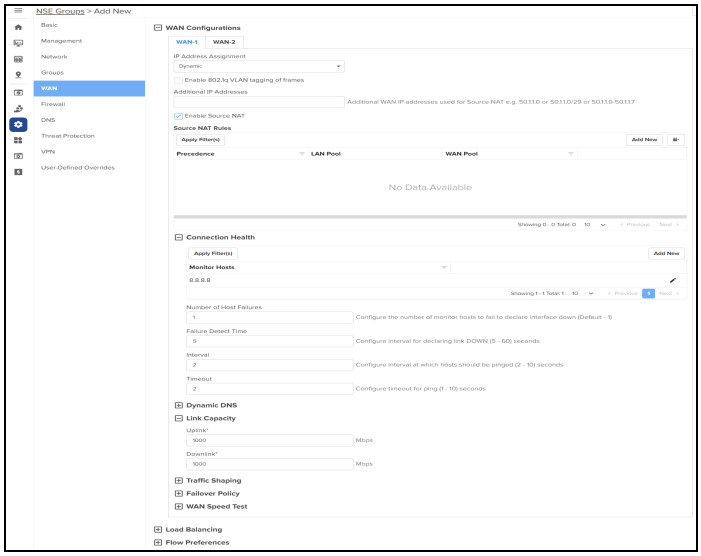
WAN

Using the **WAN** tab, you can configure the settings related to the WAN interface.

To configure parameters on the WAN page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **WAN** tab.
   The **WAN** page appears, as shown in Figure 323.

Figure 323 The WAN page



2. Configure the parameters, as described in Table 77.

Table 77: Parameters on the WAN page

Parameter	Description
On the WAN page, there are **WAN Configurations**, **Load Balancing**, and **Flow Preferences** sections.	
WAN Configurations In this section, you can configure the parameters in **Connection Health**, **Dynamic DNS**, **Link Capacity**, **Traffic Shaping**, **Failover Policy**, and **WAN Speed Test** subsections. The same parameters appear in both **WAN-1** and **WAN-2** tabs.	
IP Address Assignment	Determines the mode of IP address assignment for the WAN interface. The following options are supported: • **Dynamic**: Dynamically learn the IP address and DNS from the DHCP server. • **Static**: Manually configure the IP address, gateway, and DNS server IP provided by the service provider. • **PPPoE**: When you configure PPPoE, you must provide the username and password of the service provider. While the account name and service name are not mandatory configurations, they may be required if the service provider enforces it. By default, the MTU is set to 1492 and the TCP MSS clamping is enabled. If required, you can also tag the packet on the WAN link to send.
Enable 802.1q VLAN	When this parameter is enabled, 802.1Q tag is inserted with

Parameter	Description
tagging of frames	configured VLAN ID for all the packets going out of the WAN interface. By default, this parameter is disabled.
VLAN ID	This parameter is applicable only when **Enable 802.1q VLAN tagging of frames** check box is selected. VLAN ID range: 1 and 4094. This is a mandatory parameter. When the 802.1Q header is configured, all transmitted frames are expected to include the 802.1Q header with the same VLAN ID.
Following parameters appear when you select **Static** from the **IP Address Assignment** drop-down list.	
IP Address	The IPv4 address of the WAN interface. This is a mandatory parameter.
Subnet Mask	The subnet mask for the IPv4 address of the WAN interface. This is a mandatory parameter.
Default Gateway	The IPv4 address of the default gateway for the WAN interface.
Primary DNS	The IPv4 address of primary upstream DNS server on this interface. This is a mandatory parameter.
Secondary DNS	The IPv4 address of secondary upstream DNS server on this interface.
Following parameters appear when you select **PPPoE** from the **IP Address Assignment** drop-down list.	
Account Controller Name	Name of the account controller. This parameter allows a maximum of 32 characters. This parameter is optional.
Service Name	Indicates the service name of the Account Controller. This parameter allows a maximum of 32 characters. The service name configuration is optional.
User	User name for PPPoE authentication. This is a mandatory parameter.
Password	Password for PPPoE authentication.

Parameter	Description
	This parameter is optional.
MTU	MTU for PPPoE interface. MTU ranges from 500 to 1492 bytes. Default: 1492 bytes.
TCP MSS Clamping	Indicates whether TCP MSS Clamping is enabled or disabled. By default, this parameter is enabled.
Additional IP Addresses	WAN IP addresses that are available for source NAT.
Enable Source NAT	Indicates whether the source NAT is enabled or disabled. When enabled, NSE device will replace the source IP address of the traffic routed from LAN to WAN with the WAN interface IP address. By default, this parameter is enabled.
Source NAT Rules Allows user to configure source NAT rules. User can choose the WAN IP addresses from the Additional IP Address for source NAT. User can configure WAN IP address(es) of their choice for source NAT. By default, all the LAN users' traffic will be source NATed to the configured WAN IP address(es). When LAN pool is configured, the traffic from the specified LAN networks will be source NATed to the configured WAN IP address(es). **Note**: Source NAT Rules supports up to 16 rules per WAN. To add a new source NAT, click **Add New**. The **Add New Source NAT Rule** window appears, as shown in Figure 324.	
Precedence	The precedence value for the source NAT rule. The precedence value can be between 1 and 150. This is a mandatory parameter.
LAN Pool	The following options are supported: • **All** • **IP Group** • **IP Address / Source Subnet**
WAN Pool	The following options are supported: • **Single IP Address** • **Multiple IP Addresses**
IP Address	IPv4 address for the WAN pool.

Parameter	Description
	Applicable only when **Single IP Address** option is selected.
Start IP	Starting IP address in the range. This parameter is applicable only when **Multiple IP Addresses** option is selected. This is a mandatory parameter.
End IP	Ending IP address in the range. This parameter is applicable only when **Multiple IP Addresses** option is selected. This is a mandatory parameter.
IP Group	Select the IP group for the source NAT. IP groups are the ones that you configure in the **Groups** > **IP Groups** section. This parameter is applicable only when **IP Group** option is selected. This is a mandatory parameter.
IP Address / Source Subnet	This parameter is applicable only when **IP Address / Source Subnet** option is selected. This is a mandatory parameter.
Connection Health This section is configured to monitor the WAN connection health. Click the edit icon to modify the **Monitor Host** configuration, as shown in Figure 325. Finally, click **Update** to apply the changes. To add a new monitor host, click **Add New**. The **Add New Monitor Host** window appears, as shown in Figure 326.	
Monitor Host	The hosts used to monitor and collect network traffic data. Default: 8.8.8.8 This is a mandatory parameter.
Number of Host Failures	The number of monitor hosts that fail to declare the link down. Default value: 1 The maximum number of monitor hosts that can be configured to fail is 5.
Failure Detect Time	The time period (in seconds) during which the device waits for the response from the monitored host before declaring the link down. Default: 5. Range: 5 to 60

Parameter	Description
Interval	The time interval (in seconds) used by the device to check and reach the monitor hosts. Default: 2. Range: 2 to 10
Timeout	The time period (in seconds) the device waits for a response from the monitor host after which the connection is timed out. Default: 2. Range: 1 to 10
Dynamic DNS	
Enable Dynamic DNS	Indicates whether the dynamic DNS for the interface is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when **Enable Dynamic DNS** check box is selected.	

DNS Provider	The following options are supported:
	• **Cloudflare:** Requires secret/access token and zone configuration.
	In the Cloudflare account, navigate to **Profile** > **API Tokens** to create a token.
	Following is the recommended setting:
	  • Permissions: Zone, DNS, Edit
	  • ZoneResource: Include, Specific Zone, <zone name>
	• **Godaddy:** Requires API key, secret/access token, and zone configuration.
	In the Godaddy account, create an API key at https://developer.godaddy.com/keys
	• **Hetzner:** Requires secret/access token and zone configuration.
	In the Hetzner account, navigate to **Profile** > **API Tokens** and create an access token.
	• **Namecheap:** Requires password and zone configuration.
	  1. In the Namecheap account, navigate to **Domains** > **Free DNS** to manage external domains.
	  2. Before you update/create a record, a new record of type **A** must exist. To create a record, navigate to the dashboard, and then navigate to **Products** > **Advanced DNS**. Add a new record of type **A**. On the same page, enable Dynamic DNS and note the password.
	• **Noip:** Requires server name, username, and password

Parameter	Description

	configuration.
	• **Route53:** Requires API key, secret/access token, and zone configuration.
	1. In the Route 53 account, navigate to **route53** > **Hosted Zones** > **Create Hosted Zone** to create a zone. Use type Public hosted zone. Note the name servers in hosted zone details and the hosted zone ID.
	2. Navigate to **IAM** > **Users** > **Create user**. Select attach policies directly. Create a policy.
	The following is an example of a policy:
	{
	"Version": "2012-10-17",
	"Statement": [
	{
	"Sid": "",
	"Effect": "Allow",
	"Action": [
	"route53:ListResourceRecordSets",
	"route53:GetChange",
	"route53:ChangeResourceRecordSets"
	],
	"Resource": [
	"arn:aws:route53:::hostedzone/<ZONE_ID>",
	"arn:aws:route53:::change/*"
	]
	},
	{
	"Sid": "",
	"Effect": "Allow",
	"Action": [
	"route53:ListHostedZonesByName",
	"route53:ListHostedZones"
	],
	"Resource": "*"
	}

Parameter	Description
	] } 3. Replace ZONE_ID in the policy with the previously noted zone id. Select the new policy for the previously created user. 4. To create access key, navigate to users, select the user, **Security Credentials** > **Create Access Key**. • **Porkbun:** Requires API key, secret/access token, and zone configuration. In the Porkbun account, navigate to **Account** > **API Access** to create a token. Additionally, the domain configuration much be changed to enable API access. • **Dyn:** Oracle Dyn requires server name, username, and password configuration. • **DynDNS2 compliant:** Requires server name, username, and password configuration. By default, **Noip** option is selected.
DNS Hostname	Indicates the DNS host name.
Link Capacity	
Uplink	The WAN uplink capacity in Mbps. Default: 1000. Range: 1 to 1000 This is a mandatory parameter.
Downlink	The WAN downlink capacity in Mbps. Default: 1000. Range: 1 to 1000 This is a mandatory parameter.
Traffic Shaping **Note**: Traffic Shaping supports up to 16 rules per WAN. To add a new traffic shaping rule, click **Add New**, the **Add New Traffic Shaping Rule** window appears, as shown in Figure 327.	
Enable Traffic Shaping	Indicates whether traffic shaping is enabled or disabled. By default, this parameter is disabled.
Precedence	The precedence value for the traffic shaping rule. The precedence value can be between 1 and 150.

Parameter	Description
	This is a mandatory parameter.
Description	Displays a user-configured description for the traffic shaping rule.
Uplink Bandwidth	Indicates the uplink bandwidth in Mbps. Range: 1 to 1000 This is a mandatory parameter.
Downlink Bandwidth	Indicates the downlink bandwidth in Mbps Range: 1 to 1000 This is a mandatory parameter.
DSCP	Differentiated Services Code Point (DSCP) can range from 0 to 63, with 0 being the lowest priority and 63 being the highest priority.
Type	Indicates the type of filter rule. The following options are supported: • **IP Based** – Allows you to configure **Protocol** parameter as **TCP**, **UDP**, or **any**. • **Application Based** – Allows you to configure **Deep Packet Inspection (DPI) Type** parameter as **Application** or **Category**.
Deep Packet Inspection (DPI) Type	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported: • **Application** – Specific type of application within a category. • **Category** – All applications belonging to a category (For example, Social Messaging). This is a mandatory parameter.
DPI Application	This parameter is applicable only when **Deep Packet Inspection (DPI) Type** parameter is set to **Application**. This is a mandatory parameter.
DPI Category	This parameter is applicable only when **Deep Packet Inspection (DPI) Type** parameter is set to **Category**. This is a mandatory parameter.
Protocol	This parameter is applicable only when **Type** parameter is **IP Based**. The following options are supported: • **TCP** – Match TCP traffic.

Parameter	Description
	• **UDP** – Match UDP traffic. • **any** – Match any of the above protocol traffic.
Source IP Address	The source IPv4 address for the shaping rule. This is a mandatory parameter.
Mask	The subnet mask for the shaping rule. This is a mandatory parameter.
Port	Displays the source port from which IPv4 address messaging is sent. This is a mandatory parameter.
Destination IP Address	The destination IPv4 address for the shaping rule. This is a mandatory parameter.
Mask	The subnet mask for the shaping rule. This is a mandatory parameter.
Port	Displays the destination port to which IPv4 address messaging is sent. This is a mandatory parameter.
Failover Policy **Note**: Failover Policy supports up to 32 rules per WAN. To add a new failover policy, click **Add New**. The **Add New Failover Policy** window appears, as shown in Figure 328.	
Enable Failover Policy	Indicates whether failover policy is enabled or disabled. By default, this parameter is disabled.
Precedence	The precedence value for the failover policy. The precedence value can be between 1 and 150. This is a mandatory parameter.
Description	A description for the policy.
Action	By default, this parameter is disabled.
Type	The type of failover rule. The following options are supported: • **IP Based** – Allows you to configure the **Protocol** parameter as **TCP**, **UDP**, or **any**.

Parameter	Description
	• **Application Based** – Allows you to configure **Deep Packet Inspection (DPI) Type** parameter as **Application**, **Category**, or **Application Group**.
Protocol	This parameter is applicable only when **Type** parameter is **IP Based**. The following options are supported: • **TCP** – Match TCP traffic. • **UDP** – Match UDP traffic. • **any** – Match any of the above protocol traffic.
Source IP Address	The source IPv4 address for the failover rule. This is a mandatory parameter.
Mask	The subnet mask for the failover rule. This is a mandatory parameter.
Port	The source port for the failover rule. This is a mandatory parameter.
Destination IP Address	The destination IPv4 address for the failover rule. This is a mandatory parameter.
Mask	The subnet mask for the failover rule. This is a mandatory parameter.
Port	Displays the destination port for the failover rule. This is a mandatory parameter.
Deep Packet Inspection (DPI) Type	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported: • **Application** – Specific type of application within a category. • **Category** – All applications belonging to a category (For example, Social Messaging). • **Application Group -** All applications belonging to a group. This is a mandatory parameter.
Apply to	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported:

Parameter	Description
	• All • User Group • IP Address / Source Subnet
User Group	This parameter is applicable when **User Group** option is selected. This is a mandatory parameter.
IP Address / Source Subnet	This parameter is applicable when **IP Address / Source Subnet** option is selected. This is a mandatory parameter.
WAN Speed Test	
Enable WAN Speed Test	Enable or disable the WAN speed test. By default, this parameter is disabled.

Figure 324 The Add New Source NAT Rule window

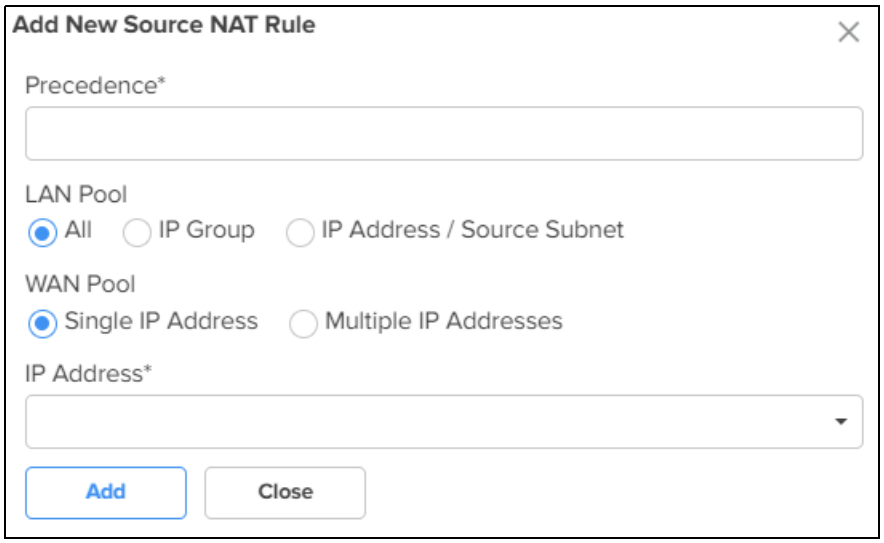


Figure 325 The Edit Monitor Host window

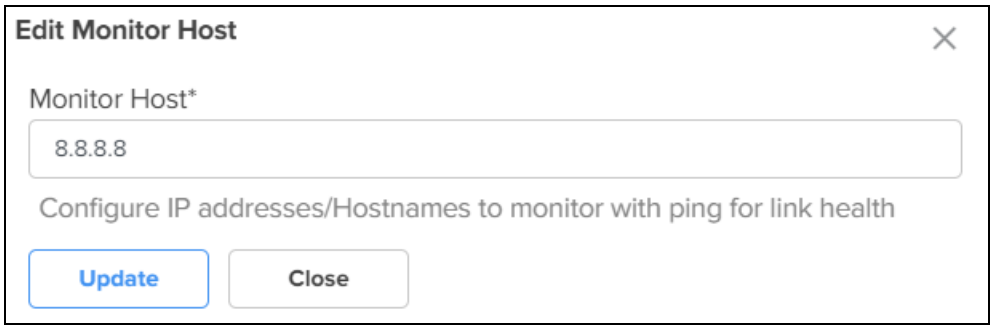


Figure 326 The Add New Monitor Host window

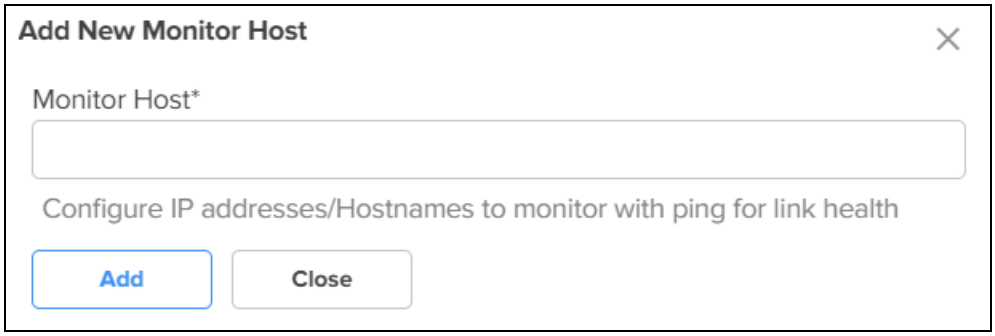


Figure 327 The Add New Traffic Shaping Rule window

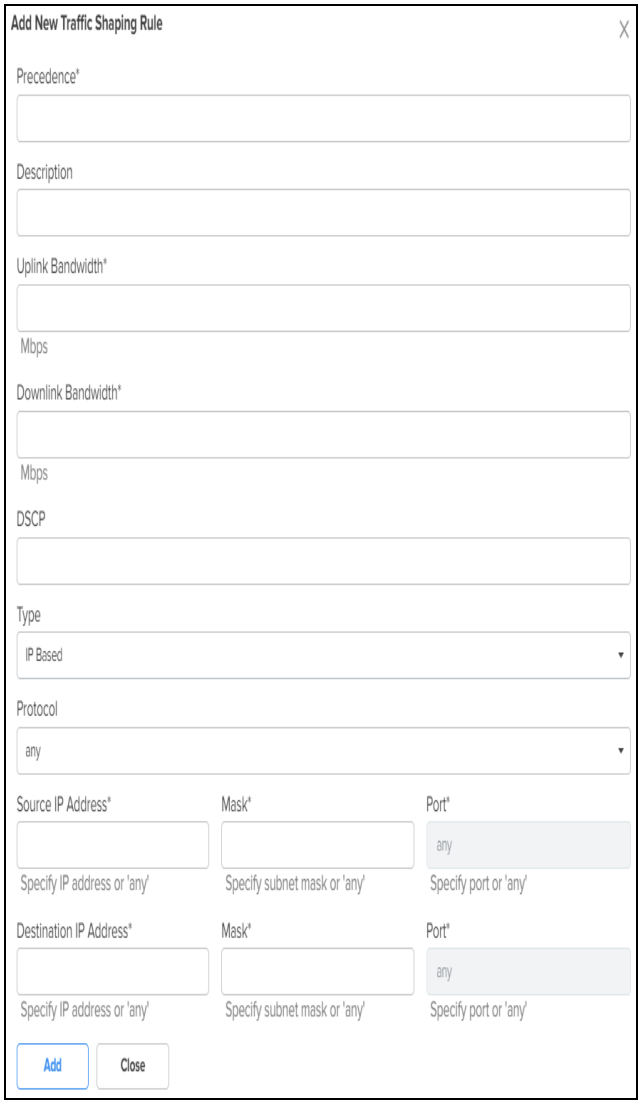


Figure 328 The Add New Failover Policy window

3. Expand the **Load Balancing** section and configure the parameters, as described in Table 78.

Table 78: Parameters on the Load Balancing section

Parameter	Description
Load Balancing	
WAN-1 Mode	Determines the load balancing mode of device. By default, the **WAN-1 Mode** parameter is set to **Shared**. The following options are supported: • **Shared** – Enables the WAN link to actively forward a percentage of user traffic. The percentage of user traffic on this link is set via the **Traffic Share Percentage** parameter. • **Backup** – The WAN link forwards user traffic only when all of the Shared WAN interfaces are down. • **Disabled** – Disables the WAN link from participating in WAN link load sharing, and failover procedures.
Traffic Share Percentage	For the **Shared** mode, the traffic share percentage must be between 5 and 100. This is a mandatory parameter.
WAN-2 Mode	Determines the load balancing adjust mode of device. By default, the **WAN-2 Mode** parameter is set to **Backup**. The following options are supported:

Parameter	Description
	• **Shared** – Enables the WAN link to actively forward a percentage of user traffic. The percentage of user traffic on this link is set via the **Traffic Share Percentage** parameter. • **Backup** – The WAN link forwards user traffic only when all of the Shared WAN interfaces are down. • **Disabled** – Disables the WAN link from participating in WAN link load sharing, and failover procedures.
Traffic Share Percentage	For the **Shared** mode, the traffic share percentage between 5 and 100. This is a mandatory parameter.

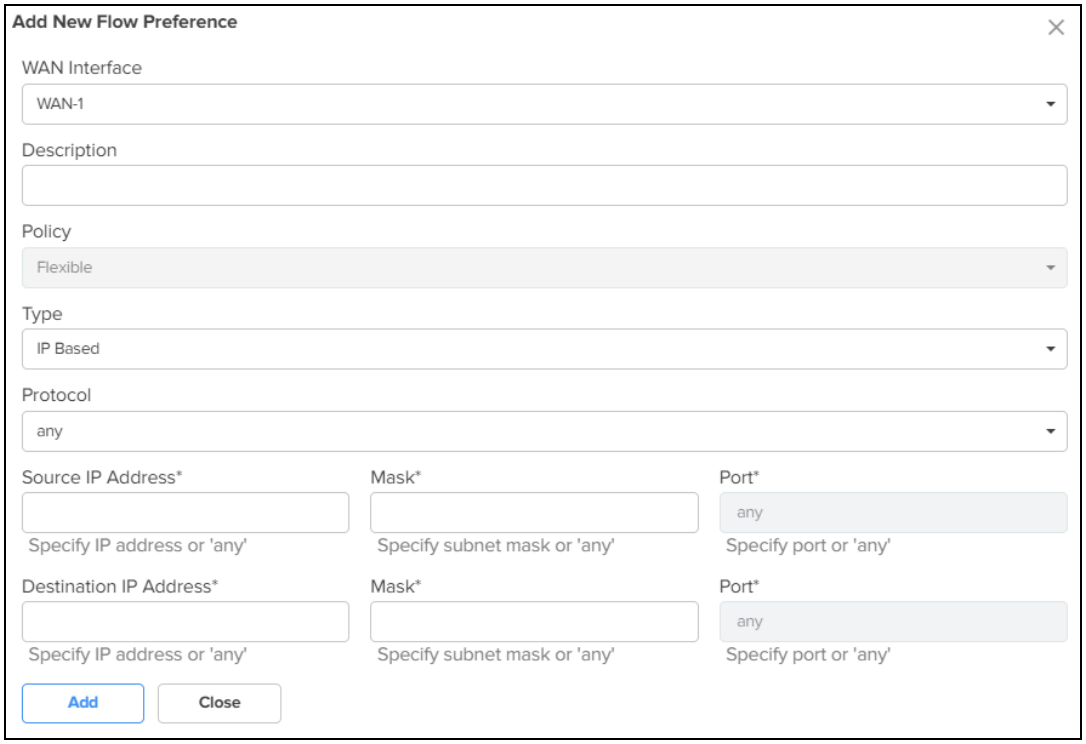
4. Expand the **Flow Preferences** section and configure the parameters, as described in Table 79.

Table 79: Parameters on the Flow Preferences section

Parameter	Description
Flow Preferences Flow preferences support up to 30 rules for both WANs combined. To add a new flow preference, click **Add New**. The **Add New Flow Preference** window appears, as shown in Figure 329.	
WAN Interface	The following options are supported: • **WAN-1** • **WAN-2**
Description	Provide a description for the flow preference.
Policy	The flow preference policy. The following options are supported: • **Flexible** – Allow traffic to failover if the preferred WAN link goes down. • **Strict** – Traffic is dropped in strict mode, if the preferred WAN link goes down.
Type	The flow preference type. The following options are supported: • **IP Based** – Allows you to configure **Protocol** parameter as **TCP**, **UDP**, or **any**. • **Application Based** – Allows you to configure **Deep Packet Inspection (DPI) Type** parameter as **Application** or **Category**.
Protocol	This parameter is applicable only when **Type** parameter is **IP Based**.

Parameter	Description
	The following options are supported: • **TCP** – Match TCP preference. • **UDP** – Match UDP preference. • **Any** – Match any of the above preferences.
Source IP Address	The source IPv4 address for the flow preference. This is a mandatory parameter.
Mask	The subnet mask for the flow preference. This is a mandatory parameter.
Port	The source port for the flow preference. This is a mandatory parameter.
Destination IP Address	The destination IPv4 address for the flow preference. This is a mandatory parameter.
Mask	The subnet mask for the flow preference. This is a mandatory parameter.
Port	The destination port for the flow preference. This is a mandatory parameter.
Deep Packet Inspection (DPI) Type	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported: • **Application** – Specific type of application within a category. • **Category** – All applications belonging to a category (For example, Social Messaging). This is a mandatory parameter.
DPI Application	This parameter is applicable only when **Deep Packet Inspection (DPI) Type** parameter is set to **Application**. This is a mandatory parameter.
DPI Category	This parameter is applicable only when **Deep Packet Inspection (DPI) Type** parameter is set to **Category**. This is a mandatory parameter.

Figure 329 The Add New Flow Preference window



5. Click **Save**.

Firewall

NSE 3000 firewall allows the user to configure the IP-based and application-based outbound rules, GEO IP filters, port forward rules, one-to-one NAT mappings, and one-to-many NAT mappings. All inbound connections are denied by default. You can configure port forwarding or NAT rules to allow inbound traffic. Outbound traffic is allowed by default. Using application-based outbound rules, users can create rules to block websites without specifying IP addresses or port ranges. Application-based rules allow the user to block a specific type of application within a category or all applications belonging to a category (For example, social messaging).

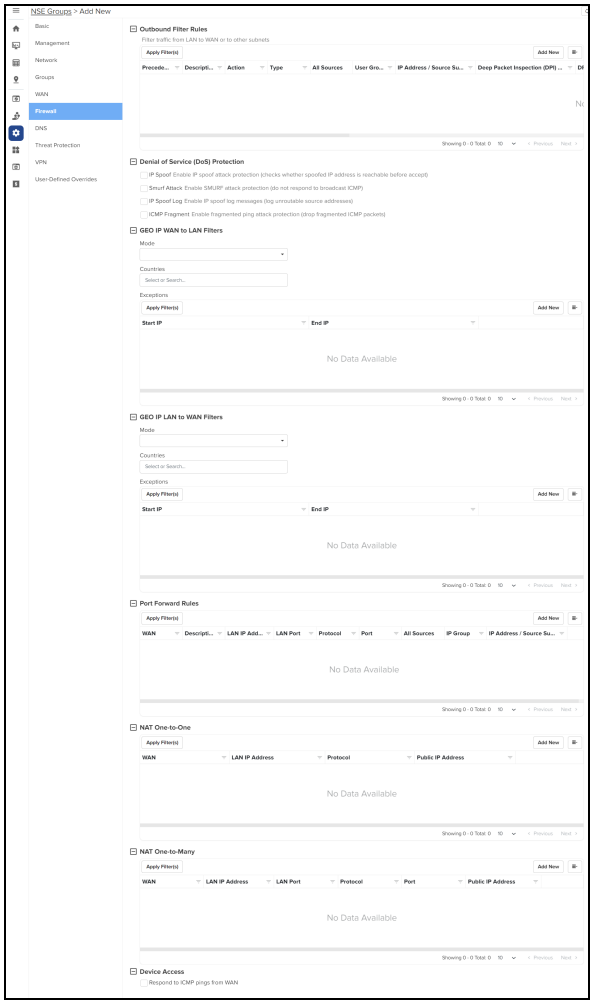
	NOTE: Up to 150 outbound firewall rules are supported for an NSE Group including combinations of IP-based and application-based rules.

To configure parameters on the **Firewall** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **Firewall** tab.

   The **Firewall** page appears, as shown in Figure 330.

Figure 330 The Firewall page



2. Configure the parameters, as described in Table 80.

Table 80: Parameters on the Firewall page

Parameter	Description
On the Firewall page, there are **Outbound Filter Rules**, **Denial of Service (DoS) Protection**, **GEO IP WAN to LAN Filters**, **GEO IP LAN to WAN Filters**, **Port Forward Rules**, **NAT One-to-One**, **NAT One-to-Many**, and **Device Access** sections.	
Outbound Filter Rules To add a new outbound filter rule, click **Add New**. The **Add New Filter Rule** window appears, as shown in Figure 331.	
Precedence	The precedence value for the filter rule. The precedence value can be between 1 and 150. This is a mandatory parameter.
Description	Displays a user-configured description for the filter

Parameter	Description
	rule.
Action	Determines the action of filter. The following options are supported: • **Permit** - Allow traffic matching this filter rule. • **Deny** - Drop traffic matching this filter rule.
Type	The type of filter rule. The following options are supported: • **IP Based** – Configure **Protocol** parameter as **TCP**, **UDP**, **ICMP** or **any**. • **Application Based** – Configure **Deep Packet Inspection (DPI) Type** parameter as Application, Category, or Application Group
Protocol	This parameter is applicable only when **Type** parameter is **IP Based**. The following options are supported: • **TCP**: Match TCP traffic. • **UDP**: Match UDP traffic. • **ICMP**: Match ICMP traffic. • **any**: Match any of the above protocol traffic.
Source IP Address	The source IPv4 address for the filter rule. This is a mandatory parameter.
Mask	The source subnet mask for the filter rule. This is a mandatory parameter.
Port	This parameter is applicable only when **Protocol** parameter is **TCP** or **UDP**. Supported values: 1 to 65535 or any This is a mandatory parameter.
Destination IP Address	The destination IPv4 address for the filter rule. This is a mandatory parameter.
Mask	The destination subnet mask for the filter rule. This is a mandatory parameter.

Parameter	Description
Port	This parameter is applicable only when **Protocol** parameter is **TCP** or **UDP**. Supported values: 1 to 65535 or any This is a mandatory parameter.
Deep Packet Inspection (DPI) Type	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported: • **Application** – Specific type of application within a category. • **Category** – All applications belonging to a category (For example, Social Messaging). This is a mandatory parameter.
DPI Application	This parameter is applicable only when **DPI Type** parameter is set to **Application**. This is a mandatory parameter.
DPI Category	This parameter is applicable only when **DPI Type** parameter is set to **Category**. This is a mandatory parameter.
Apply to	This parameter is applicable only when **Type** parameter is **Application Based**. The following options are supported: • **All** • **User Group** • **IP Address / Source Subnet**
User Group	This parameter is applicable when **User Group** option is selected. This is a mandatory parameter.
IP Address / Source Subnet	This parameter is applicable when **IP Address / Source Subnet** option is selected. This is a mandatory parameter.
Denial of Service (DoS) Protection	
IP Spoof	Enable or disable the IP spoof attack protection. By default, this parameter is disabled.

Parameter	Description
Smurf Attack	Enable or disable the smurf attack protection. By default, this parameter is disabled.
IP Spoof Log	Enable or disable IP spoof log messages. By default, this parameter is disabled.
ICMP Fragment	Enable or disable the fragmented ping attack. By default, this parameter is disabled.
GEO IP WAN to LAN Filters GEO IP WAN to LAN filters allows users to configure rules to permit/deny traffic based on the source country of inbound traffic.	
Mode	Specifies the mode for GEO IP WAN to LAN filters. The following options are supported: • **Allow Only (Deny by default)** – Allow traffic coming from the countries that are configured. The traffic coming from the countries which are not part of the configured countries will be dropped. • **Deny Only (Allow by default)** – Block traffic coming from the countries that are configured. The traffic coming from countries that are not part of the configured countries will be allowed. • **None** – Disables the feature. Traffic is allowed from all the countries.
Countries	The source countries from which the traffic originates.
Exceptions Exceptions allow users to configure source IP address ranges that are allowed in the inbound traffic. To add a new exception, click **Add New**. The **Add New Exception** window appears, as shown in Figure 332.	
Start IP	Starting IPv4 address in the range. This is a mandatory parameter.
End IP	Ending IPv4 address in the range. This is a mandatory parameter.

Parameter	Description
GEO IP LAN to WAN Filters GEO IP LAN to WAN Filters allows users to configure rules to permit/deny traffic based on the destination country of outbound traffic.	
Mode	Specifies the mode for GEO IP LAN to WAN filters. The following options are supported: • **Allow Only (Deny by default)**: Allow traffic destined to the countries matching the configured countries. The traffic destined for the countries which are not part of the configured countries will be dropped. • **Deny Only (Allow by default)**: Block traffic destined to the countries matching the configured countries. The traffic destined for the countries which are not part of the configured countries will be allowed • **None**: Disables the feature. Traffic is allowed in all countries.
Countries	The destination countries to which the traffic is destined.
Exceptions Exceptions allow users to configure destination IPv4 address ranges that are allowed in the outbound traffic. To add a new exception, click **Add New**. The **Add New Exception** window appears, as shown in Figure 332.	
Start IP	Starting IPv4 address in the range. This is a mandatory parameter.
End IP	Ending IPv4 address in the range. This is a mandatory parameter.
Port Forward Rules Port Forward Rules allow users to forward traffic destined to the WAN Interface IP address of NSE 3000 on a specific TCP or UDP port to any of the LAN IP address. Port Forward Rules provides remote access to internal resources. To add a new port forward rule, click **Add New**. The **Add New Port Forward Rule** window appears, as shown in Figure 333.	
WAN	The interface to forward inbound traffic to the internal host.

Parameter	Description
	The following options are supported: • **WAN-1** • **WAN-2**
Description	Displays the user-configured description for the port forward rule.
LAN IP Address	The IPv4 address to which traffic will be forwarded. This is a mandatory parameter.
LAN Port	The LAN port to which the traffic will be forwarded. Supported values: 1 to 65535. This is a mandatory parameter.
Protocol	The protocol of forwarded traffic. The following options are supported: • **TCP** • **UDP**
Port	The destination port of the incoming traffic on the WAN interface. Supported values: 1 to 65535. This is a mandatory parameter.
Apply To	The following options are supported: • **All** • **IP Group** • **IP Address / Source Subnet**
IP Group	This parameter is applicable only when **IP Group** option is selected.
IP Address / Source Subnet	This parameter is applicable only when **IP Address / Source Subnet** option is selected. This is a mandatory parameter.
NAT One-to-One NAT One-to-One allows users to map an IP address on the WAN side to a LAN IP address. The IP address on the WAN side should be different from any of the WAN interface (WAN-1/WAN-2) IP addresses. NAT One-to-One rules provide remote access to any of the LAN resources. To add a new NAT one-to-one, click **Add New**. The **Add New NAT One-to-One** window	

Parameter	Description
appears, as shown in Figure 334.	
WAN	The following options are supported: • **WAN-1** • **WAN-2**
Public IP Address	The public IPv4 address on the WAN side that is used to access the LAN resource. The public IPv4 address is different from the IPv4 address of the WAN (WAN-1/WAN-2) interfaces. This is a mandatory parameter.
LAN IP Address	The LAN IPv4 address of the server which is hosting the resource. This is a mandatory parameter.
Protocol	The protocol of the incoming traffic. The following options are supported: • **TCP** • **UDP**
NAT One-to-Many NAT One-to-Many provides remote access to internal resources. It maps a public IP address to multiple LAN IPs and ports. To add a new NAT one-to-many, click **Add New**, the **Add New NAT One-to-Many** window appears, as shown in Figure 335.	
WAN	The following options are supported: • **WAN-1** • **WAN-2**
Public IP Address	The public IPv4 address on the WAN side that is used to access the LAN resource. The public IPv4 address is different from the IPv4 address of the WAN (WAN-1/WAN-2) interfaces. This is a mandatory parameter.
LAN IP Address	The LAN IPv4 address of the server which is hosting the resource. This is a mandatory parameter.

Parameter	Description
LAN Port	The LAN Port which is hosting the resource. This is a mandatory parameter.
Protocol	The protocol of the incoming traffic. The following options are supported: • TCP • UDP
Port	The destination port of the incoming traffic on the WAN interface. This is a mandatory parameter.
Device Access	
Respond to ICMP pings from WAN	This parameter is disabled by default. When enabled, this service is enabled for all the sources, unless specific IP addresses or IP groups are configured in the **IP Group** and **IP Address / Source Subnet** parameters.
IP Group	Specifies the IP group for this service.
IP Address / Source Subnet	Specifies the IPv4 address or source subnet for this service.

Figure 331 The Add New Filter Rule window

Figure 332 The Add New Exception window

Figure 333 The Add New Port Forward Rule window

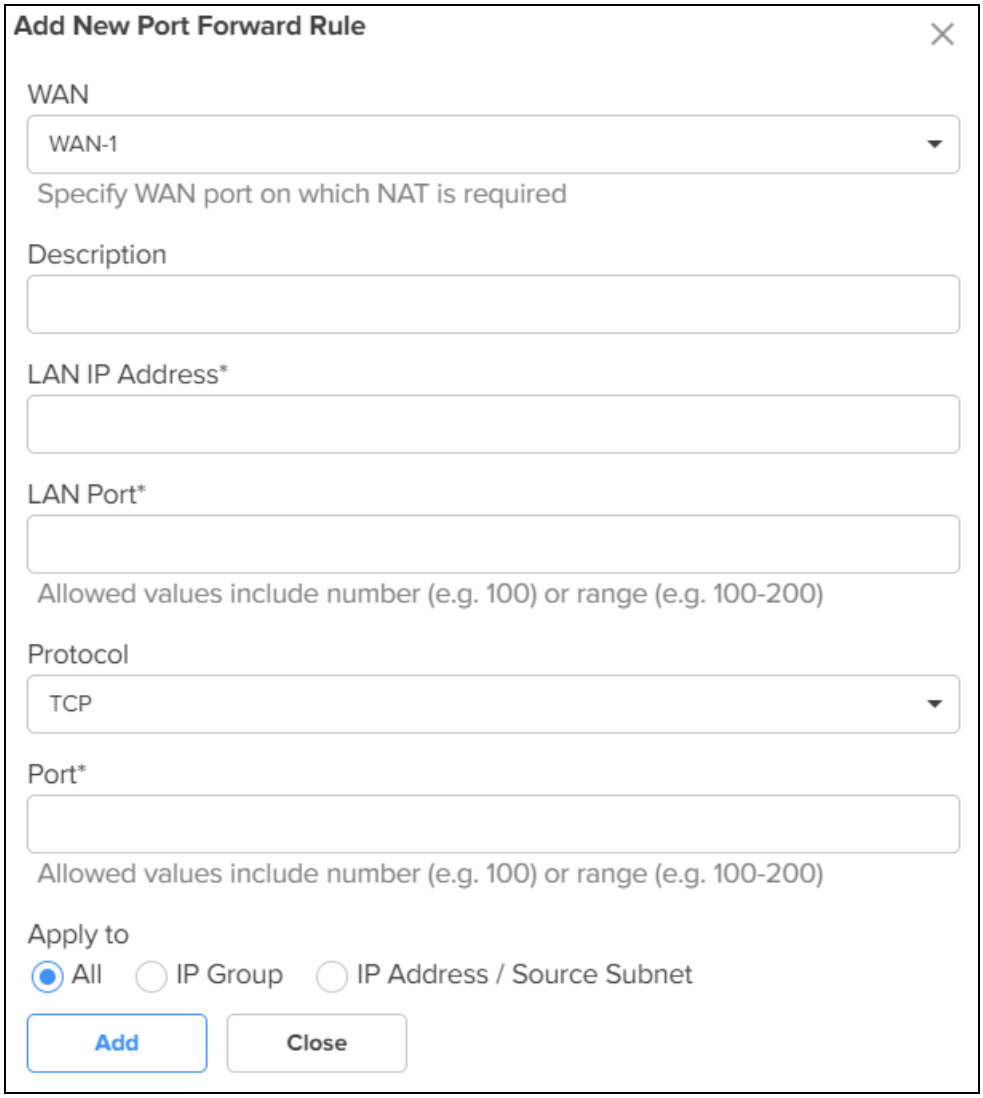


Figure 334 The Add New NAT One-to-One window

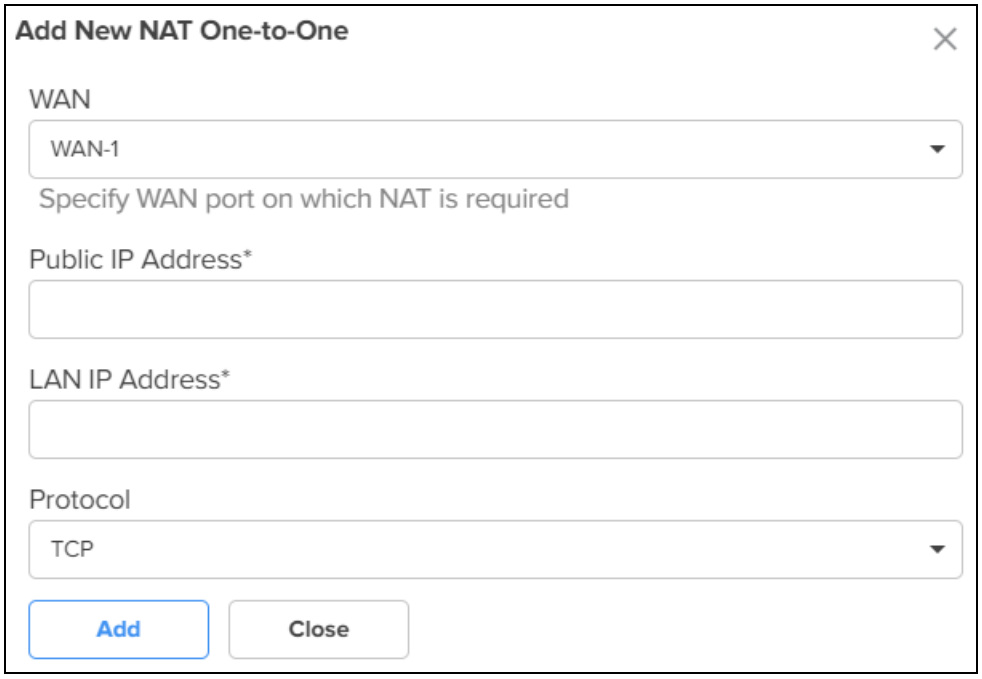
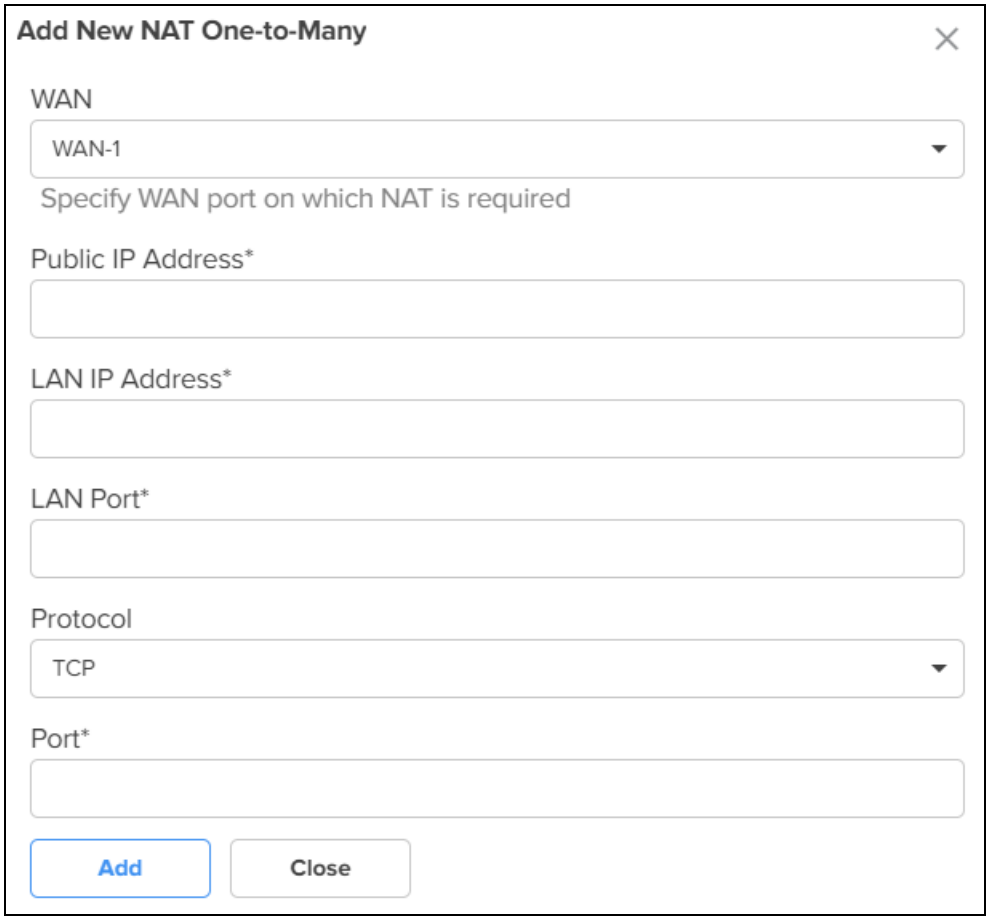


Figure 335 The Add New NAT One-to-Many window



3. Click **Save**.

DNS

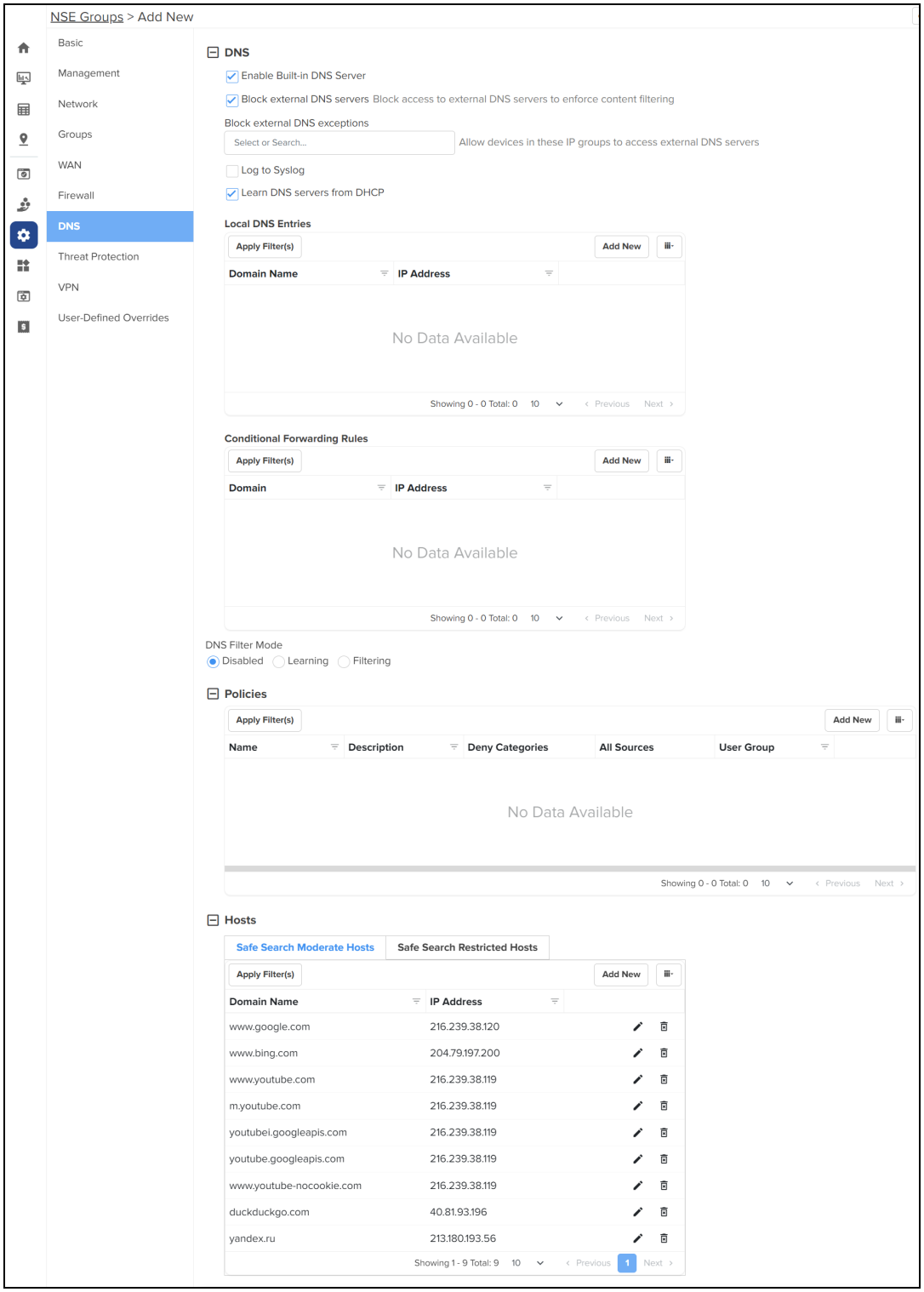
NSE 3000 supports DNS-based filters. DNS-based filters allow users to block certain category of websites. From the blocked list, users can still allow certain websites by adding them to the exception list. For example, if user blocks social-media category then all the social websites will be blocked including linkedin.com since linkedin.com belongs to social-media category. Adding linkedin.com to the Exception to filters list will allow access to linkedin.com while blocking other social-media websites.

To configure parameters on the **DNS** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **DNS** tab.

   The **DNS** page appears, as shown in Figure 336.

Figure 336 The DNS page



2. Configure the parameters, as described in Table 81.

Table 81: Parameters on the DNS page

Parameter	Description
On the DNS page, there are **DNS**, **Policies**, and **Hosts** sections.	
DNS	
Enable Built-in DNS Server	Indicates whether the on-board DNS server is enabled or disabled. By default, this parameter is enabled.
Block external DNS servers	Blocks the client to reach to any external DNS servers. By default, this parameter is enabled.
Block external DNS exceptions	Allows the clients added in the exceptions list to reach to any external DNS servers.
Log to Syslog	Specifies whether the DNS queries received from the client is logged to an external syslog server.
Learn DNS servers from DHCP	Dynamically learns the DNS server IP on WAN. By default, this parameter is enabled. When you disable this parameter, the **Primary DNS** and **Secondary DNS** parameters are displayed.
Primary DNS	The IPv4 address of the primary upstream DNS server.
Secondary DNS	The IPv4 address of the secondary upstream DNS server.
Local DNS Entries To add a new local host, click **Add New**. The **Add New Local Host** window appears, as shown in Figure 337.	
Domain	A domain name for the local host. This is a mandatory parameter.
IP address	The IPv4 address of the local host. This is a mandatory parameter.
Conditional Forwarding Rules To add a new forwarding rule, click **Add New**. The **Add New Forwarding Rule** window appears, as shown in Figure 338.	
Domain	A domain name for the forwarding rule. This is a mandatory parameter.
IP address	The IPv4 address of the server to which the DNS query is forwarded.

Parameter	Description
DNS Filter Mode	Specifies the mode for DNS filtering. The following options are supported: • **Disabled**: Disables DNS filter. By default, this option is selected. • **Learning**: Builds local cache for domain categories but does not filter requests. • **Filtering**: Filters requests based on configuration.
Policies To add a new policy, click **Add New**. The **Add New Policy** window appears, as shown in Figure 339.	
Name	Name for the policy. This is a mandatory parameter.
Description	Description about the policy.
Deny categories	Categories to deny in the following sections: • **Productivity** • **Privacy** • **Sensitive** • **Misc** • **IT Resources** • **Security** Expand the sections and select individual categories. To select all categories in a section, select the check box provided for the section.
Safe Search Mode	The following options are supported: • **Disabled:** Disables safe search mode. By default, this option is enabled. • **Moderate:** Enable moderate safe search mode. • **Restricted:** Enable restricted safe search mode.
Allow Exceptions (List of Domain Names)	Enter the exempted domain names separated by a comma (,).
Apply to	The following options are supported: • **All**: Apply to all user groups. By default, this option is selected. • **User Group**: Apply to selected user groups.

Parameter	Description
User Group	This parameter is applicable only when **User Group** option is selected for **Apply to** parameter. This is a mandatory parameter.
Hosts Hosts section contains two tabs - **Safe Search Moderate Hosts** and **Safe Search Restricted Hosts** The following parameters appear in both the tabs and can be configured as required. A list of hosts are already added by default. You can modify these hosts by clicking the edit icon or you can add new hosts by clicking **Add New** in the respective tabs as shown in Figure 340 and Figure 341.	
Domain Name	The domain name for the safe search host This is a mandatory parameter.
IP address	The IPv4 address of the safe search host. This is a mandatory parameter.

Figure 337 The Add New Local Host window

Figure 338 The Add New Forwarding Rule window

Figure 339 The Add New Policy window

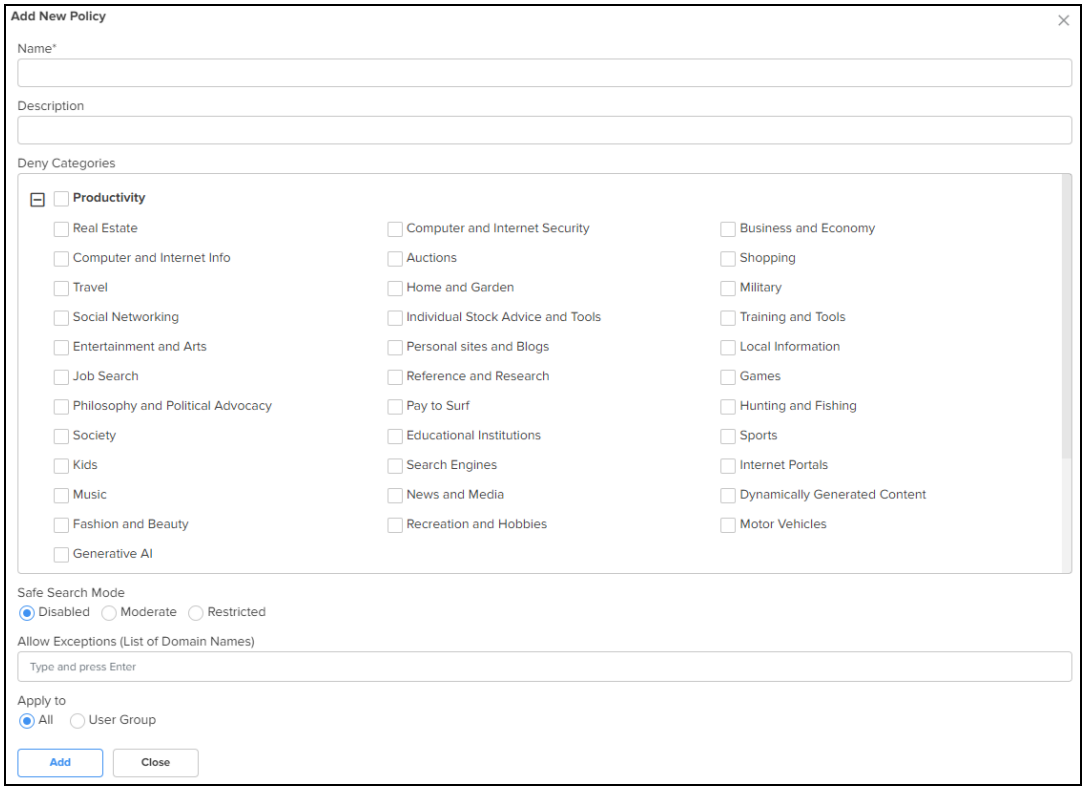


Figure 340 The Add New Safe Search Moderate Host

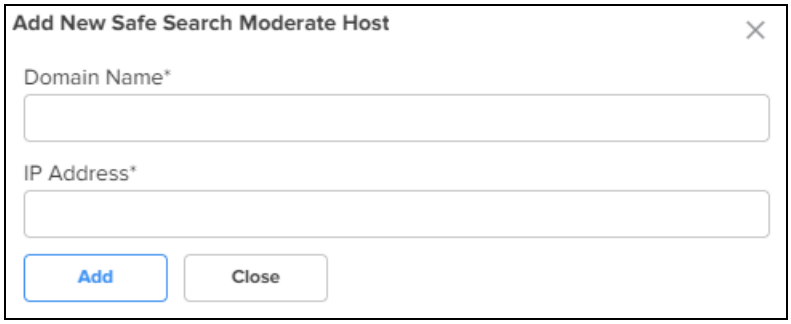


Figure 341 The Add New Safe Search Restricted Host

3. Click **Save.**

Threat Protection

Using the **Threat Protection** tab, you can configure the Intrusion Detection and Prevention system (IDS/IPS) parameters.

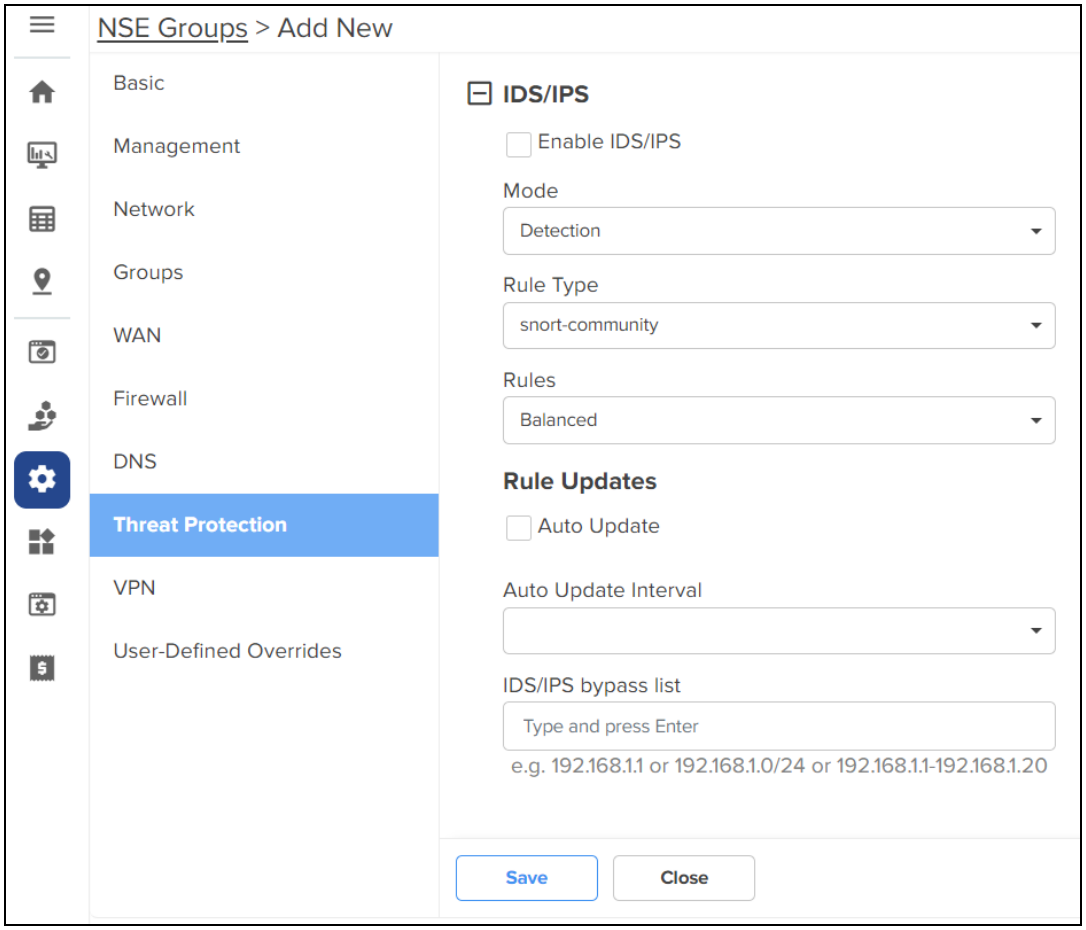
NSE 3000 supports IDS/IPS engine. IPS engine uses a series of rules that help define a malicious network activity. IPS engine supports rules from snort and emerging threats. The solution supports both community and licensed rules. The IPS engine uses these rules to find packets that match against them and generates alerts for users.

To configure parameters on the **Threat Protection** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **Threat Protection** tab.

   The **Threat Protection** page appears, as shown in Figure 342.

Figure 342 The Threat Protection page



2. Configure the parameters, as described in Table 82.

Table 82: Parameters on the Threat Protection page

Parameter	Description
IDS/IPS	
Enable IDS/IPS	Indicates whether IDS/IPS is enabled or disabled. By default, this parameter is disabled.
Mode	Specifies the IDS/IPS mode.

Parameter	Description
	The following options are supported: • **Detection** – Detects malicious activity and generates alerts for users. • **Prevention** – Detects malicious activity, generates alerts for users, and takes action to prevent attacks.
Rule Type	Specifies the IDS/IPS rule type. The following options are supported: • **snort-community** – The community rule set is a GPLv2 Talos certified rule set that is distributed free of charge and without any license restrictions. The rules are updated every Tuesday and Thursday. • **snort-vrt** – The Snort Subscriber rule set is developed by Talos research team and is governed by license agreement. The rule set is updated on Tuesday and Thursday. The snort-vrt rule set requires an oinkcode to download and activate rules. • **emerging-threats open** – Consists of signatures contributed from the community. The emerging-threats open rule sets are distributed free of charge. • **emerging-threats pro** – Consists of signatures created as a result of Proofpoint research. The rule sets are governed by license agreement. The emerging-threats pro rule set requires an oinkcode to download and activate the rules.
Rules	Specifies the IDS/IPS rule policy. This parameter is applicable when **Rule Type** is **snort-vrt** or **snort-community**. The following options are supported: • **Connectivity** – Policy designed to favor device performance over the security controls in the policy. • **Balanced** – This policy is the default policy that is recommended for initial deployments. The policy attempts to balance security needs and performance characteristics. • **Security** – This policy is designed for customer base that is extremely concerned about organizational security. This policy is deployed in networks that have higher security requirements.
Oink Code	This parameter is applicable when **Rule Type** is **snort-vrt** or **emergency-threats pro**.
Category	Categories to select from the **Category** section. This parameter is applicable when **Rule Type** is **snort-vrt** or **emergency- threats pro**.
Rule Updates	

Parameter	Description
Auto Update	Indicates whether the IDS/IPS rules must be automatically updated or not. By default, this parameter is disabled. When **Auto Update** is enabled, NSE 3000 will periodically download and activate the IDS/IPS rules.
Auto Update Interval	Time interval for the periodic updates of IDS/IPS rules. The following options are supported: • **12 Hrs** – Auto updates the rules every 12 hours. • **24 Hrs** – Auto updates the rules every 24 hours.
IDS/IPS bypass list	List of allowed IPv4 addresses or range of allowed IPv4 addresses. IDS/IPS operating in prevention mode blocks traffic from a host on detecting malicious traffic from the host. When an IPv4 address is part of allowed IP addresses, IDS/IPS will not block traffic from the host even when malicious traffic is detected.

3. Click **Save**.

VPN

NSE 3000 provides an on-board VPN server that allows remote users to establish a connection using the native VPN client supported in most of the operating systems. The VPN server uses the L2TP/IPsec protocol with the IPsec encryption and hashing algorithms. The VPN server maintains a pool of IP addresses and leases the IP addresses from this pool for remote users.

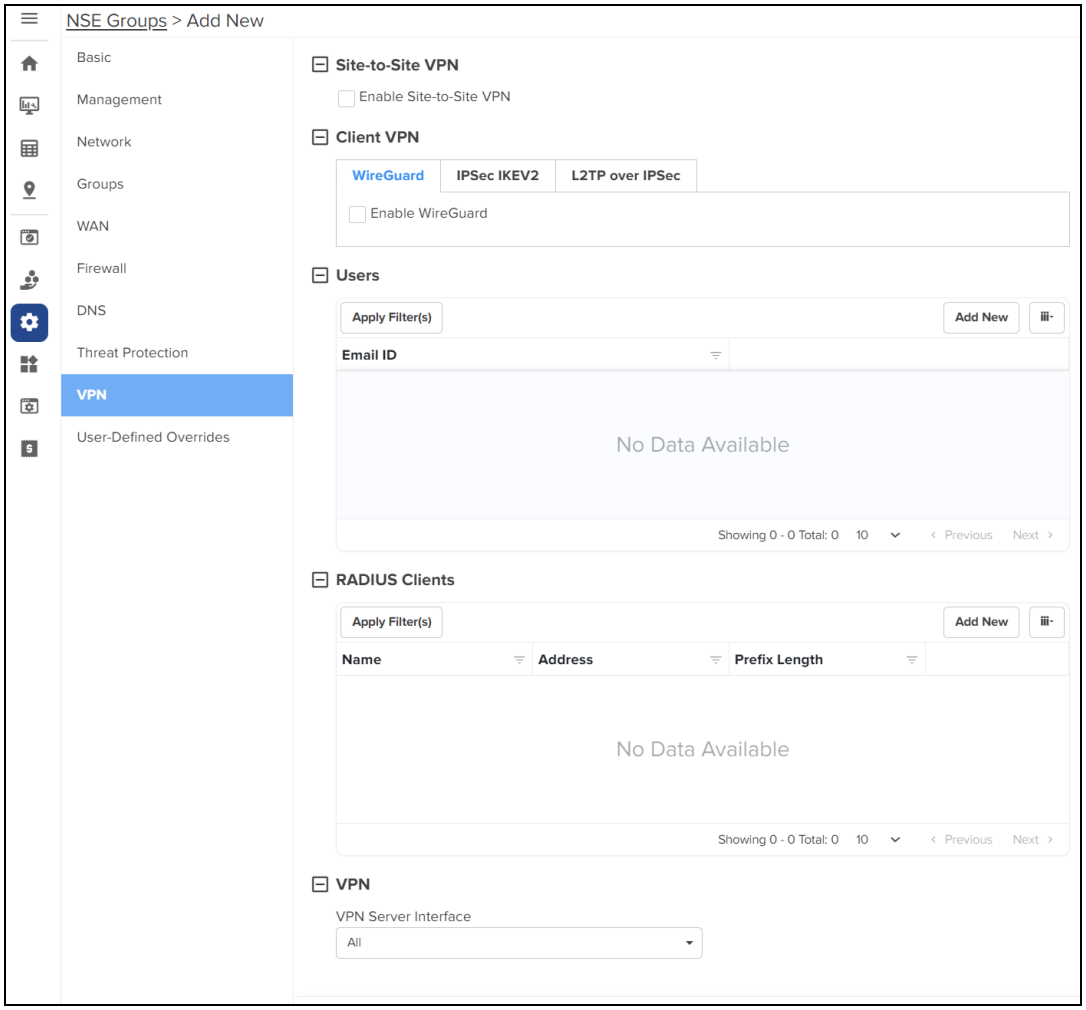
NSE 3000 also provides an on-board RADIUS server that allows authentication and accounting of enterprise and remote users. The RADIUS server maintains user profiles in a central database.

Using the **VPN** tab, you can configure DNS server, VPN server, and RADIUS server parameters.

To configure parameters on the **VPN** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **VPN** tab.
   The **VPN** page appears, as shown in Figure 343.

Figure 343 The VPN page



2. Configure the parameters, as described in Table 83.

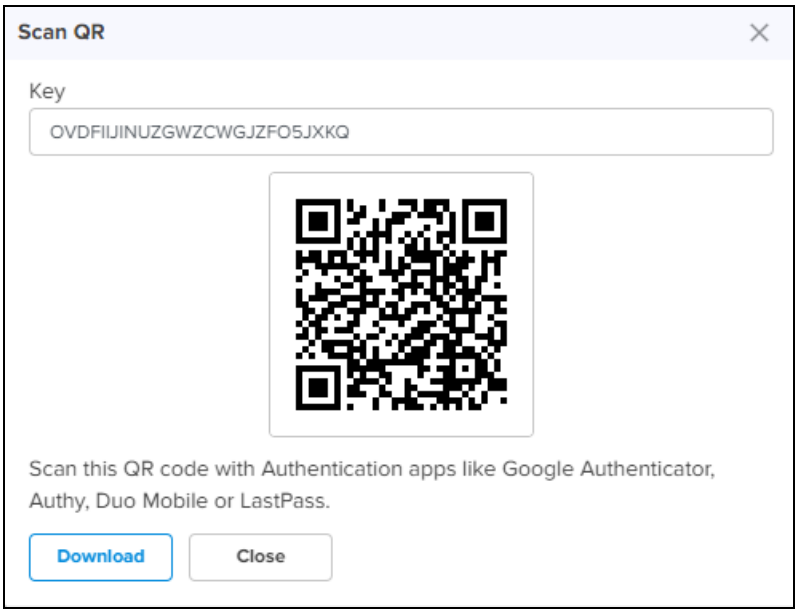
Table 83: Parameters on the VPN page

Parameter	Description
On the VPN page, there are **Site-to-Site VPN**, **Client VPN**, **Users**, **RADIUS Clients**, and **VPN** sections.	
Site-to-Site VPN IPsec tunnel is a VPN technology that provides a secure, encrypted connection between two devices or networks over the internet or another public network. It uses IPsec protocols to encrypt the traffic between two endpoints, making it difficult for anyone to intercept the communication. IPsec site-to-site tunnel is used to connect two remote sites for secure communications. NSE allows setting up tunnels both in responder mode and initiator mode. Both, IKEv1 and IKEv2 are supported in the configuration. The default version is IKEv2. Pre-shared key is the authentication method supported by the device. Each site can have its own pre-shared key. The site is identified by an identifier (string or the IP address of the site). Each site has to be configured with a local and remote site for the tunnel to establish. To view the IPsec tunnel stats, navigate to the **NSE Group > Network > VPN Sites** tab, as shown in Figure 345. To add a new site-to-site VPN, click **Add New**. The **Add New Site-to-Site VPN** window appears, as shown in Figure 344.	
Enable Site-to-Site VPN	Indicates whether site-to-site VPN is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when you select **Enable Site-to-Site VPN** check box.	
Name	A name for the new site-to-site VPN. This is a mandatory parameter.
IKE version	The Internet Key Exchange (IKE) version for the site-to-site VPN. The following options are supported: • **IKE v1** • **IKE v2**
Role	Specifies the role for the tunnels. The following options are supported: • **Initiator** • **Responder** Default role: Responder
Dead peer detection interval	The interval (in seconds) for detecting dead peers.

Parameter	Description
	Range: 30 - 600 seconds. Default: 120 seconds This is a mandatory parameter.
Remote ID	The remote ID. The value of 192.168.50.10 is pre-configured and is not modifiable. This is a mandatory parameter.
Local ID	The local ID. This is a mandatory parameter.
Local Subnets	The comma-separated list of local subnets. This is a mandatory parameter.
Remote Subnets	The comma-separated list of remote subnets. This is a mandatory parameter.
Remote PSK	The remote PSK. This is a mandatory parameter.
Local PSK	The local PSK. This is a mandatory parameter.
The following parameters are common for both **IKE Phase 1** and **IKE Phase 2**.	
Encryption	The following options are supported: • **aes128** • **aes192** • **aes256** • **aes128-gcm16** • **aes192-gcm16** • **aes256-gcm16** • **3des**
Integrity	The following options are supported: • **md5** • **sha1** • **sha256**
DH Group	The following options are supported:

Parameter	Description
	• 1 • 2 • 5 • 14 • 15
Key Lifetime	The duration (in hours) for the pre-shared key. Range: 1 to 24
Client VPN: This section contains the following tabs: • WireGuard: A VPN protocol that is highly secure. It is simpler and more efficient than traditional IPSec. • IPSec IKEV2 • L2TP over IPSec	
WireGuard: A VPN protocol that is highly secure. It is simpler and more efficient than traditional IPSec.	
Enable WireGuard	Indicates whether WireGuard is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when you select **Enable WireGuard** check box.	
Port	Indicates the WireGuard listen port number. Default: 51820 This is a mandatory parameter.
Client Pool	Indicates the WireGuard interface IP for the device and the client IPs to be assigned for the WireGuard clients. This is a mandatory parameter.
Keep Alive	Periodic keep alive packets sent for the configured duration. Default: 5 seconds This is a mandatory parameter.
Enable Split Tunnel	Indicates whether the split tunnel is enabled or disabled. By default, this parameter is disabled. **Note**: When you enable split tunnel, only the traffic

Parameter	Description
	destined to tunnelled subnets is allowed. You can override the **Enable Split Tunnel** parameter at the user level.
Tunnelled Subnets	Specifies the list of local subnets in NSE that should be allowed access from the WireGuard clients. **Note**: The same **Tunnelled Subnets** field is auto-populated in the **Add New User** window. You can edit this field at the user level.
IPSec IKEV2	
Enable IPSec IKEV2	Indicates whether IPSec IKEV2 is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when you select **Enable IPSec IKEV2** check box.	
Client IP Pool Range Start	Starting IPv4 address in the range. This is a mandatory parameter.
Client IP Pool Range End	Ending IPv4 address in the range. This is a mandatory parameter.
L2TP over IPSec	
Enable L2TP over IPSec	Indicates whether L2TP over IPSec is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when you select **Enable L2TP over IPSec** check box.	
Client IP Pool Range Start	Starting IPv4 address in the range. This is a mandatory parameter.
Client IP Pool Range End	Ending IPv4 address in the range. This is a mandatory parameter.
IPsec Shared Secret	Enter a pre-shared key string for the IPsec protocol. The shared secret is used between the VPN Client and Server for device authentication. This is a mandatory parameter.
Enable 2FA	Indicates whether two-factor authentication (2FA) is enabled or disabled. By default, this parameter is disabled.

Parameter	Description
VPN Two-Factor Authentication 1. When you enable two-factor authentication (2FA), scan the QR code to add a 16-digit key to a particular user's Google Authenticator app.  2. An email is also sent to the configured email address with the QR code and the 16-digit key. 3. The two-factor authentication gets enabled for the user when the user tries to connect to the NSE device using the remote VPN client from the WAN side. Users on the LAN side do not require two-factor authentication.	
Users: This section is common for all the three protocols - WireGuard, IPSec IKEV2, and L2TP over IPSec. To add a new user, click **Add New**. The **Add New User** window appears, as shown in Figure 346.	
Email ID	Email ID of the user. User is either an enterprise user or a remote user. This is a mandatory parameter.
Password	Password for the user. This is a mandatory parameter.
Enable WireGuard	Indicates whether WireGuard is enabled or disabled. By default, this parameter is disabled.
Following parameters appear when **Enable WireGuard** check box is selected in the **Add New User** window.	
Enable Split Tunnel	Indicates whether split tunnel is enabled or disabled.

Parameter	Description
	By default, this parameter is enabled.
Tunnelled Subnets	Specifies the list of local subnets in NSE that should be allowed access from the WireGuard clients.
Device	Indicates the NSE device. When you select an NSE device, the device's public key is populated in the [Peer] section of the WireGuard client configuration file. This is a mandatory parameter.
WAN Interface	WAN Interface of the NSE device. When you select a WAN interface, the NSE's WAN IP is populated as the endpoint IP in the [Peer] section of the WireGuard client configuration file. The following WAN Interface options are supported: • WAN-1 • WAN-2
Clients: In this section, you have an option to add a new WireGuard client. To add a new WireGuard client, click **Add New**. The **Add New WireGuard Client** window appears, as shown in Figure 347.	
Name	Name for the new WireGuard client. This is a mandatory parameter.
Auto generate key pair	Generates a public and private key pair for the client. By default, this parameter is enabled. When this option is enabled, the **Client Public Key** field is auto-populated with the public key generated for that client. When this option is disabled, you need to provide the WireGuard client public key generated on the WireGuard client device.
Client Public Key	Public key of the client. This is a mandatory parameter.
IP Address	Auto-generated IP address of the WireGuard client.
Note: You have options to download QR code and configuration file in the **Add New WireGuard Client** window, as shown in Figure 347.	

Parameter	Description
RADIUS Clients To add a new RADIUS client, click **Add New**. The **Add New RADIUS Client** window appears, as shown in Figure 348.	
Name	Name of the RADIUS client. This is a mandatory parameter.
Secret	The shared secret of the RADIUS client. This is the shared secret (password) that the NAS needs to communicate with the RADIUS server. This is a mandatory parameter.
Address	The IPv4 address or network address of the RADIUS client. This is a mandatory parameter.
Prefix Length	The client network prefix length. This is a mandatory parameter.
VPN	
VPN Server Interface	The following options are supported: • **WAN-1 -** The first WAN interface on your server. • **WAN-2 -** The second WAN interface on your server. • **All -** Applies to all WAN interfaces.

Figure 344 The Add New Site-to-Site VPN window

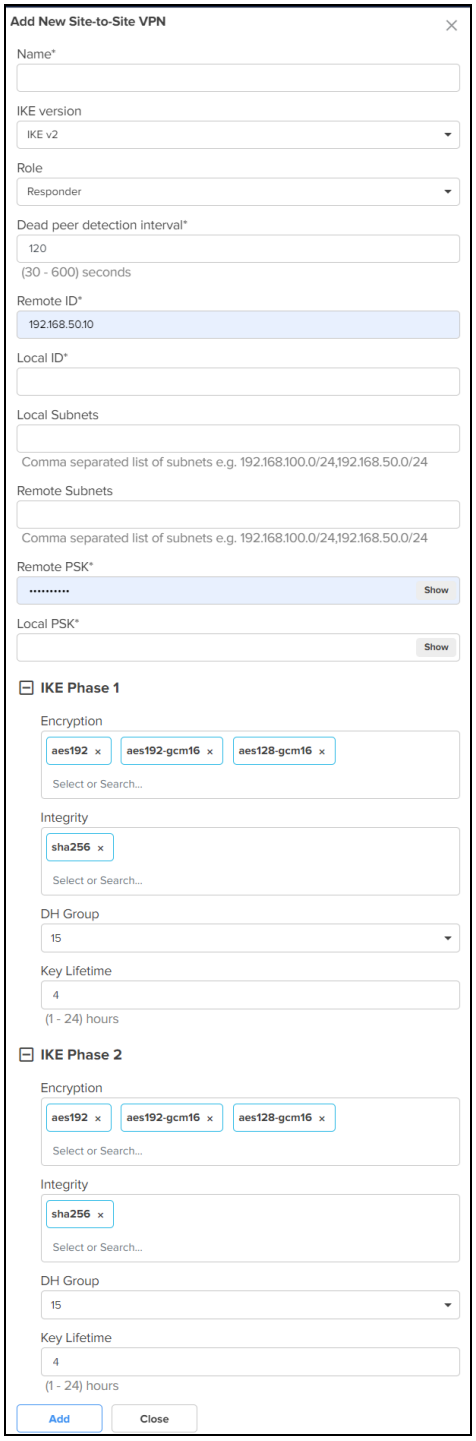


Figure 345 The VPN Sites page

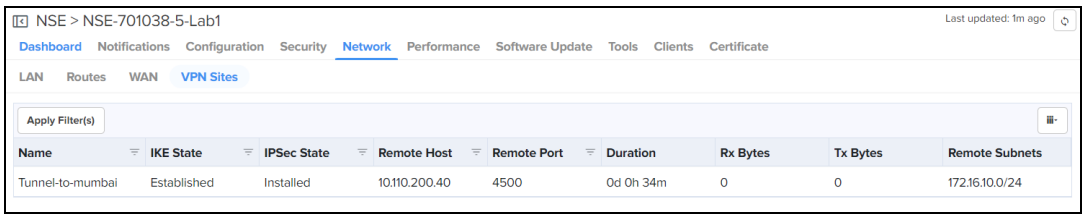


Figure 346 The Add New User window

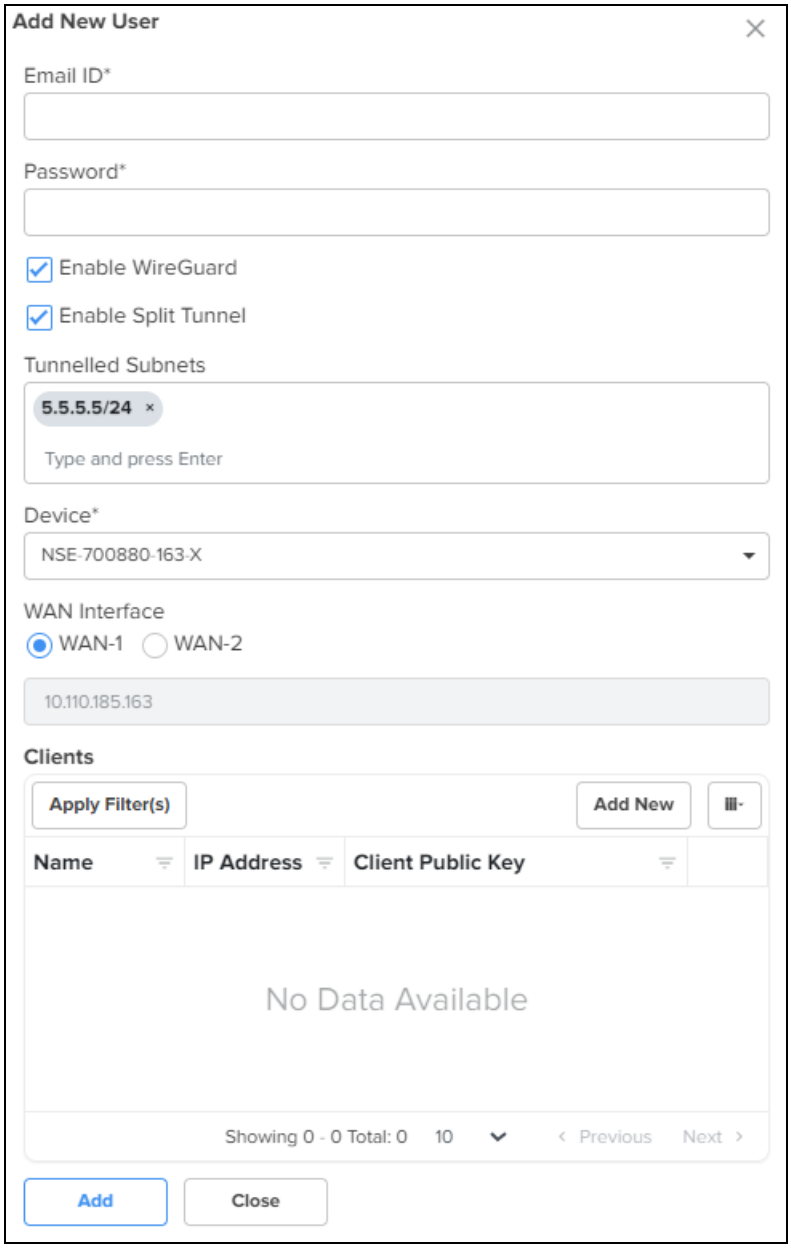


Figure 347 The Add New WireGuard client window

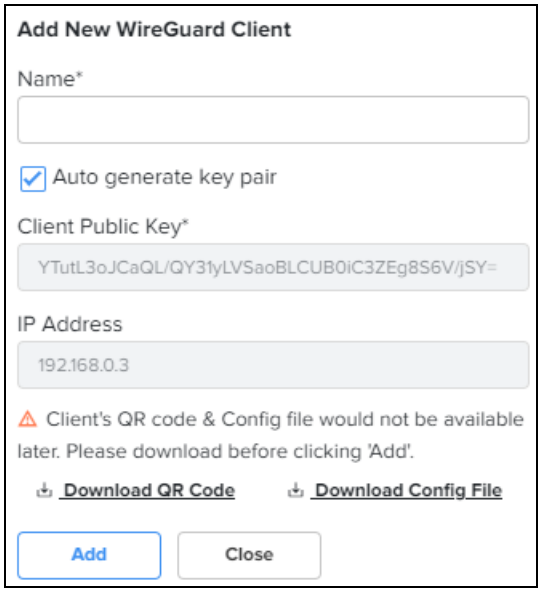
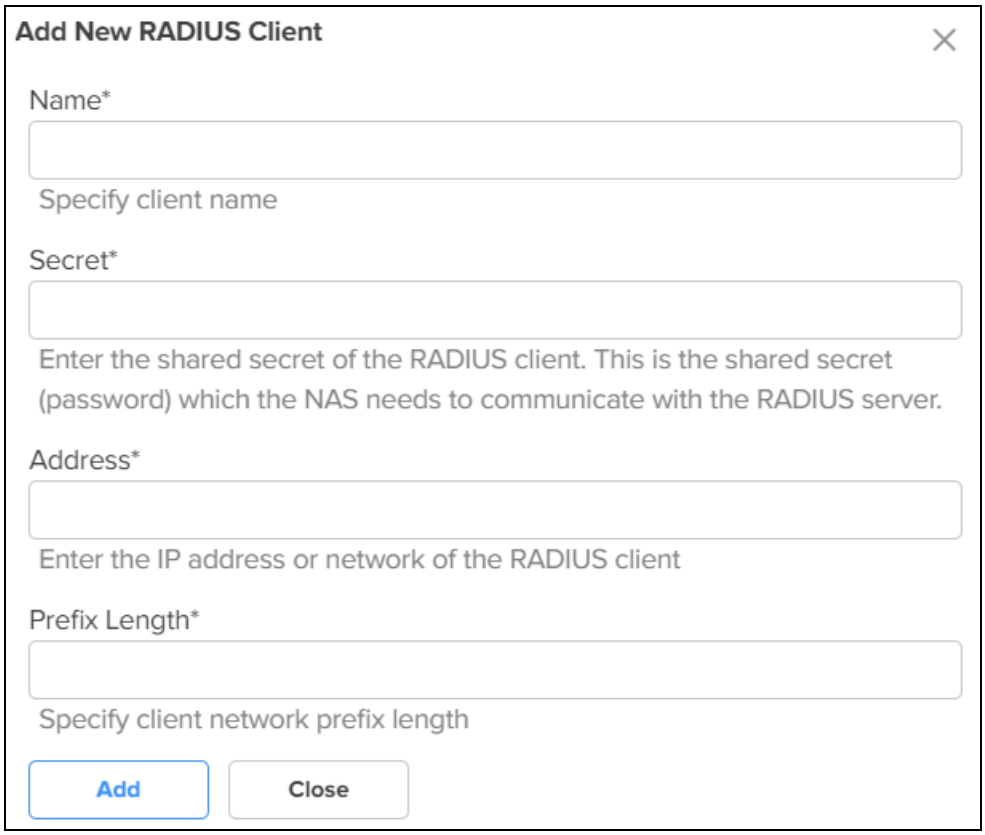


Figure 348 The Add New RADIUS Client window



3. Click **Save**.

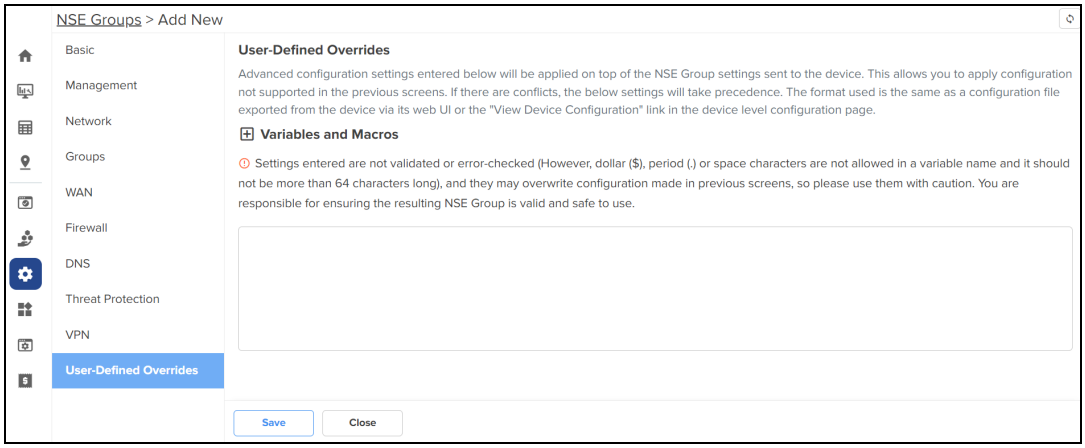
User-Defined Overrides

Using the **User-Defined Overrides** tab, you can configure the user-defined overrides.

To configure parameters on the **User-Defined Overrides** page, complete the following steps:

1. On the **NSE Groups > Add New** page, select the **User-Defined Overrides** tab.
   The **User-Defined Overrides** page appears, as shown in Figure 349.

Figure 349 The User-Defined Overrides page



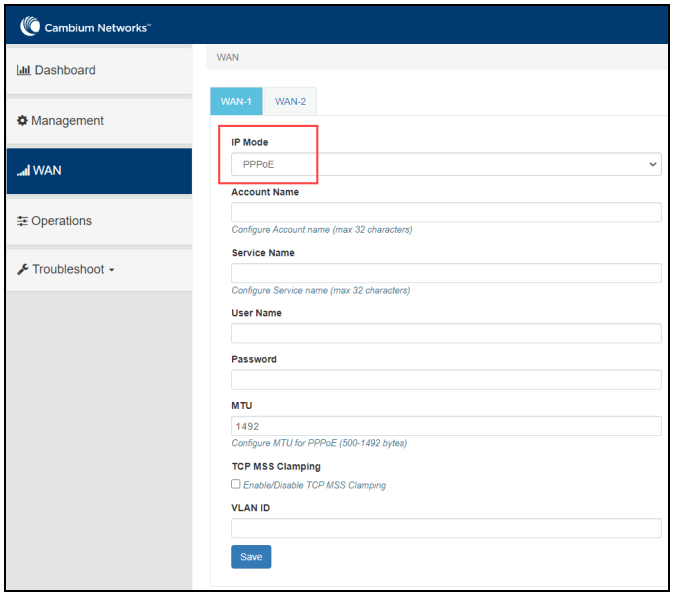
2. In the text box, enter the configuration that you want to apply to the device.
3. Click **Save**.

Configuring WAN in the device UI

In the **WAN** page, you can configure the device's IPv4 address based on the IP mode.

	NOTE: If **PPPoE** is used as the WAN connection mode as shown in Figure 350, make sure to configure the PPPoE username and password. Once you have configured the PPPoE user name and password, you can proceed to configure the NSE group by providing the same username and password and then attaching the default NSE group to the device.

Figure 350 PPPoE as WAN connection mode

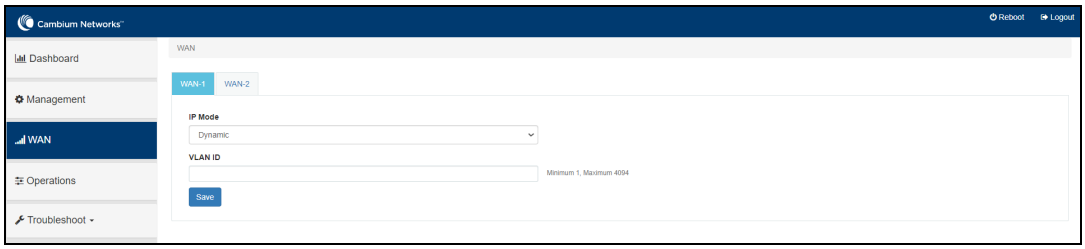


To view and configure the WAN settings, complete the following steps in the device UI:

1. From the main NSE 3000 dashboard page, click **WAN** tab from the left panel.
   The **WAN** page appears, as shown in Figure 351.

	NOTE: By default, WAN-1 page appears. You can configure WAN on WAN-1 or WAN-2.

Figure 351 The WAN page



2. Configure the parameters, as described in Table 84.

Table 84: Parameters on the WAN page

Parameter	Description
IP Mode	Determines the network that must be configured to use IPv4 addresses. The following options are supported: • **Dynamic** • **Static** • **PPPoE** By default, the **Dynamic** mode is selected.
VLAN ID	The VLAN ID can range from 1 to 4094. The VLAN configuration is optional. When the 802.1Q header is configured, all transmitted frames are expected to include the 802.1Q header with the same VLAN ID.
Following parameters appear only when you select the mode as **Static** from the **IP Mode** drop-down list, as shown in Figure 352.	
IP Address	The 32-bit binary number that identifies a network element by both network and host.
Subnet Mask	The subnet mask for the destination IP/network for the route.
Gateway	The gateway for the destination IP/network for the route.
DNS	

Parameter	Description
Primary DNS	The IPv4 address of primary upstream DNS server.
Secondary DNS	The IPv4 address of secondary upstream DNS server.
Following parameters appear only when you select the mode parameter as **PPPoE** from the **IP Mode** drop-down list, as shown in Figure 353.	
Account Name	The name of Access Controller. This parameter allows a maximum of 32 characters. This parameter is optional.
Service Name	Service name of Access Controller. This parameter allows a maximum of 32 characters. This parameter is optional.
User Name	A user name for PPPoE authentication. This parameter is mandatory.
Password	A password for PPPoE authentication. This parameter is optional.
MTU	MTU for PPPoE interface in bytes. Default: 1492. Range: 500 to 1492
TCP MSS Clamping	Indicates whether TCP MSS Clamping is enabled or disabled. By default, this parameter is disabled.

Figure 352 Static mode

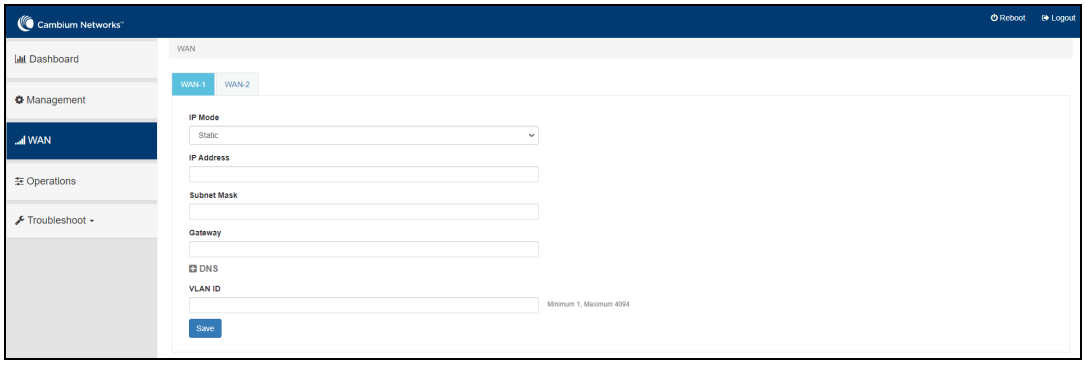
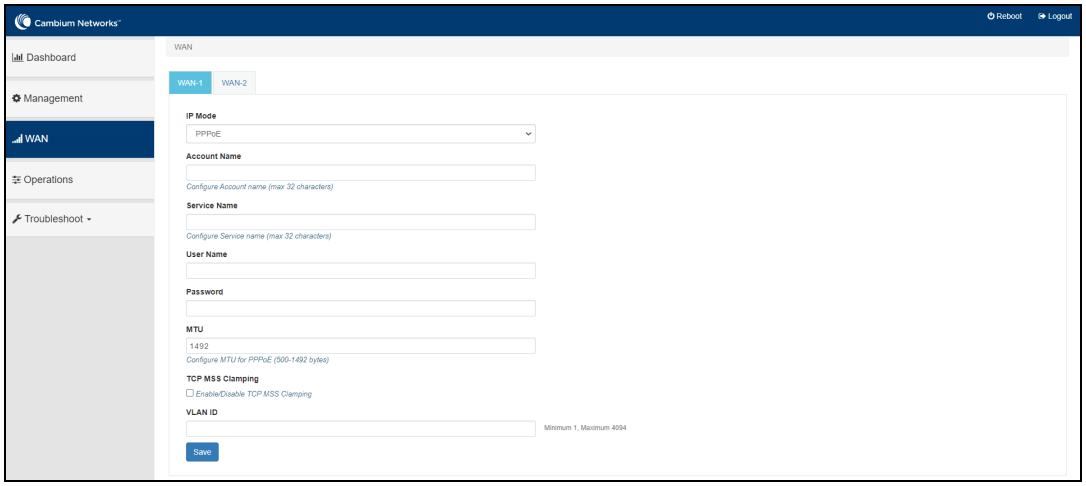


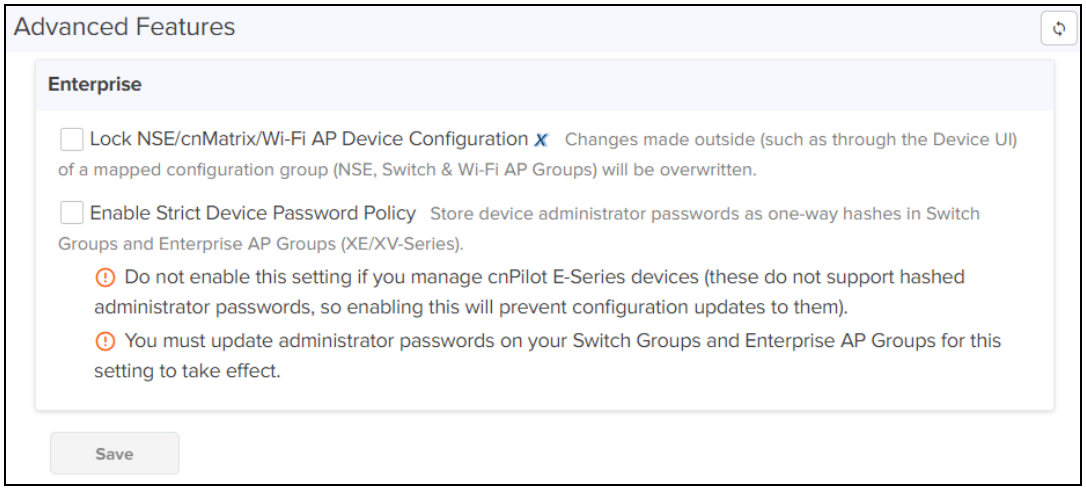
Figure 353 PPPoE mode



3. Click **Save**.

Configuring Advanced Features

To configure advanced features, navigate to **Configuration > Advanced Features** page.



Lock Device Configuration

To lock NSE, cnMatrix, and Wi-Fi Device Configuration, select the check box. Once you enable this check box, you cannot update the device-level configuration using the device UI or any other method. Only the configuration pushed from cnMaestro for NSE, Switch and Wi-Fi AP groups will be retained on the device.

Strict Device Password Policy

To enable strict password policy for Switch Groups or Enterprise AP Groups, select the **Enable Strict Device Password Policy** check box.

If you enable this option:

- The device administrator passwords are stored as one-way hashes for all NSE Groups, Switch Groups, and Enterprise AP Groups (XE/XV-series).
- The administrator password has to be updated for all NSE Groups, Switch Groups, and Enterprise AP Groups under **Configuration > NSE Group > Management** page, **Configuration > Switch Group > Management** page, and **Configuration > Wi-Fi Profiles > AP Group > Management** page respectively for this setting to take effect.
- The configuration cannot be pushed to cnPilot E-series device.
- Device software versions must be at or above 1.3 for NSE, 4.6.1 for cnMatrix, and 6.5.3 for Enterprise Wi-Fi XE/XV-Series to support the strict password policy. cnMaestro will not push any configuration to devices not meeting these requirements, including all cnPilot E-Series devices when the strict policy is enabled.

If you disable this option:

- The password has to be updated for all NSE Groups, Switch Groups, and Enterprise AP Groups under **Configuration > Switch Group > Management** page for this setting to take effect.

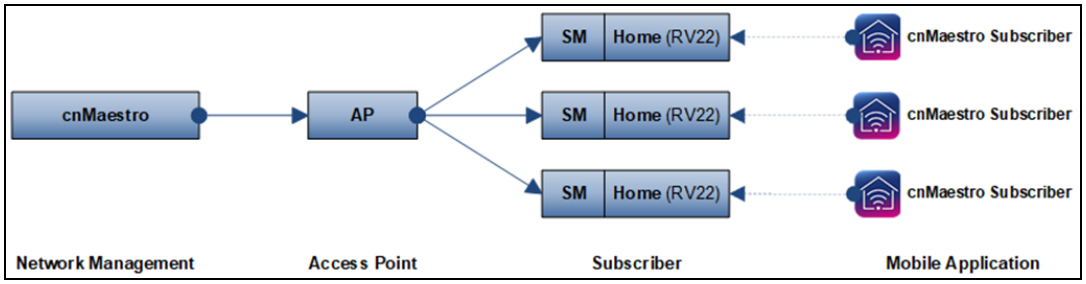
Managing Home Mesh Router

The Home Mesh Router is engineered to provide superior Wi-Fi performance and mesh networking capabilities. It incorporates the advanced 802.11ax technology, ensuring it is fully compatible with a wide range of consumer devices while offering low latency and high throughput. These routers are specifically designed for comprehensive home coverage, supporting simultaneous operation on both 2.4 GHz and 5 GHz bands. This enables extended range, enhanced efficiency, and reduced interference compared to previous generations of Wi-Fi technology. Additionally, the routers are configured to work in tandem, creating a seamless mesh network that covers the entire home, effectively eliminating areas with weak or no Wi-Fi signal.

The Home Mesh Routers can be configured using cnMaestro Cloud and the cnMaestro Subscriber application.

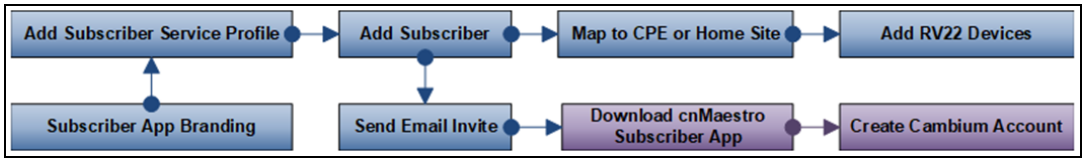
For information on supported platforms, see *Home Mesh Router User Guide*.

The basic architecture of the Home Mesh Router is as shown below.



The cnMaestro Subscriber application allows home customers to manage RV22 devices using their mobile phones. In the graphic above, the Subscriber is demarcated by the SM CPE. Alternatively, it could be mapped to a PON ONU, or to no explicit backhaul at all. In the latter case, the Subscriber would be attached to a new cnMaestro Home Site.

The workflow for creating and onboarding Subscribers, so customers can use the mobile application, has a cnMaestro (blue) and a customer (purple) component, as shown below.



A Subscriber is configured in cnMaestro Cloud, and an invite is sent to the customer's email address, which will enable home Wi-Fi management using the mobile application. The customer must download the cnMaestro Subscriber application from the Apple App store or Google Play Store. The "Site" in the application, which maps to the Subscriber, can be customized and branded.

Feature	Details
Onboarding	Supported using Cambium ID or Serial Number (MSN).
Dashboard	Dashboards tailored for Home Site and RV22 Home Mesh.
Configuration	Available through RV22 Home Mesh AP Groups.
Details	Overview and network information display.

Feature	Details
Notifications	Alarms, AP Events, and Wi-Fi Events aggregated at System, Managed Account, Network, Site, and Device levels.
Performance	WAN Throughput, Wireless Throughput (downlink/uplink), Clients by Band, Noise Floor, Interference, and Airtime (2.4/5 GHz) performance graphs.
Statistics	System, Managed Service, and Network statistics available.
Software Update	Software update provided at System, Managed Account, Network, Site, and Device levels.
Maps	Location of Home Sites and Devices.
Clients	Both Wired and Wireless Clients supported at Site and Device levels.
Tools	Status, Debug, Network Connectivity, Wi-Fi Analyzer, Speed Test, and Packet Capture tools available.
Reports	Data Reports downloaded from the System, Managed Service, Network, and Site levels.

This topic contains the following sections:

Configuring Home Mesh Router

Before shipping the Home Mesh Routers to the subscribers, they must be configured with AP groups, Wi-Fi profiles, and associated with the corresponding subscriber.

Configuring the routers involves the following steps:

1. Configuring WLAN profiles (SSIDs)
2. Configuring AP Groups
3. Onboarding the Home Mesh Router to cnMaestro
   a. cnMaestro Subscriber application branding
   b. Adding a Subscriber Service Profile
   c. Adding a subscriber
   d. Claiming the Home Mesh Router

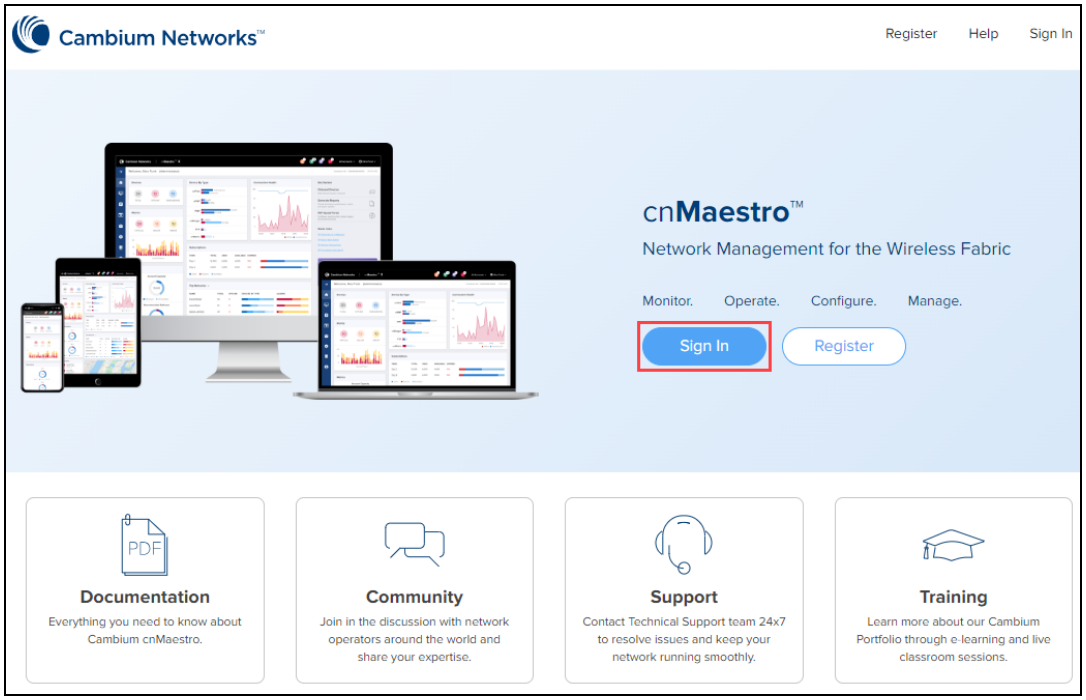
Configuring WLAN Profiles (SSIDs)

WLANs allow you to configure home and guest access SSIDs for the Home Mesh Router. This WLAN profile is associated with an AP group that contains configuration applied on the Home Mesh Routers. These SSIDs act as default SSIDs on all routers associated with the AP group.

To configure a WLAN profile, complete the following steps:

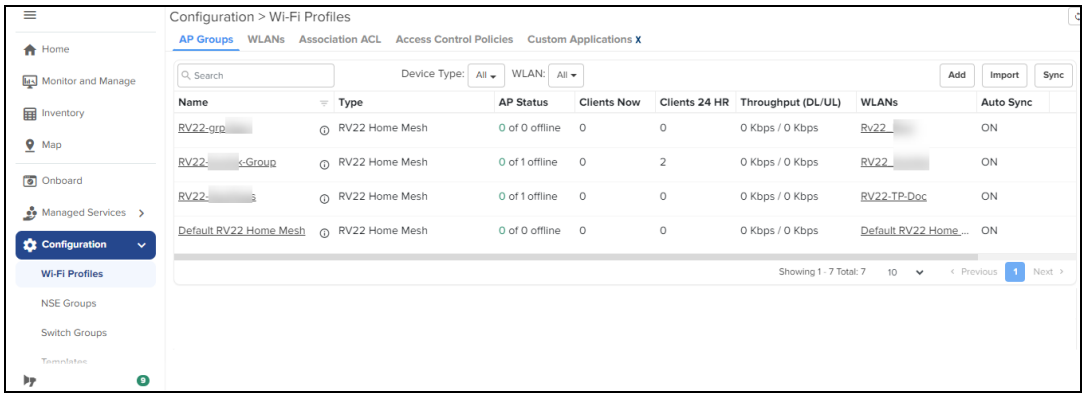
1. Sign in to cnMaestro.

   The home page appears.



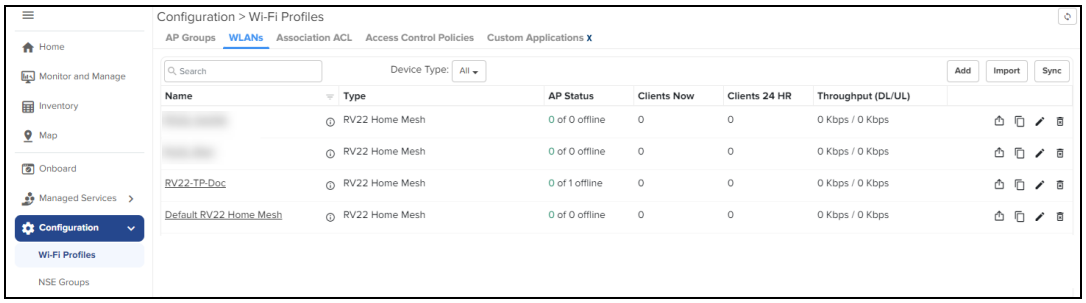
2. Navigate to **Configuration** > **Wi-Fi Profiles**.

   The **AP Groups** page under **Wi-Fi Profiles** appears, by default.



3. Click the **WLANs** tab.

   The **WLANs** page appears.



4. Click **Add**.

   The **WLANs** > **Add New** window appears.

   In the **WLANs** > **Add New** window, configure the WLAN parameters as described in Table 85.

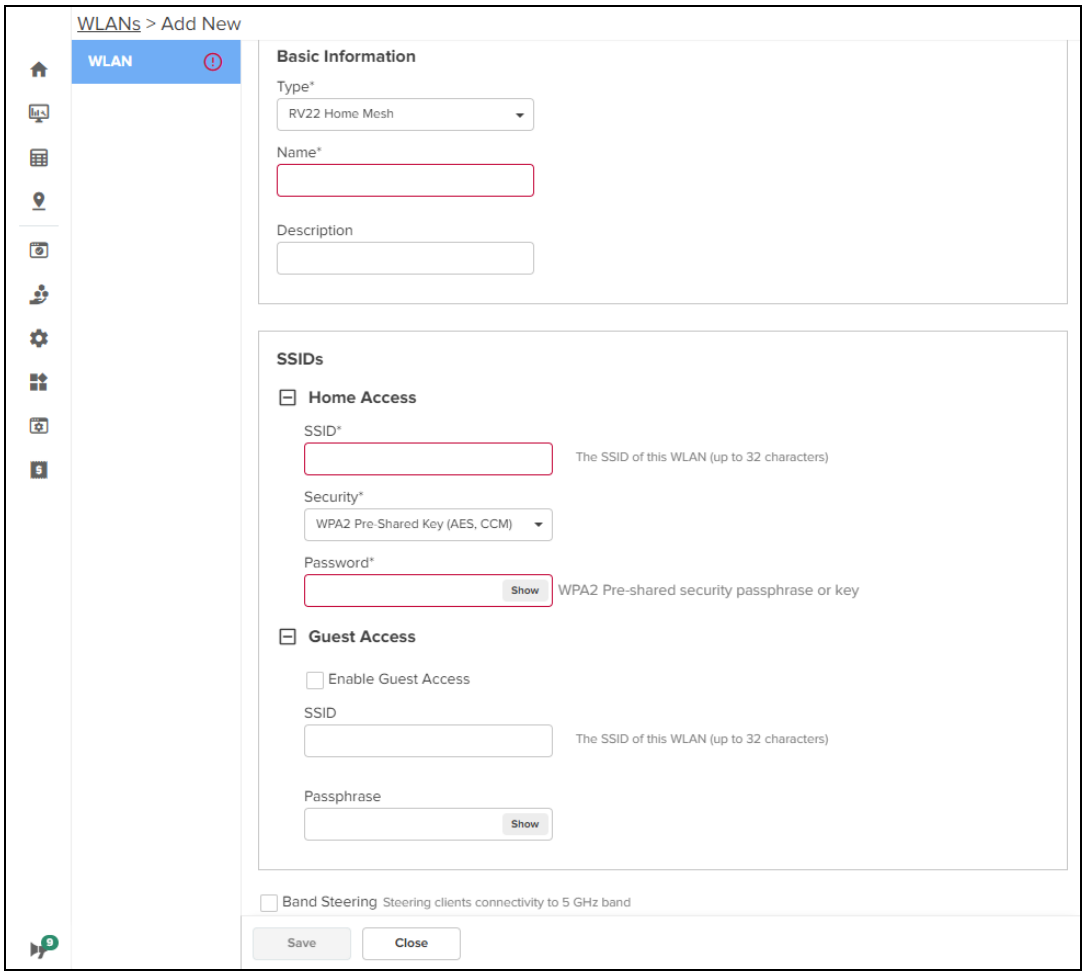


Table 85: WLAN parameters

Parameter	Description
Basic Information	
Type	Type of device for which the WLAN profile is configured. Select **RV22 Home Mesh** from the drop-down list.
Name	Name of the WLAN profile.
Description	Brief description for the WLAN profile.
SSIDs—Home Access Configure the default SSID that is used to connect devices wirelessly. Only one home SSID can be configured.	
SSID	Unique name of the SSID for this WLAN. Supports a maximum of 32 characters. You must either configure the default SSID or enter a customized SSID. The default SSID: `RV22_<last 6 digits of device MAC>`. For example, `RV22_`

Parameter	Description
	123456.
Security	Security method used for encryption. The following security methods are supported: • **Open** • **WPA Pre-Shared Key (AES, CCM)** • **WPA2 Pre-Shared Keys (AES, CCM)** • **WPA2 Pre-shared Keys (TKIP, AES)** • **WPA Pre-Shared Key (TKIP, AES)**
Password	Security passphrase or key used to connect to this SSID. You must either configure the default password or enter a customized password. Default password: password
SSIDs—Guest Access Configure the guest SSID to allow any guest devices to access the wireless network.	
Enable Guest Access	Determines whether the guest access is enabled. Select the check box to enable guesst access.
SSID	Unique name of the guest SSID for this WLAN. Supports a maximum of 32 characters.
Password	Security passphrase or key used to connect to this guest SSID.
Band Steering	Determines whether the band steering is enabled for the wireless clients. When enabled, APs steer wireless clients to connect to the 5 GHz band.

5. Click **Save**.

Configuring AP Groups

AP groups apply the same configuration to multiple Home Mesh Routers. AP groups contain configuration, such as administrator password, event logging, radio settings, WAN mappings, and DNS mode.

The following are part of the AP group:

- **Basic**
- **Management**
    - Administrator Access
    - Time Settings

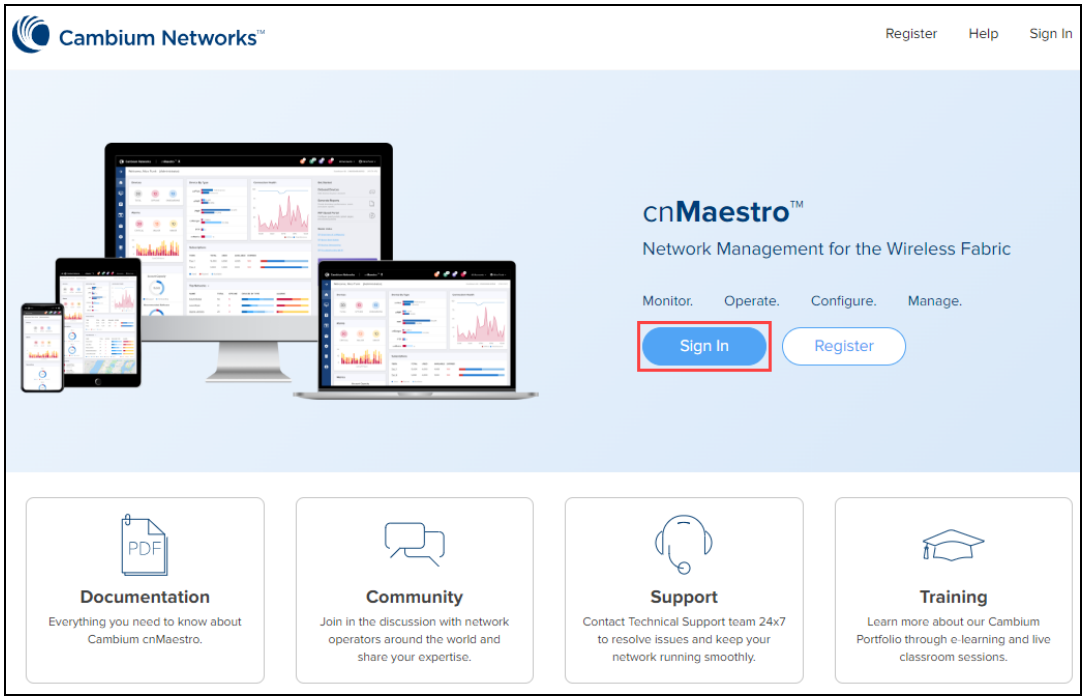
- Event Logging
- SNMP

- **Radio**
- **Network**
  - WAN Configuration
  - LAN Configuration
- **Security**
  - DoS Protection
  - Access Control List (ACL)

To configure an AP group, complete the following steps:

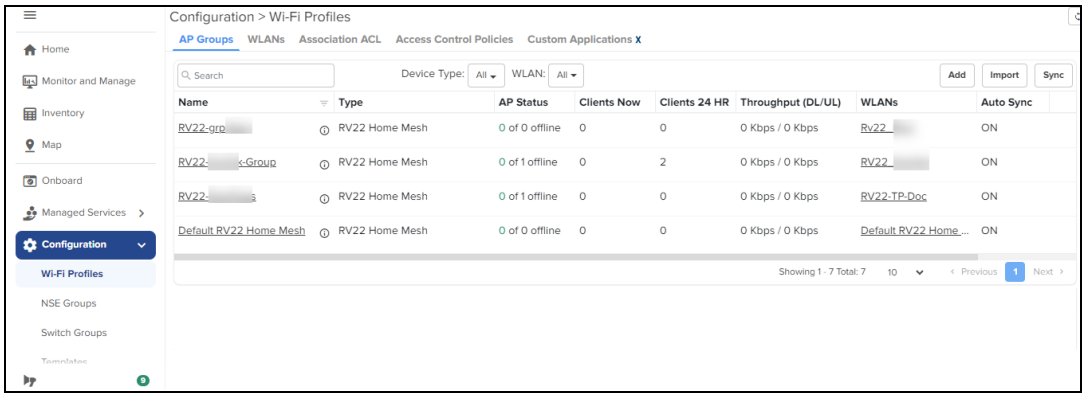
1. Sign in to cnMaestro.

   The home page appears.



2. Navigate to **Configuration** > **Wi-Fi Profiles**.

   The **AP Groups** page under **Wi-Fi Profiles** appears, by default.



3. Click **Add**.

   The **Add New** window appears with multiple tabs. By default, the **Basic** tab is selected.

4. In the **Add New** window > **Basic** tab, select **RV22 Home Mesh** in the **Type** drop-down list and configure the parameters described in Table 86.

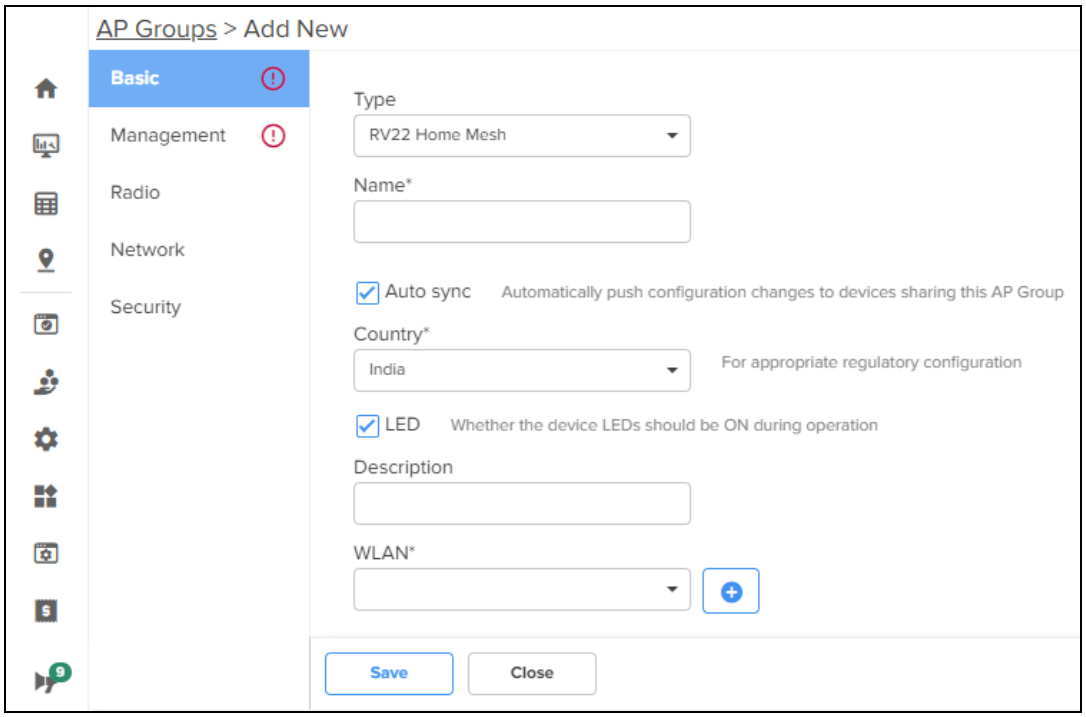


Table 86: Basic parameters

Parameter	Description
Type	Type of device for which the AP group is configured. Select **RV22 Home Mesh** from the drop-down list.
Name	Hostname of the device. Supports a maximum of 64 characters.
Auto sync	Specifies whether configuration is applied to the router automatically after saving. Select the check box to enable auto sync of configuration.
Country	Country from where the device is operated. To be set by the administrator only. The allowed operating channels and the respective transmit power levels depend on the country of operation. The list of countries supported depends on the SKU of the device (FCC and ROW). **Note**: Radios remain disabled unless this parameter is configured.
LED	When enabled, turns on the device LEDs during operation.
Description	Brief description for the AP group.
WLAN	WLAN profile to be associated with this AP group. WLAN profile contains SSID details of the wireless network. Select the WLAN from the drop-down list. If no WLAN is configured, create one by clicking the add () icon. For more information, See Configuring WLAN profiles (SSIDs).

5. Click the **Management** tab on the left pane and configure the parameters described in Table 87.

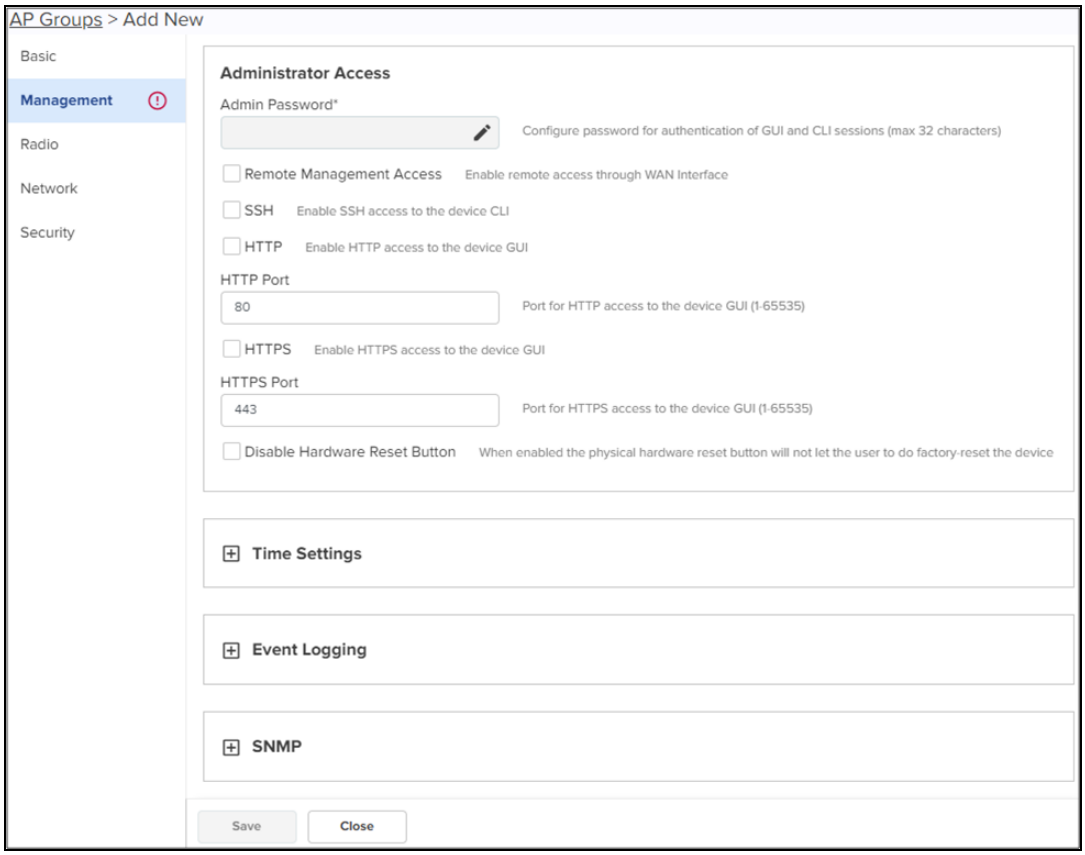


Table 87: Management parameters

Parameter	Description
Administrator Access-related parameters	
Admin Password	Password required for authentication of the router.
Disable Hardware Reset Button	Determines whether the reset button on the router is required to prevent a factory reset operation of the router. Select the check box to prevent the user from performing the factory reset operation.
Time Settings-related parameters	
Time Zone	Time zone of the location where the router is installed. Select an appropriate time zone from the drop-down list.
NTP Server 1	Hostname or IPv4 address of the Network Time Protocol (NTP) server.
NTP Server 2	Hostname or IPv4 address of a second NTP server.
Event Logging-related parameters	

Parameter	Description
Syslog Server	Hostname, IPv4, or IPv6 address of the Syslog server and the respective port number. Default port number: 514
Syslog Severity	The severity level of event that must be forwarded to the server. The supported severity levels (0-7) are based on RFC standards.
SNMP-related parameters	
Enable	Determines whether SNMPv2c or SNMPv3 support on the router is enabled. Select the check box to enable SNMP support.
Trap Receiver IP	IPv4 address of the SNMP server to receive the SNMP traps. This parameter is appicable to both SNMP v2c and v3 versions.
Version	Specifies the SNMP version configured for the router. The following options are available: • v2c • v3
SNMPv2c-related parameters	
SNMPv2c RO community	The SNMP v2c read-only community string used as a password when obtaining information from the router.
SNMPv2c RW community	The SNMP v2c read-write community string as a password when writing information to the router.
SNMPv3-related parameters	
SNMPv3 Username	Username for the SNMPv3 server. Supports a maximum of 32 characters.
Enable Authentication	Indicates whether authentication is enabled for SNMP communication. Select the check box to enable authentication.
Authentication Protocol	Specifies the authentication protocol. The following options are available: • MD5 • SHA Cambium uses SHA-1 authentication protocol. By default, the **SHA** option is selected.

Parameter	Description
Authentication Password	Password used for authentication. Supports 8 to 32 characters.
Enable Encryption	Indicates whether encryption is enabled for SNMP communication. Select the check box to enable encryption.
Encryption Type	Specifies the encryption type. The following options are available: • AES • DES By default, the **AES** option is selected.
Encryption Password	Password used for encryption. Supports 8 to 32 characters.

6. Click the **Radio** tab on the left pane and configure the preferred radios (2.4 GHz or 5 GHz or both).

   By default, both the radios are enabled. You can disable only the 2.4 GHz radio.

   Configure the parameters (described in Table 88), which are similar across 2.4 and 5 GHz radios.

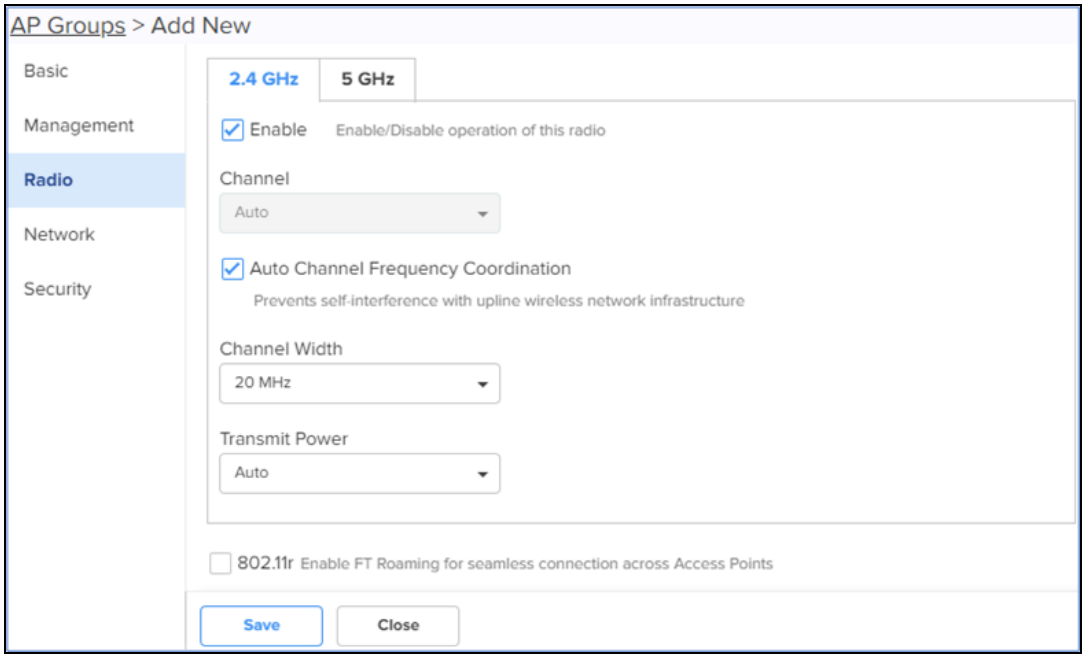
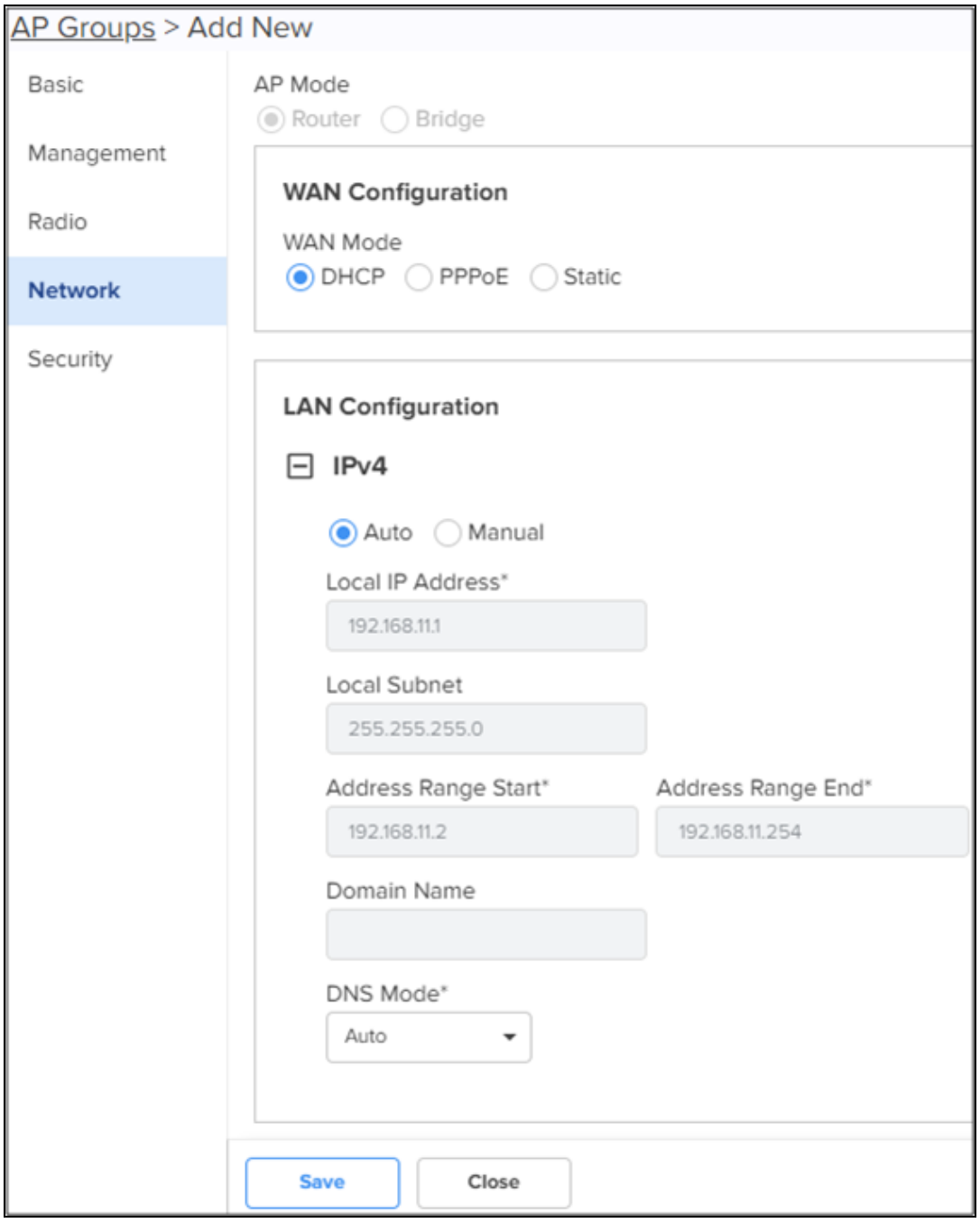


Table 88: Radio parameters

Parameter	Description
Enable	Enables the operation of radio.
Channel	This parameter cannot be modified. This is configured as **Auto**, by default.
Auto Channel Frequency Coordination	Enable to prevent router from self-interference with upline wireless network infrastructure.
Channel Width	Select the following channel widths for the operation: • For 2.4 GHz—20 MHz and 40 MHz channel width are supported. Default: 20 MHz • For 5 GHz—20 MHz, 40 MHz, 80 MHz, and 160 MHz channel width are supported. Default: 80 MHz
Transmit Power	Transmit power of the router in percentage (%). The following options are available: • Auto • 20 • 40 • 60 • 80 • 100

7. Click the **Network** tab on the left pane and configure the WAN mode and IP address assignment parameters.



i. The **AP Mode** is pre-configured as **Router** and cannot be modified.

ii. In the **WAN Configuration** section, select the required WAN mode and configure the corresponding parameters.

This mode selects the mode of IP address assignment for the WAN interface. The following WAN modes are supported:

- **DHCP**—This mode is selected by default.

  No additional parameter configuration is required.

- **PPPoE**—Configure the PPPoE parameters as described in Table 89.

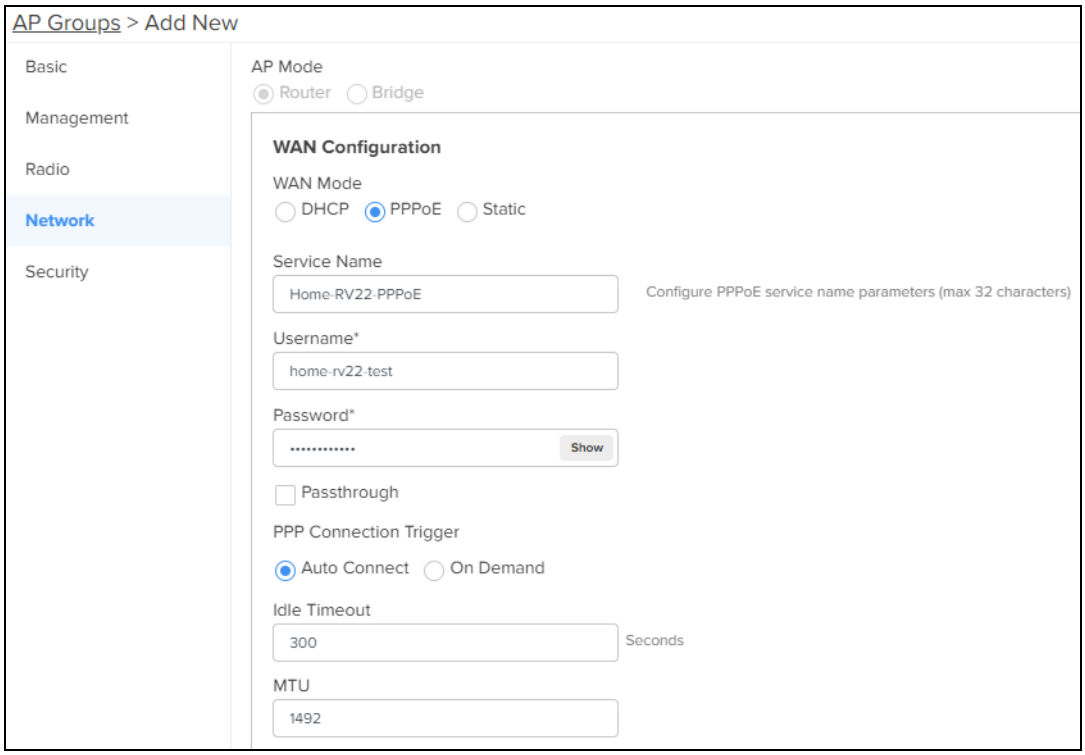


Table 89: WAN Mode: PPPoE parameters

Parameter	Description
PPPoE-related parameters	
Service Name	Name of the PPPoE service name. Supports a maximum of 32 characters.
Username	Username of the PPPoE service required for authentication.
Password	Password of the PPPoE service required for authentication.
Passthrough	Indicates whether the clients must directly establish connection with the service provider. Select the check box to enable passthrough.

Table 89: WAN Mode: PPPoE parameters

Parameter	Description
PPP Connection Trigger	Indicates the connection method for the router for keeping the connection intact. The following options are supported: • Auto Connect • On Demand
Idle Timeout	This parameter is mandatory when you select **On Demand** type of **PPP Connection Trigger**. Specifies the duration (in seconds) after which PPPoE keep-alive packets must be sent to keep the connection intact. Default: 300
MTU	Maximum size (in bytes) of each packet sent in a single transmission between connected devices. Default: 1492

- **Static**—Configure the Static parameters as described in Table 90.

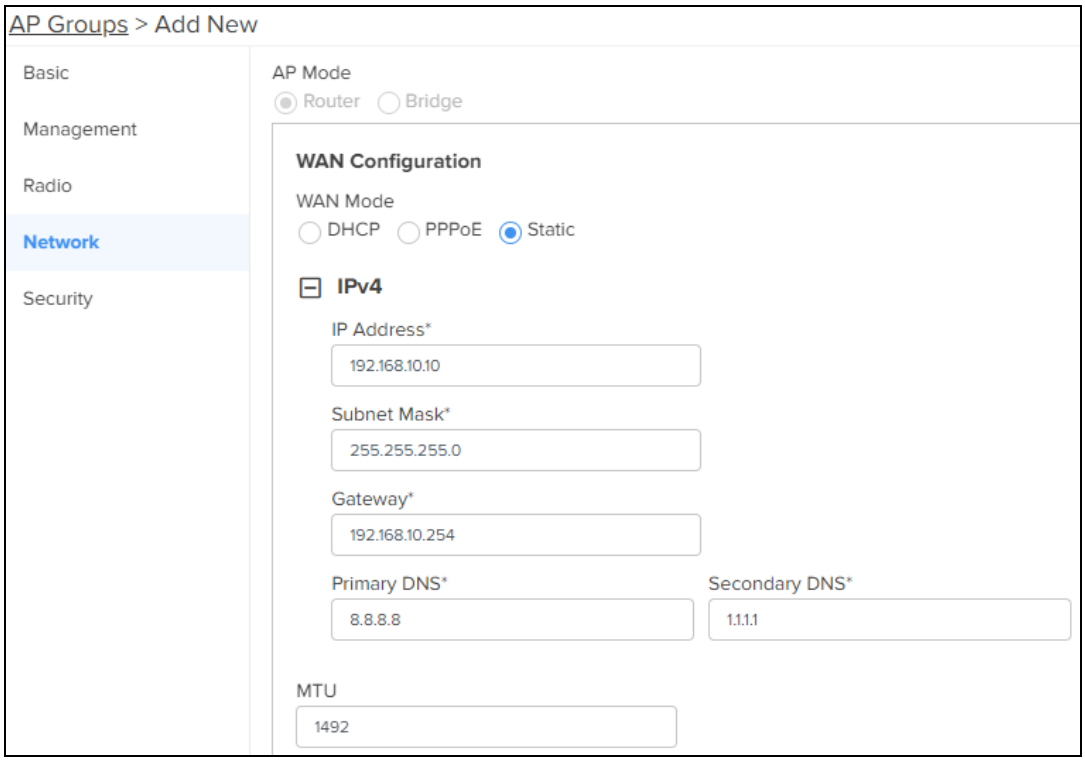


Table 90: WAN Mode: Static parameters

Parameter	Description
Static-related parameters	
IP Address	IPv4 address assigned to the router.
Subnet Mask	Subnet mask assigned to the router's IPv4 address.
Gateway	IPv4 address of the gateway used for communication.
Primary DNS	IPv4 address of the primary DNS server.
Secondary DNS	IPv4 address of the secondary DNS server.
MTU	Maximum size (in bytes) of each packet sent in a single transmission between connected devices. Default: 1492

Note

If you select **PPPoE** or **Static** mode, you must preconfigure the settings in the router before shipping the routers to customers. Complete the following steps before shipping the Home Mesh Router to the customers:

i. Onboard the Home Mesh Router using the standard WAN mode as **DHCP**.

ii. After the Home Mesh Router is onboarded, set the WAN mode to **PPPoE** or **Static**.

iii. Configure the username and password credentials.

The configuration and the credentials are applied on the Home Mesh Router.

iv. Disconnect the Home Mesh Router and ship it to the customer.

When the customer connects the router to the PPPoE authenticated network, the Home Mesh Router uses the PPPoE credentials to authenticate.

iii. In the **LAN Configuration** section, configure the mode of IP address assignment for connecting devices to **Auto** or **Manual**.

If you select Manual mode of assignment, configure the following parameters:

Table 91: LAN Configuration parameters for Manual mode

Parameter	Description
IPv4-related parameters	
Local IP Address	Local IPv4 address assigned to the router.
Local Subnet	Subnet mask assigned to the router's IPv4 address.
Address Range Start	Starting IPv4 address in the address pool.
Address Range End	Ending IPv4 address in the address pool.
Domain Name	The domain name.
DNS Mode	DNS mode used for IP address resolution. Following are the supported options: • Auto • Manual • Proxy

8. Click the **Security** tab on the left pane and configure protection against different types of attacks, such as Smurf attack and ICMP fragment.

   Select the check box corresponding to the DoS protection options.

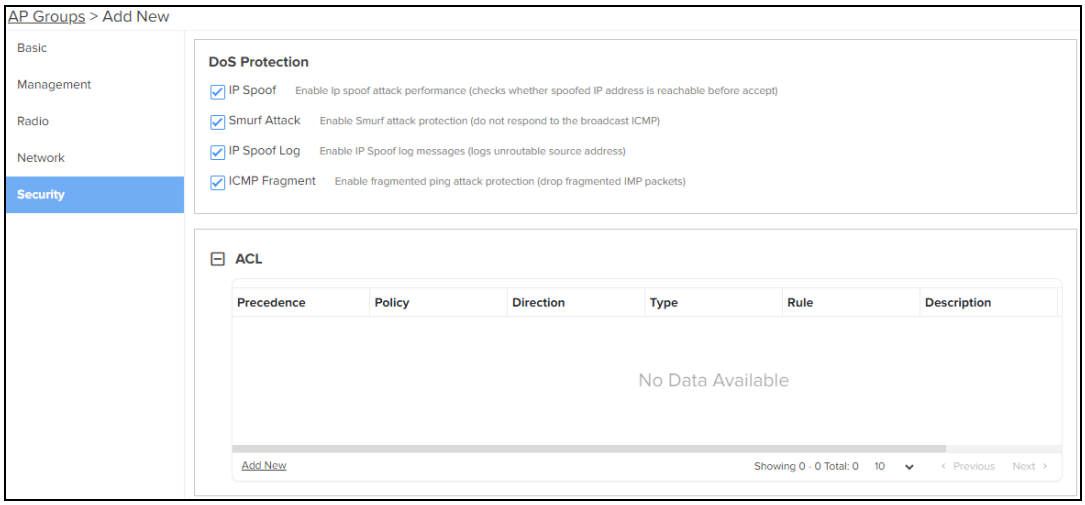


Table 92: Security parameters: DoS Protection

Parameter	Description
IP Spoof	Enable protection agains IP spoof attacks. When enabled, the router checks whether the spoofed IP address is reachable before accepting.
Smurf Attack	Enable protection agains Smurf attacks. When enabled, the router does not respond to the broadcast ICMP.
IP Spoof Log	Enable logging of IP spoof addresses. When enabled, the router logs the unroutable source IP address.
ICMP Fragment	Enable protection against ICMP fragmented ping attack. When enabled, the router drops the fragmented ICMP packets.

9. Click **Add New** in the **ACL** section and configure the parameters as described in Table 92.

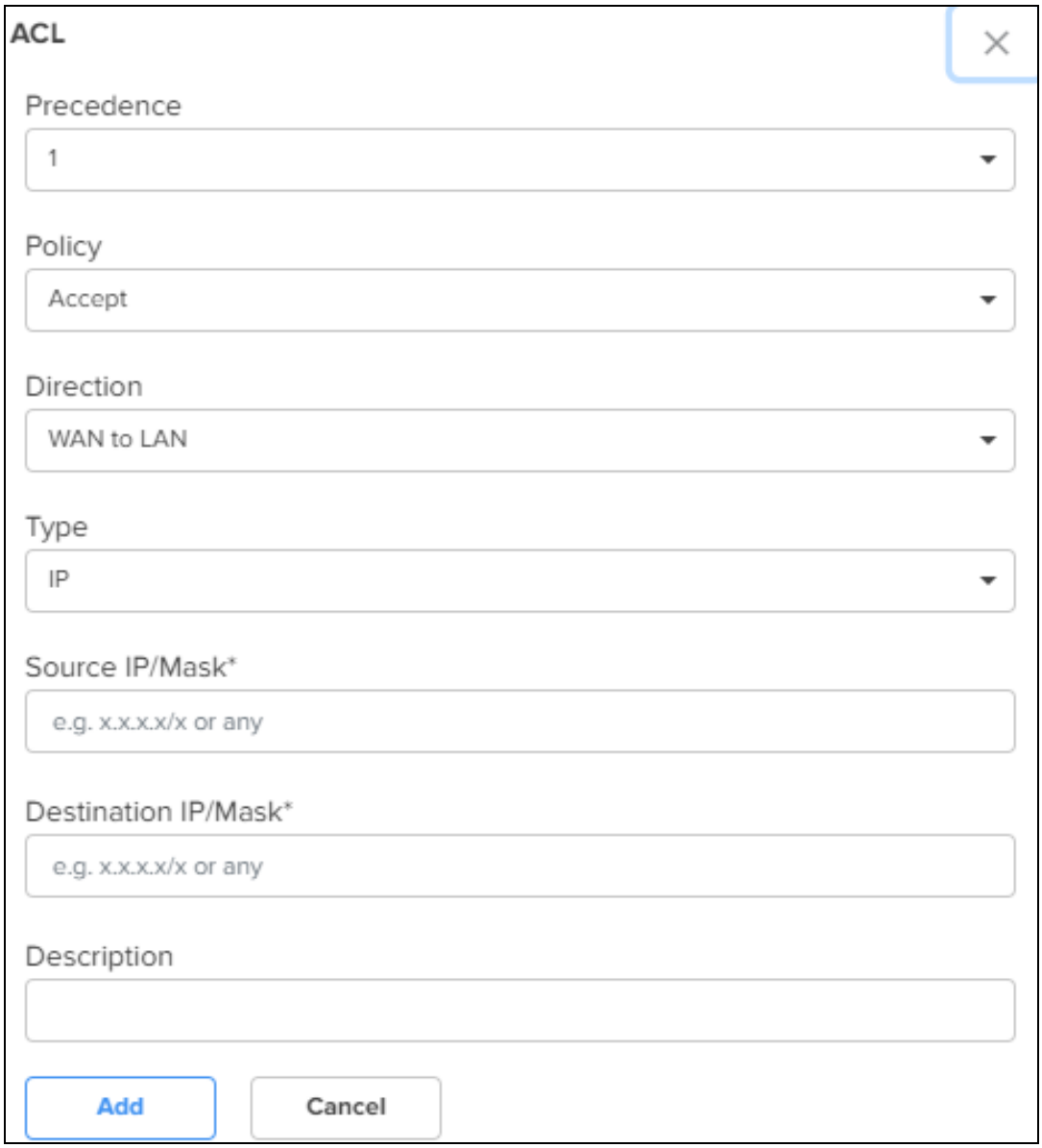


Table 93: Security parameters: Access Control List (ACL)

Parameter	Description
Precedence	Specifies the priority of the rule configured. Select the precedence from the drop-down list.
Policy	Indicates the action to be taken for the policy. The following are the supported actions: • Accept • Drop • Reject
Direction	Direction to which the policy must be applied.

Table 93: Security parameters: Access Control List (ACL)

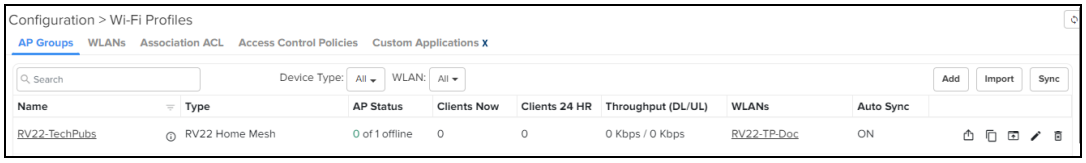
Parameter	Description
	The following are the supported options: • WAN to LAN • LAN to WAN • WAN to Router • Router to WAN
Type	Type of traffic to which the policy must be applied. The following are the supported options: • IP • IPv6 • MAC • Protocol • Protocolv6 Additional parameters are enabled when you selct the type.
Source IP/Mask Destination IP/Mask	This field is applicable when you select the **Type** as **IP**, **IPv6**, **Protocol**, or **Protocolv6**. Specifies the source IPv4 or IPv6 address and the destination IPv4 or IPv6 address for the policy. You can configure **Any** if there is no specific IP address to apply the policy to any source IP address.
Source MAC/Mask Destination MAC/Mask	This field is applicable when you select the **Type** as **MAC**. Specifies the source MAC address and the destination MAC address for the policy. You can configure **Any** if there is no specific MAC address to apply the policy to any source IP address.
Protocol	Type of protocol for which the policy must be applied. The following are the supported options: • TCP • UDP • ICMP • Any Additional parameters are enabled when you selct the protocol.

Table 93: Security parameters: Access Control List (ACL)

Parameter	Description
Source Port	This field is applicable when you select the **Protocol** as **TCP**, **UDP**, or **Any**. Specifies the source port number for the policy.
Destination Port	This field is applicable when you select the **Protocol** as **TCP**, **UDP**, or **Any**. Specifies the source port number for the policy.
Description	Description for the rule.

10. Click **Save**.

    The AP group is successfully created with the configured parameters.



Onboarding the Home Mesh Router to cnMaestro

After creating a WLAN profile and an AP group, you must now create a subscriber profile and associate it with the subscriber. Finally, you must onboard the router(s) to the corresponding subscriber.

Adding a subscriber and onboarding the router involves the following steps:

1. cnMaestro Subscriber application branding
2. Adding a home site
3. Adding a Subscriber Service Profile
4. Adding a subscriber
5. Claiming the Home Mesh Router

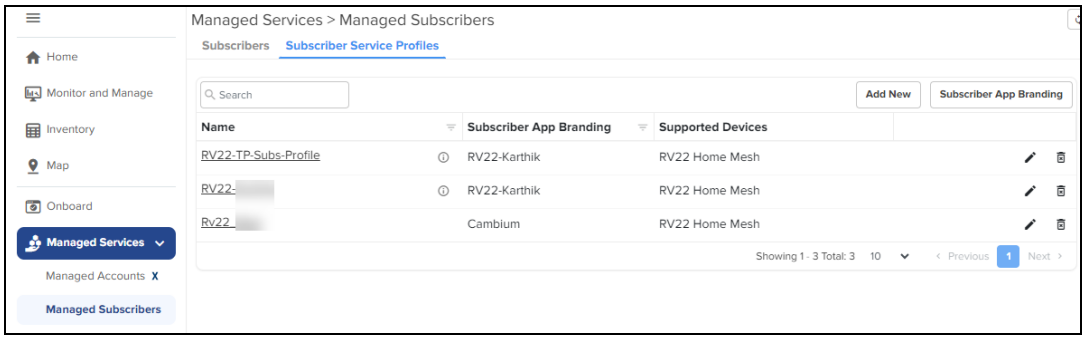
cnMaestro Subscriber application branding

Customize the cnMaestro Subscriber mobile application with your company name, brand logo, and other details, such as support contact information and hours. This branding can be associated with individual subscriber service profiles.

To add brand details to the cnMaestro Subscriber application, complete the following steps:

1. Navigate to the **Manage Service Providers** > **Managed Subscribers** > **Subscriber Service Profiles** tab.

   The **Subscriber Service Profiles** page appears.



2. Click **Subscriber App Branding**.

3. Click the add (+) icon.

   The **Subscriber App Branding** window appears. Configure the following parameters as described in Table 94.

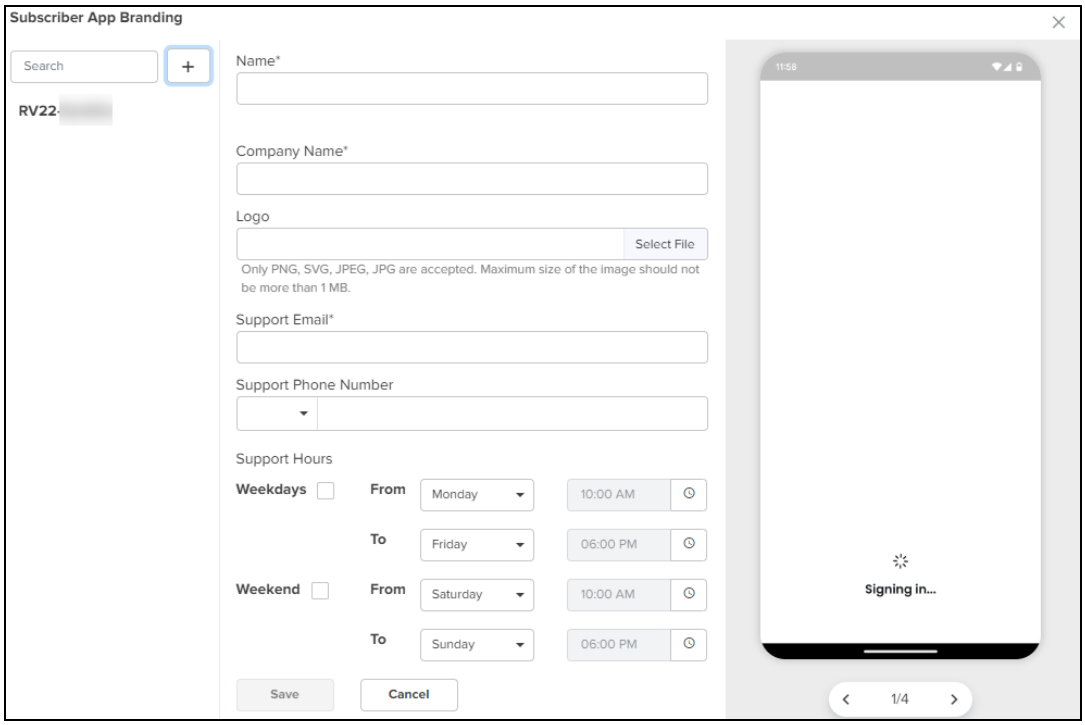


Table 94: Subscriber App Branding parameters

Parameter	Description
Name	Name of the application branding.
Logo	Brand logo displayed in the cnMaestro Subscriber application. Maximum size of the image supported is 1 MB. Only JPEG, JPG, PNG, and SVG file formats are supported.
Support	Email address for customer support team displayed in the application.

Parameter	Description
Email	
Support Phone Number	Phone number for customer support team displayed in the application.
Support Hours	Contact hours for the customer support team. • Select the **Weekdays** check box and configure the week days on when the customer support team is available. You can also configure the time using the time picker tool. • Select the **Weekends** check box and configure the weekend days on when the customer support team is available. You can also configure the time using the time picker tool.

You can preview your branding updates by scrolling through the images in the preview window on the right.

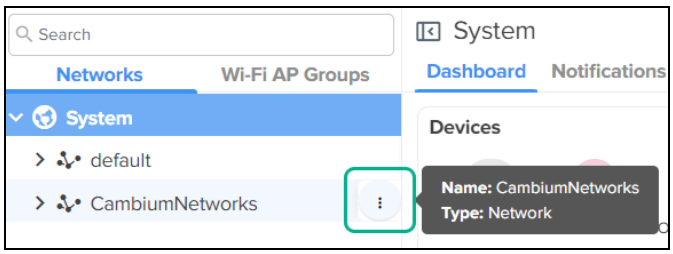
4. Click **Save**.

Adding a home site

A home site is required to associate the subscriber's device with the device configuration.

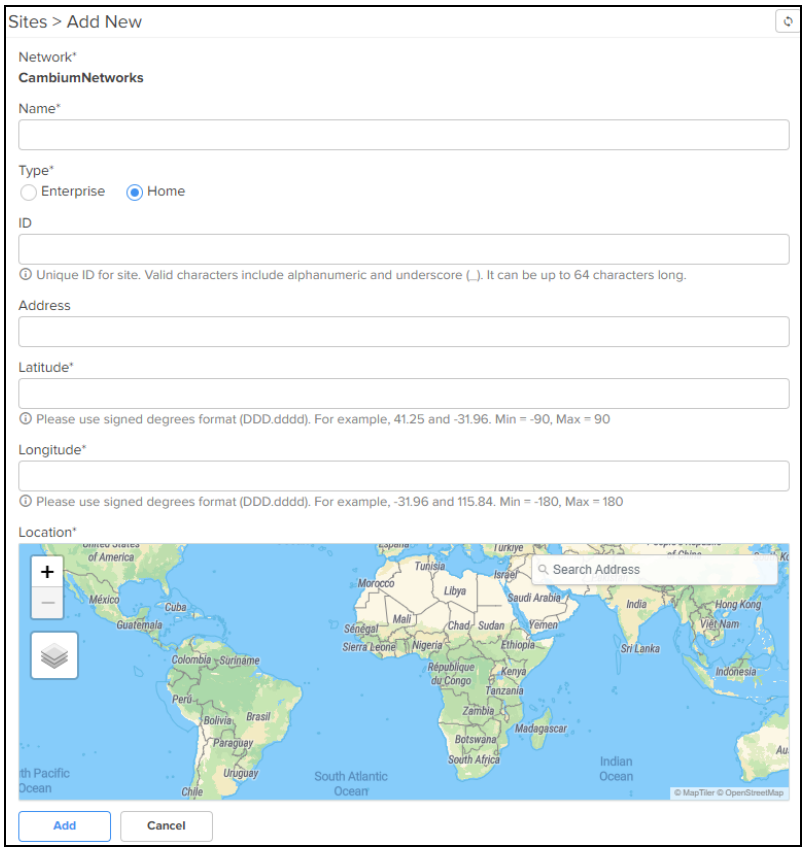
To create a home site, complete the following steps:

1. Click **Monitor and Manage** ( ).
2. In the **Networks** tab, search for the network and hover over the network name.



3. Click the actions ( ) icon and select **Add Site**.

   The **Sites > Add New** page appears.



4. Select the **Home** option in the **Type** field.
5. Enter the location details in the **Longitude** and **Latitude** fields.

   You can also search for the location in the map to fill in the details.
6. Click **Add**.

Managing subscribers (end-customer)

To enable a subscriber to manage the router using the Android or iOS application, you must add a subscriber profile in cnMaestro and send an invitation to the subscriber.

This pocess involves the following actions:

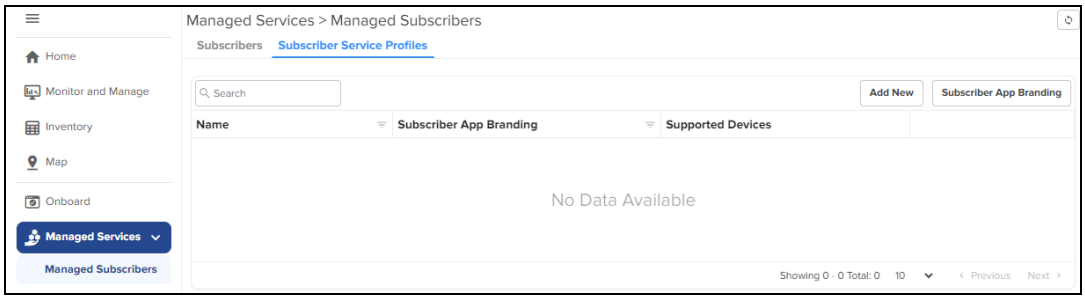
1. Adding a subscriber service profile
2. Adding a subscriber
3. Claiming the Home Mesh Router

Adding a Subscriber Service Profile

To add a subscriber service profile, complete the following steps:

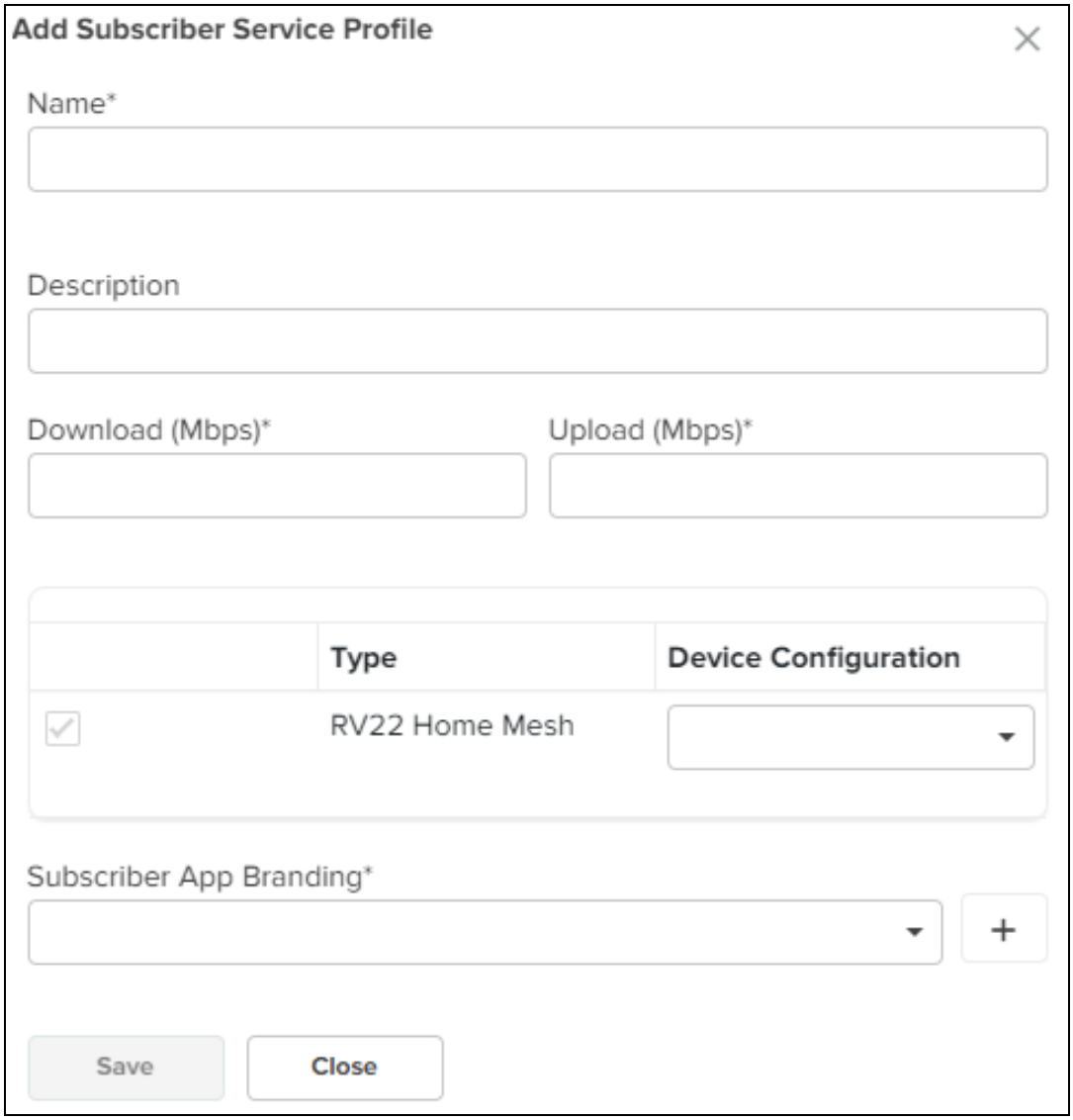
1. Navigate to the **Manage Service Providers** > **Managed Subscribers** > **Subscriber Service Profiles** tab.

   The **Subscriber Service Profiles** page appears.



2. Click **Add New**.

   The **Add Subscriber Service Profile** window appears.



3. Select the Home Mesh Router configuration to which you want to associate with the subscriber service profile and configure the parameters as described in Table 95.

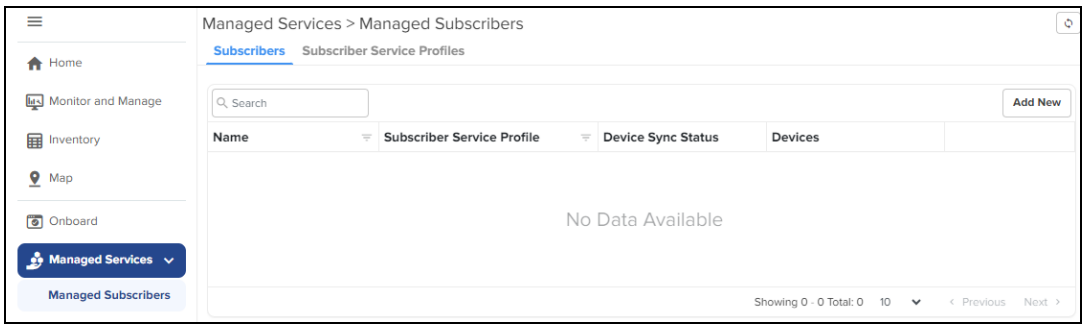
Table 95: Subscriber Service Profile parameters

Parameter	Description
Name	Name of the subscriber service profile.
Description	Brief description for the subscriber service profile.
Download (Mbps)	Download speed (in Mbps) configured for the profile. Subscribers that are onboarded to this profile will be restricted to this download speed.
Upload (Mbps)	Upload speed (in Mbps) configured for the profile. Subscribers that are onboarded to this profile will be restricted to this upload speed.
Type	Displays the device type as **RV22 Home Mesh**. This field cannot be modified.
Device Configuration	Specifies the Wi-Fi AP group (created for Home Mesh Router) that must be associated with the service profile. Select the group from the drop-down list.
Subscriber App Branding	Specifies the cnMaestro Subscriber application branding that must be used in this profile. All routers sent to subscribers in this service profile contain the selected branding logo and information. Select the required branding from the drop-down list. If no branding is present, create one by clicking the add (+) icon. See cnMaestro Subscriber application branding for more information.

4. Click **Save**.

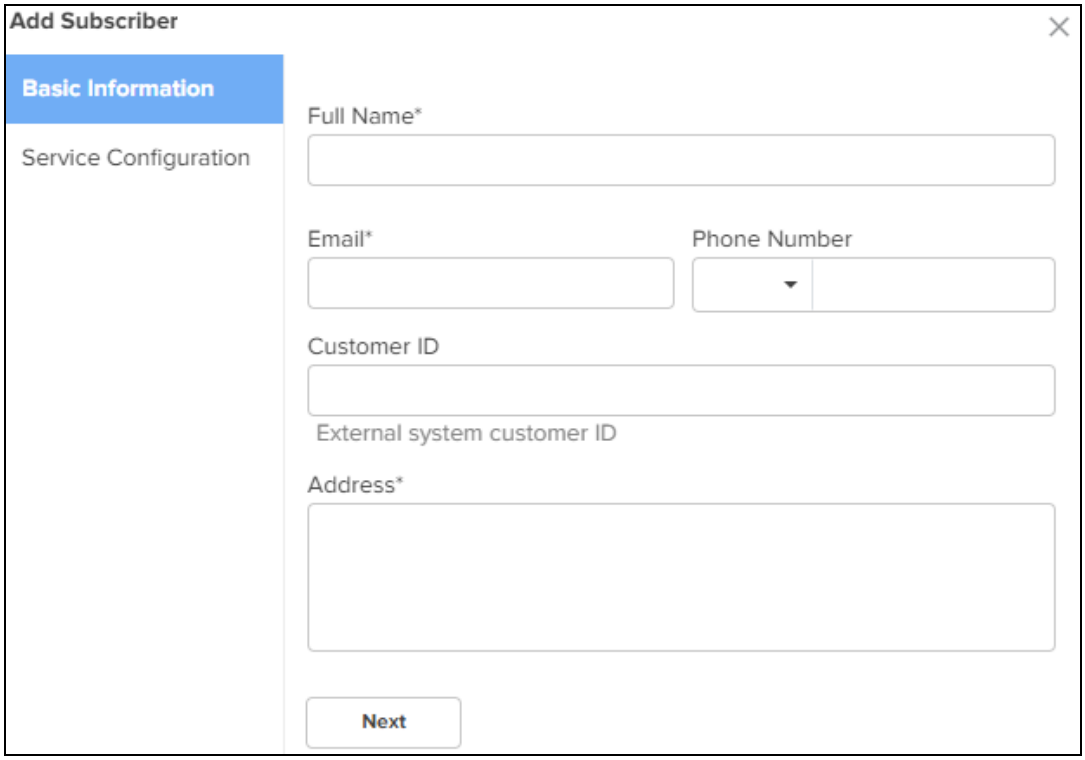
Adding a subscriber

5. Click the **Subscribers** tab on the **Managed Subscribers** page.



6. Click **Add New**.

The **Add Subscriber** window appears.



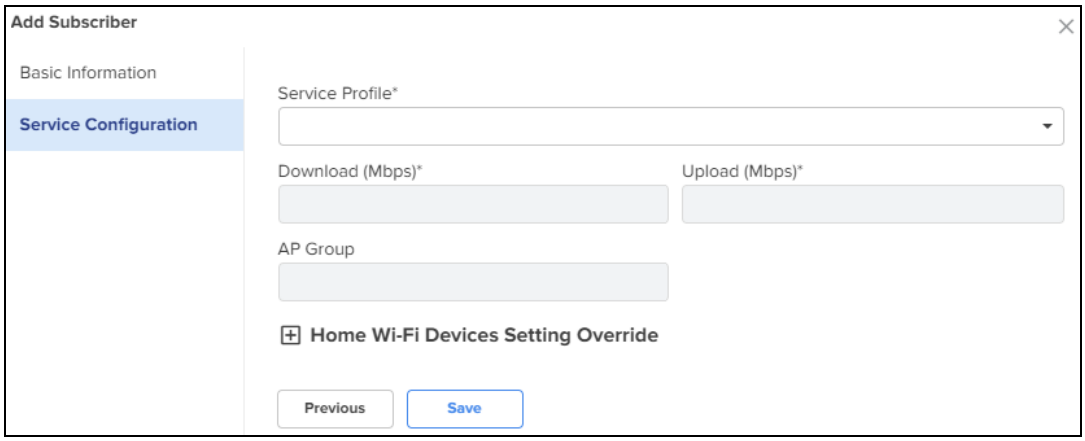
7. In the **Add Subscriber** window, configure the details of the subscriber in the **Basic Information** section, as described in Table 96.

Table 96: Subscriber > Basic tab parameters

Parameter	Description
Full Name	Name of the subscriber.
Email ID	Email address of the subscriber.
Phone Number	Phone number of the subscriber.
Customer ID	Unique ID for the subscriber.
Address	Address of the subscriber where the routers will be installed.

8. Click **Next**.

The **Service Configuration** tab is displayed.

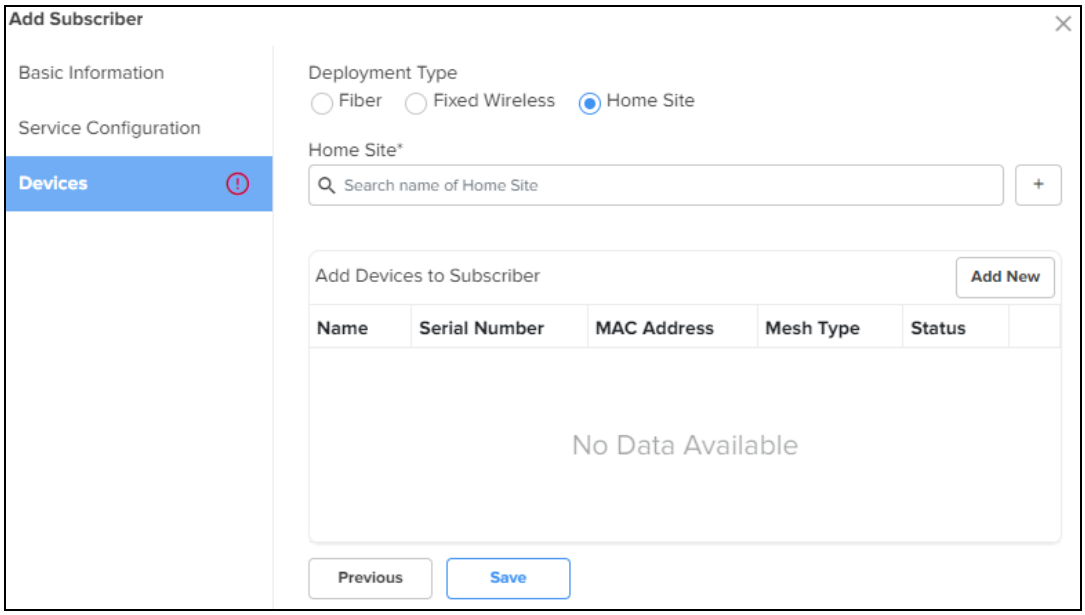


9. Select the subscriber service profile to be associated with this subscriber from the **Service Profile** drop-down list.
10. Click **Save**.

    A new tab, **Devices** appears, where you can link (or claim) the Home Mesh Router to the subscriber. See Claiming the Home Mesh Router.

    The cnMaestro Subscriber application invitation email is sent to the subscriber with the link to join the account.

    After the email is sent, you must follow the steps, as described in Logging in to the cnMaestro Subscriber application, to accept the invitation and join the account to manage the routers in the cnMaestro Subscriber application.
11. Click **Devices**.



12. Select one of the following options in the **Deployment Type** field:

    - **Fiber**—Select the Optical Network Unit (ONU) device that you want to associate with the subscriber's router by searching in the **ONU** search box.

- **Fixed Wireless**—Select the Subscriber Module (SM) device that you want to associate with the subscriber's router by searching in the **SM** search box.
- **Home Site**—Select the home site that you want to associate with the subscriber's router by searching in the **Home Site** search box. To add a home site, see Adding a home site.

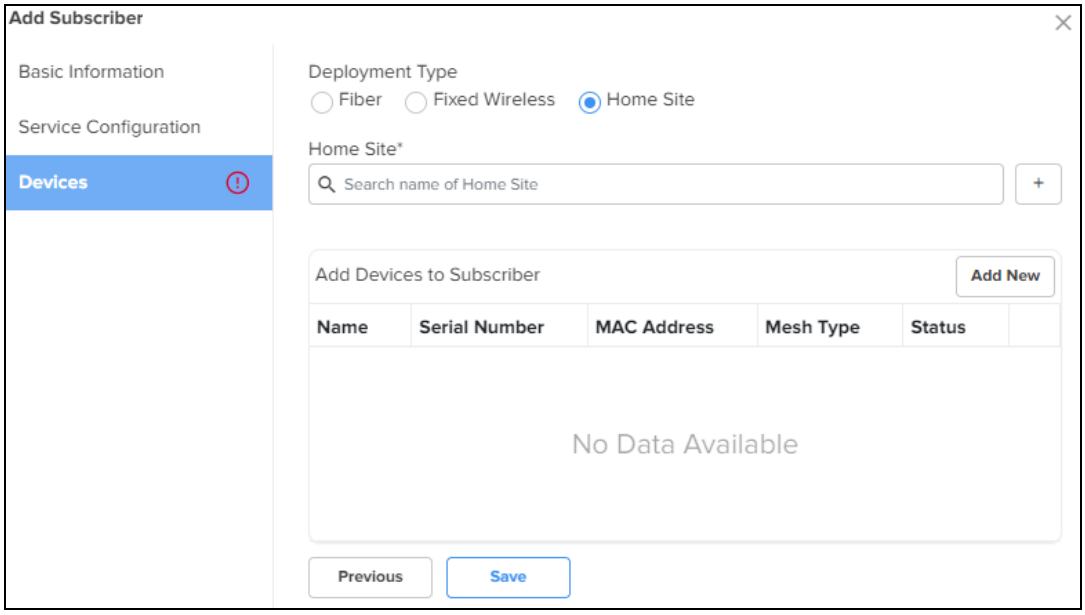
13. Before linking the Home Mesh Router to the subscriber, click **Save**.

Claiming the Home Mesh Router

After adding a subscriber profile and a subscriber, you must now associate the Home Mesh Router to the subscriber by claiming the router in cnMaestro.

To claim the router, complete the following steps:

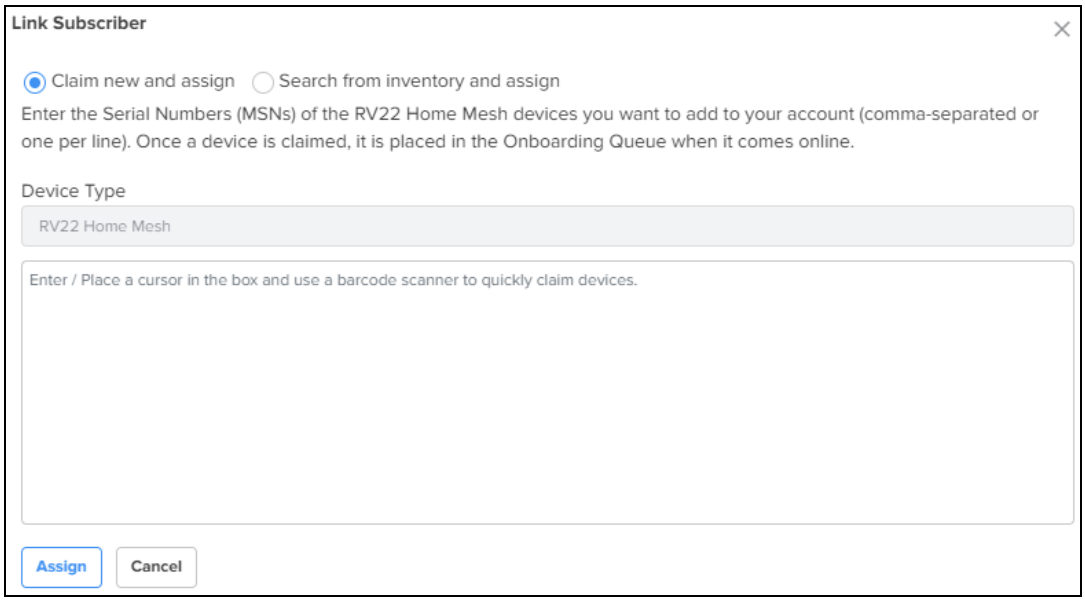
1. Navigate to the **Manage Service Providers** > **Managed Subscribers** > **Subscribers** tab.
2. In the list of subscribers, select the subscriber name for which you want to associate the Home Mesh Router.
3. Click the **Devices** tab.
4. In the **Add Devices to Subscriber** section, click **Add New**.



The **Link Subscriber** window appears.

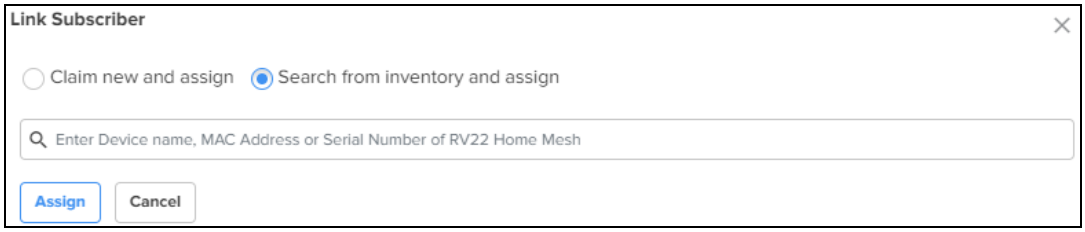
5. In the **Link Subscriber** window, link the Home Mesh Router to the subscriber by using any of the following methods:
   - To claim a new router that is not onboarded to cnMaestro, select the **Claim new and assign** option and enter the serial number of the device to be claimed.

     You can claim multiple routers by adding multiple serial numbers separated by commas.



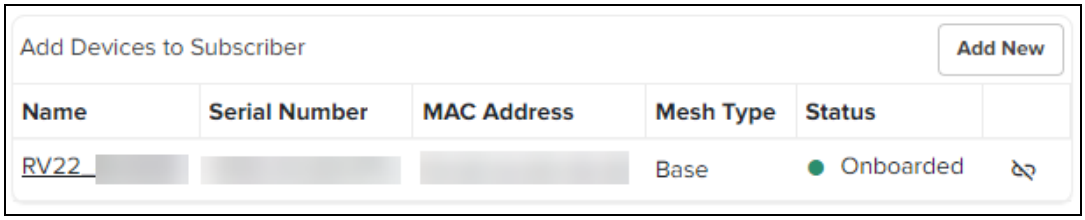
- To claim a router that is already onboarded to cnMaestro, select the **Search for inventory and assign** option.

  Enter the details of the router you want to claim.



6. Click **Assign**.

   The assigned router appears in the **Add Devices to Subscriber** section.



	Note Click the unlink ( ) icon to unlink the router from the subscriber.

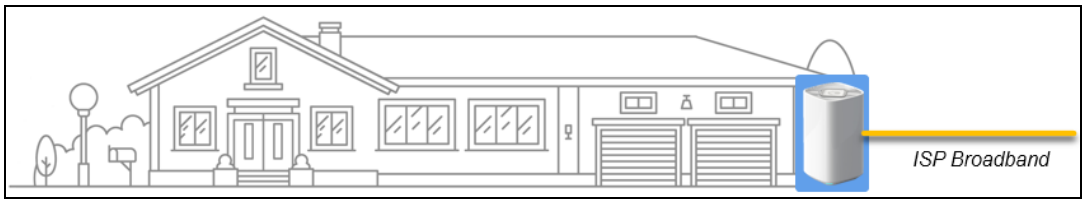
Setting up the Home Mesh Router

Home Mesh Routers can be deployed in one of the following modes:

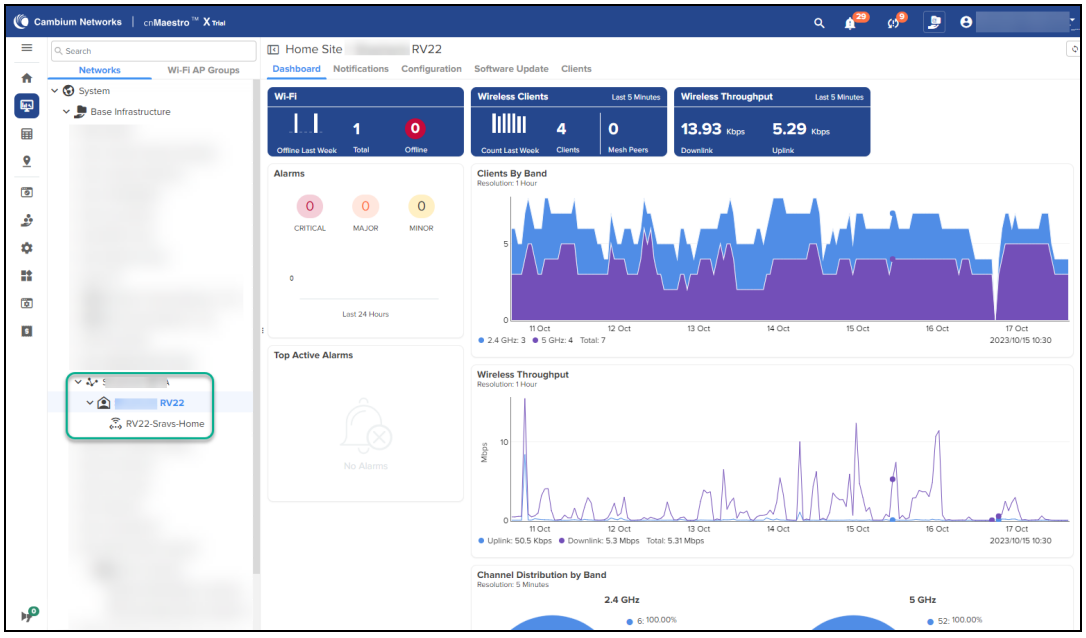
- Setting up the Home Mesh Router—Standalone mode
- Setting up the Home Mesh Router—Wireless Mesh Mode
- Setting up the Home Mesh Router—Wired Mesh Mode

Setting up the Home Mesh Router—Standalone mode

In standalone mode of deployment, there is only one Home Mesh Router deployed. A sample scenario is shown in the following figure:



A sample cnMaestro dashboard for the standalone mode of deployment is shown in the following figure:



Setting up the Home Mesh Router—Wireless Mesh Mode

To configure a wireless mesh, onboard the routers to a site—Claim all the routers, which you want to be part of the mesh, on cnMaestro in the subscriber workflow. See Claiming the Home Mesh Router. Connect the mesh base router to the internet and wirelessly connect the node routers. The AP group mapped to the subscriber is applied to all the routers to sync the configuration.

Following are some of the wireless mesh configuration scenarios and the corresponding dashboards and hierarchy in cnMaestro:

- Wireless mesh: 1-1 deployment
- Wireless mesh: 1-1-1 deployment
- Wireless mesh: 1-2 deployment
- Wireless and wired mixed mesh 1-2 deployment

Wireless mesh: 1-1 deployment

In this deployment, the base router is connected to one node router, thereby creating a wireless 1-1 mesh deployment.

Figure 354 Wireless mesh: 1-1 deployment

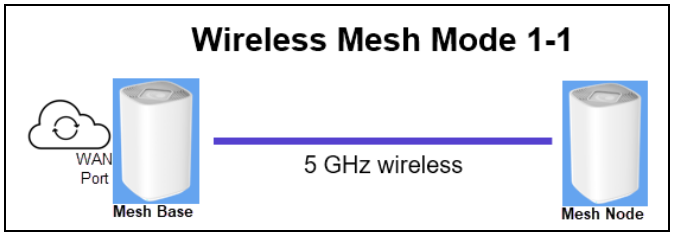


Figure 355 displays a sample cnMaestro dashboard for the wireless mesh 1-1 deployment.

Figure 355 Sample dashboard for wireless mesh: 1-1 deployment

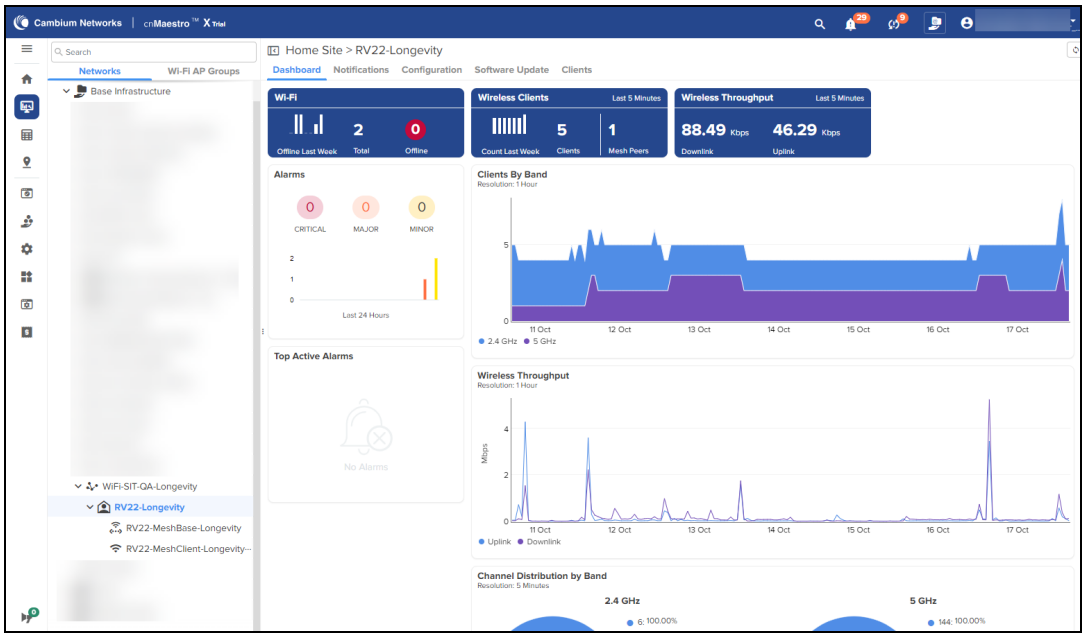
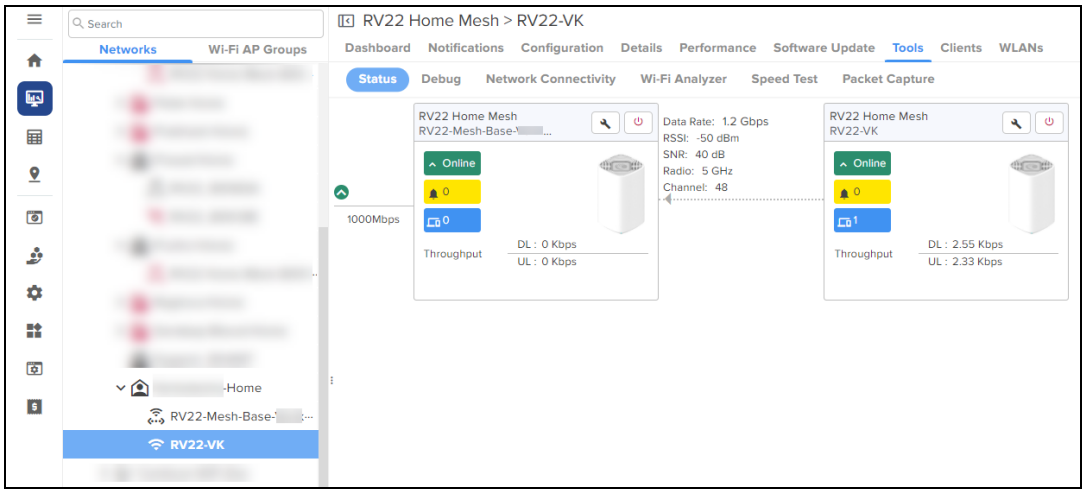


Figure 356 displays a sample cnMaestro status page for the wireless mesh 1-1 deployment.

Figure 356 Sample status page for wireless mesh: 1-1 deployment



Wireless mesh: 1-1-1 deployment

In this deployment, the base router is connected wirelessly to only one of the node routers, which is inturn connected to another node router, thereby creating a wireless 1-1-1 mesh deployment.

Figure 357 Wireless mesh: 1-1-1 deployment

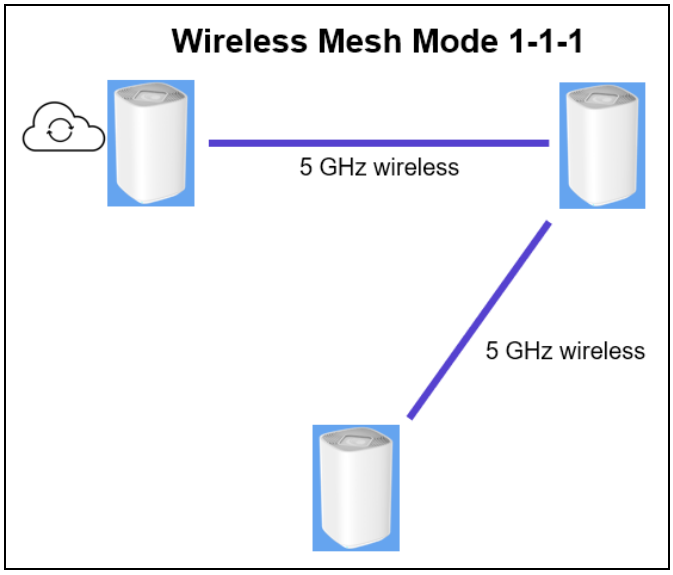


Figure 358 displays a sample cnMaestro dashboard for the wireless mesh 1-1-1 deployment.

Figure 358 Sample dashboard for wireless mesh: 1-1-1 deployment

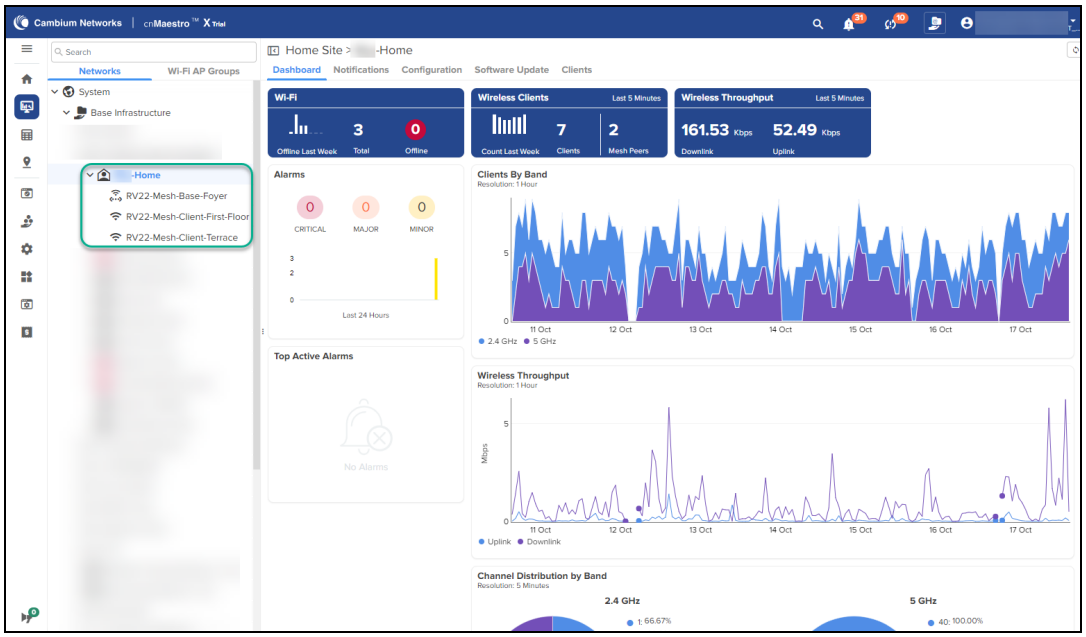
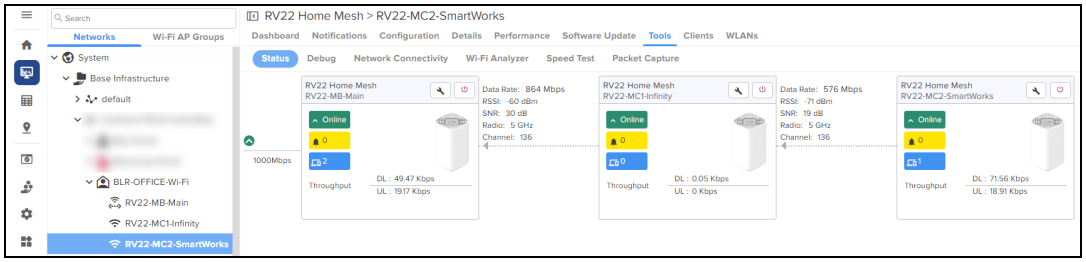


Figure 359 displays a sample cnMaestro status page for the wireless mesh 1-1-1 deployment.

Figure 359 Sample status page for wireless mesh: 1-1-1 deployment



Wireless mesh: 1-2 deployment

In this deployment, the base router is connected to two node routers simultaneously, thereby creating a wireless 1-2 mesh deployment.

Figure 360 Wireless mesh: 1-2 deployment

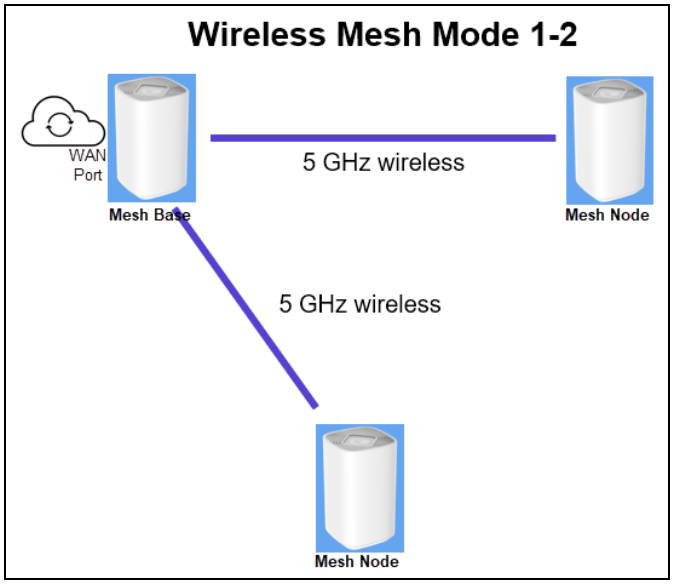


Figure 361 displays a sample cnMaestro dashboard for the wireless mesh 1-2 deployment.

Figure 361 Sample dashboard for wireless mesh: 1-2 deployment

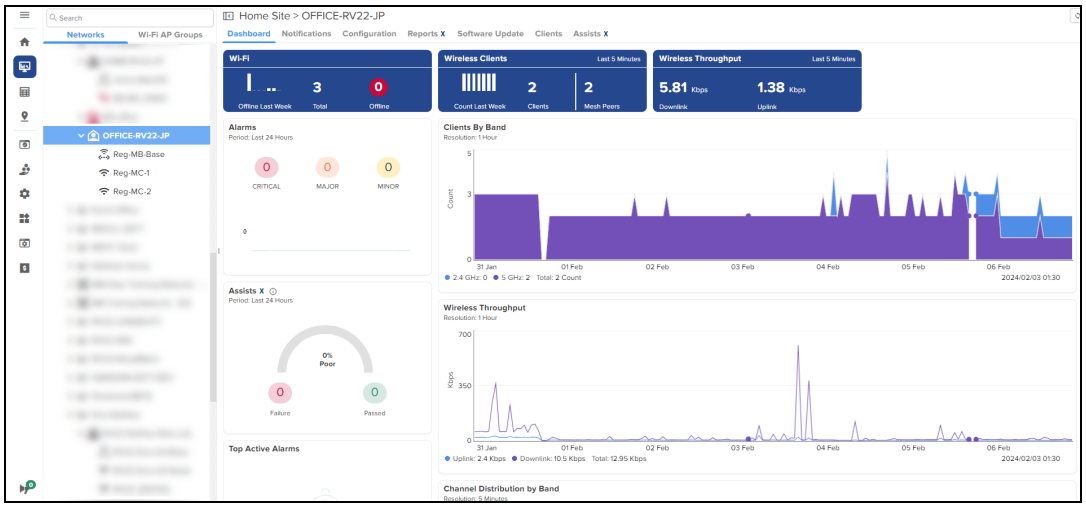
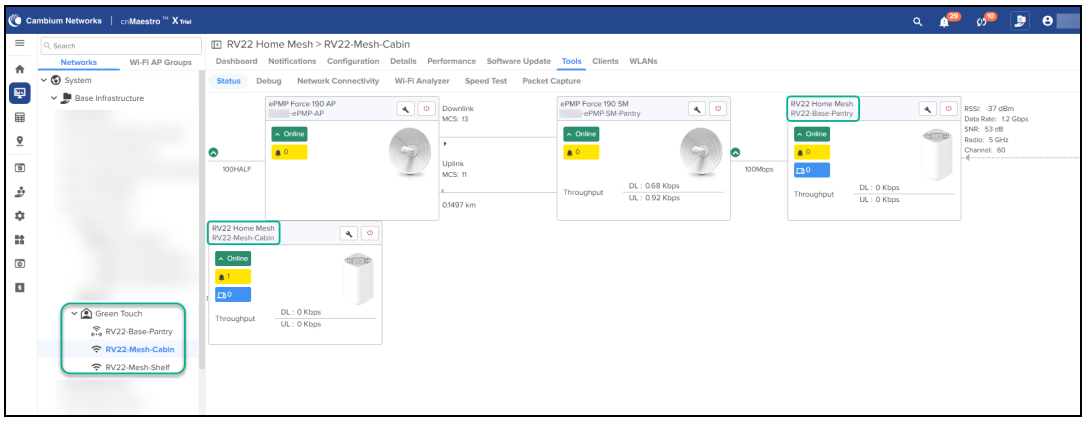


Figure 362 and Figure 363 display sample status pages for the node routers in a wireless mesh 1-2 deployment.

In the following status samples, the **RV22-Base-Pantry** router is connected to both **RV22-Mesh-Shelf** and **RV22-Mesh-Cabin** routers, forming a 1-2 multi-mesh topology.

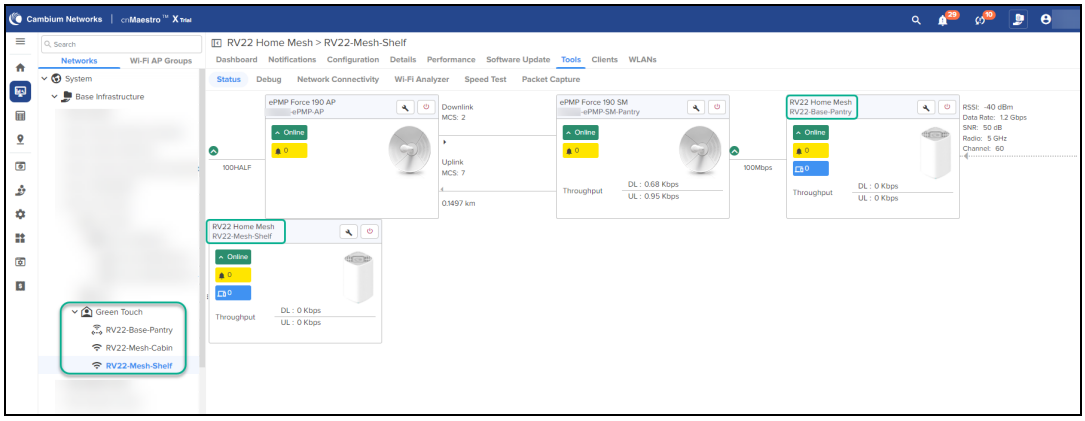
- Network toplogy for the **RV22-Mesh-Cabin** router

Figure 362 Sample status page for RV22-Mesh-Cabin node router in a wireless mesh: 1-2 deployment



- Network toplogy for the **RV22-Mesh-Shelf** router

Figure 363 Sample status page for RV22-Mesh-Shelf node router in a wireless mesh: 1-2 deployment



Wireless and wired mixed mesh 1-2 deployment

In this deployment, the base router is connected to one node router wirelessly and simultaneously to another by a wired connection, thereby creating a mixed 1-2 mesh deployment.

Figure 364 Wireless and wired mixed mesh: 1-2 deployment

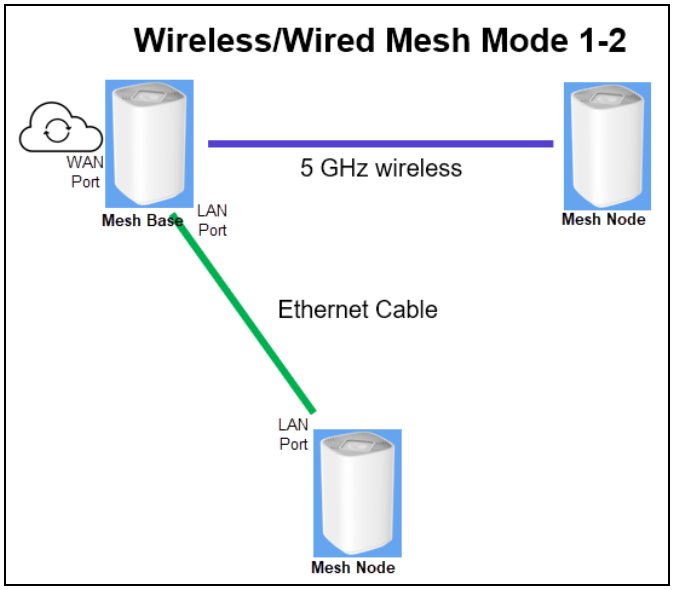
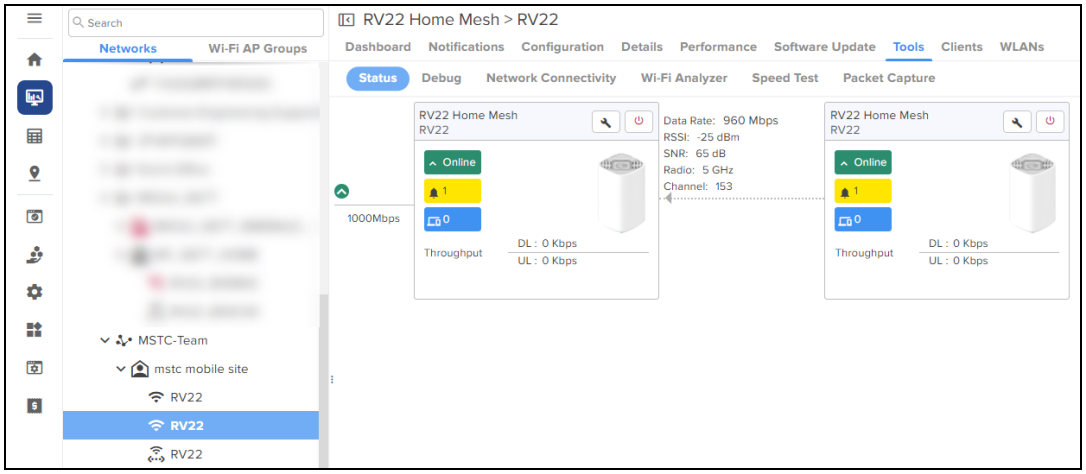


Figure 362 and Figure 363 display sample status pages for the node routers in a mixed mesh 1-2 deployment.

In the following status samples, one RV22 base router is connected to one RV22 node router wirelessly and simultaneously to another RV22 node router by a wired connection.

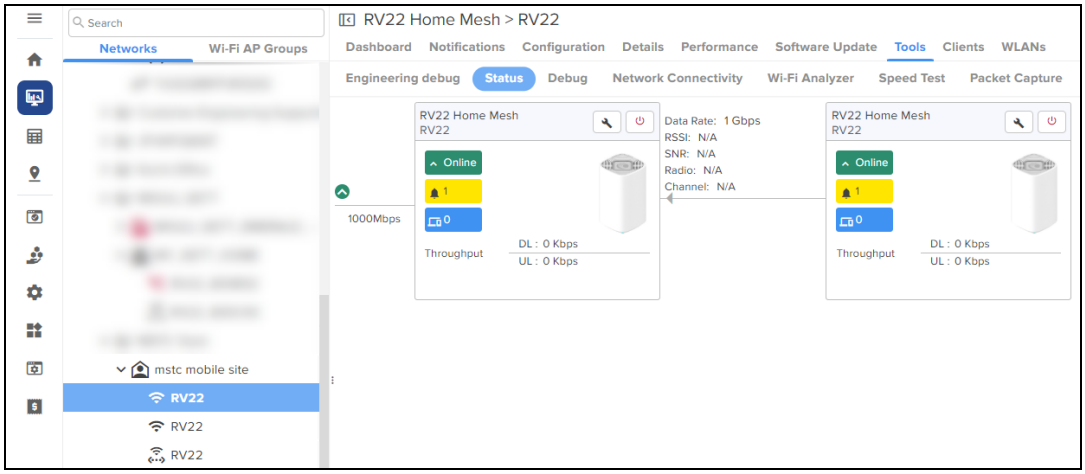
- Network toplogy for the wireless RV22 node router

  Figure 365 Sample status page for the wireless RV22 node router in a mixed mesh: 1-2 deployment



- Network toplogy for the wired RV22 node router

Figure 366 Sample status page for the wired RV22 node router in a mixed mesh: 1-2 deployment



Setting up the Home Mesh Router—Wired Mesh Mode

To configure a wired mesh, onboard the routers to a site—Claim the routers, which you want to be part of the mesh, on cnMaestro in the subscriber workflow. See Claiming the Home Mesh Router. Connect the mesh base router to the internet and connect the node routers to the base router using Ethernet cables. The AP group mapped to the subscriber is applied to all the routers to sync the configuration.

No configuration changes are required for RV22 routers to work in both wired and wireless mesh modes. Use any LAN port on the mesh base and any LAN port on the mesh node routers to establish a wired mesh connection. When a mesh node router detects an RV22 neighbor on its LAN port, it automatically establishes a wired mesh link using the LAN ports.

	Note You must not use the WAN port on the mesh node router to establish a wired mesh.

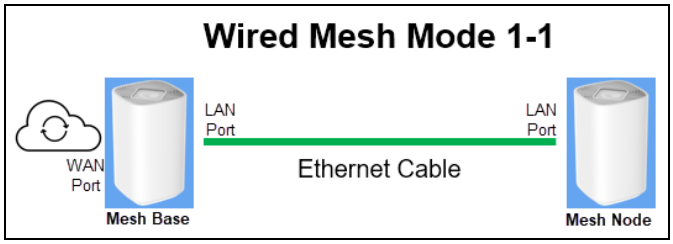
Following are some of the wired mesh configurations supported:

- Wired mesh: 1-1 deployment
- Wired mesh: 1-1-1 deployment
- Wired mesh: 1-2 deployment

Wired mesh: 1-1 deployment

In this deployment, the base router is connected to one node router using an Ethernet cable (between any LAN ports on both routers), thereby creating a wired 1-1 mesh deployment.

Figure 367 Wired mesh: 1-1 deployment



Wired mesh: 1-1-1 deployment

In this deployment, the base router is connected to only one of the node routers, which is inturn connected to another node router, by a wired connection (between any LAN ports on the routers), thereby creating a wired 1-1-1 mesh deployment.

Figure 368 Wired mesh: 1-1-1 deployment

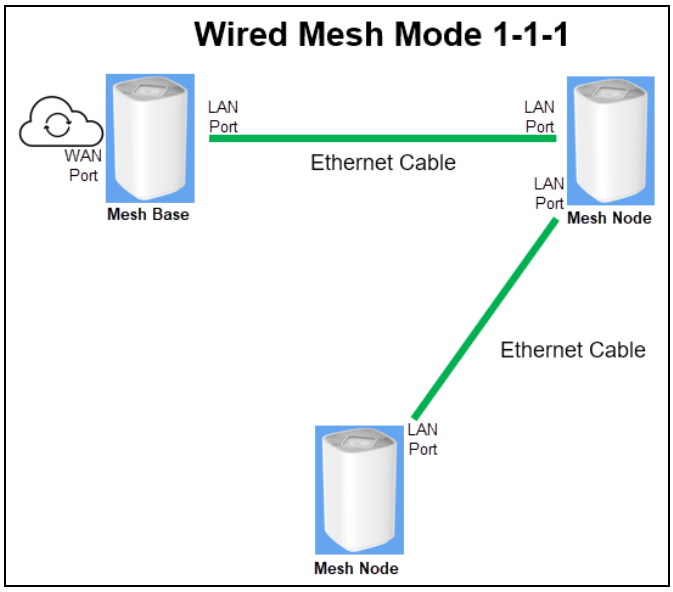
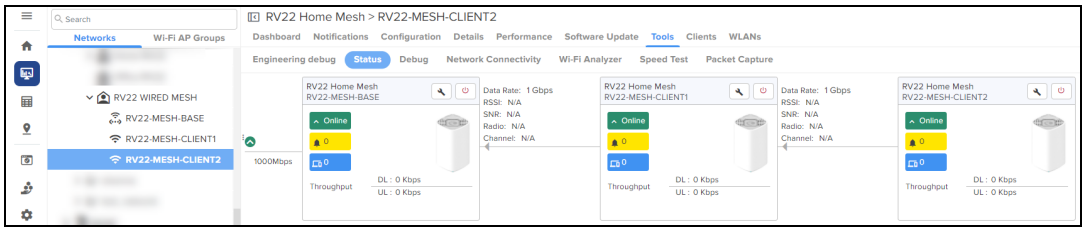


Figure 369 displays a sample cnMaestro status page for the wired mesh 1-1-1 deployment.

Figure 369 Sample status page for wired mesh: 1-1-1 deployment



Wired mesh: 1-2 deployment

In this deployment, the base router is connected to two node routers simultaneously by a wired connection, thereby creating a wired 1-2 mesh deployment.

Figure 370 Wired mesh: 1-2 deployment

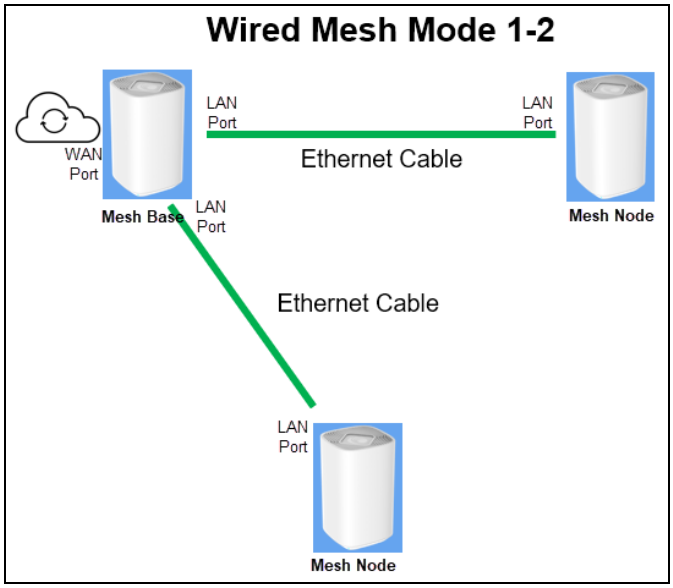
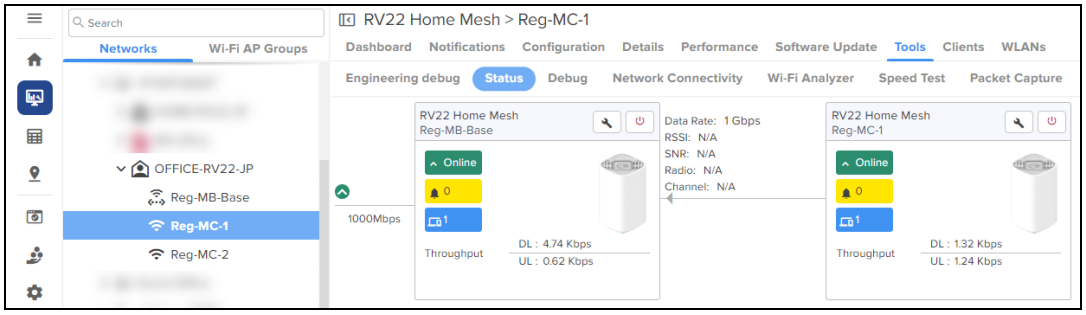


Figure 371 and Figure 372 display sample status pages for the node routers in a wired mesh 1-2 deployment.

In the following status samples, the **Reg-MB-Base** router is connected to both **Reg-MC-1** and **Reg-MC-2** routers using Ethernet cables, forming a wired 1-2 multi-mesh topology.

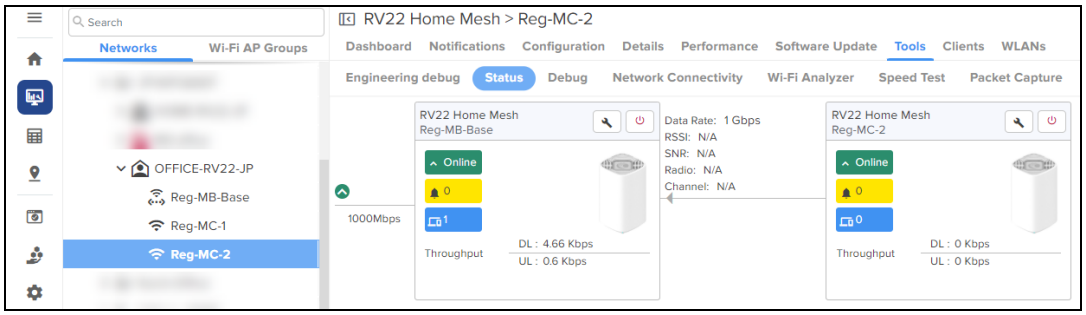
- Network toplogy for the **Reg-MC-1** router

Figure 371 Sample status page for Reg-MC-1 node router in a wired mesh: 1-2 deployment



- Network toplogy for the **Reg-MC-2** router

Figure 372 Sample status page for Reg-MC-2 node router in a wired mesh: 1-2 deployment



Viewing router system information and network traffic status

When the customer configures the Home Mesh Router and connects to the internet, you can check the connection of the router in cnMaestro. You can also check the details of the clients that are connected.

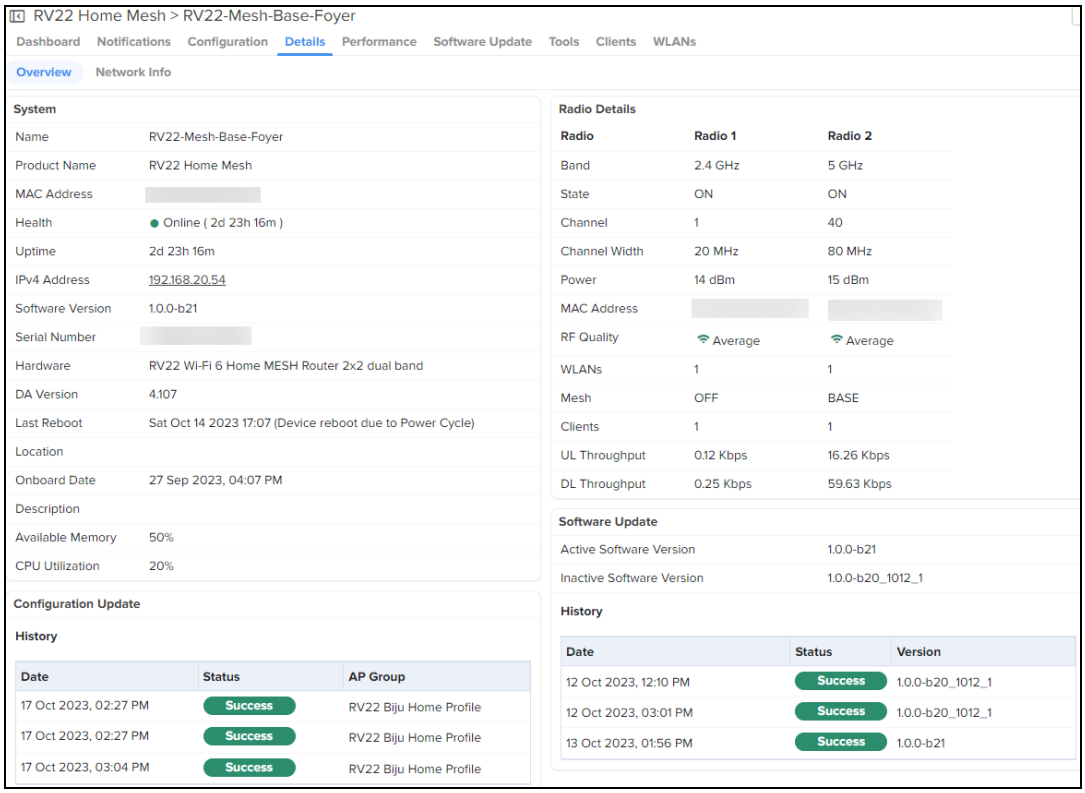
To view router system information and the connection status, navigate to **Monitor and Manage** > *<Home-Mesh-Router-name>* > **Details** tab.

The **Details** page displays information in the following tabs:

- **Overview**

  This page displays information in the following sections:

  - **System**—Displays information, such as router name, MAC address, health of the router (online, offline), software version, and location.
  - **Radio**—Displays radio details, such as the running bands, RF quality, count of clients connected to each radio, and the average throughput.
  - **Configuration Update**—Displays the history of configuration updates to the router.
  - **Software Update**—Displays the currently running software version and a history of software updates that were performed and the status.

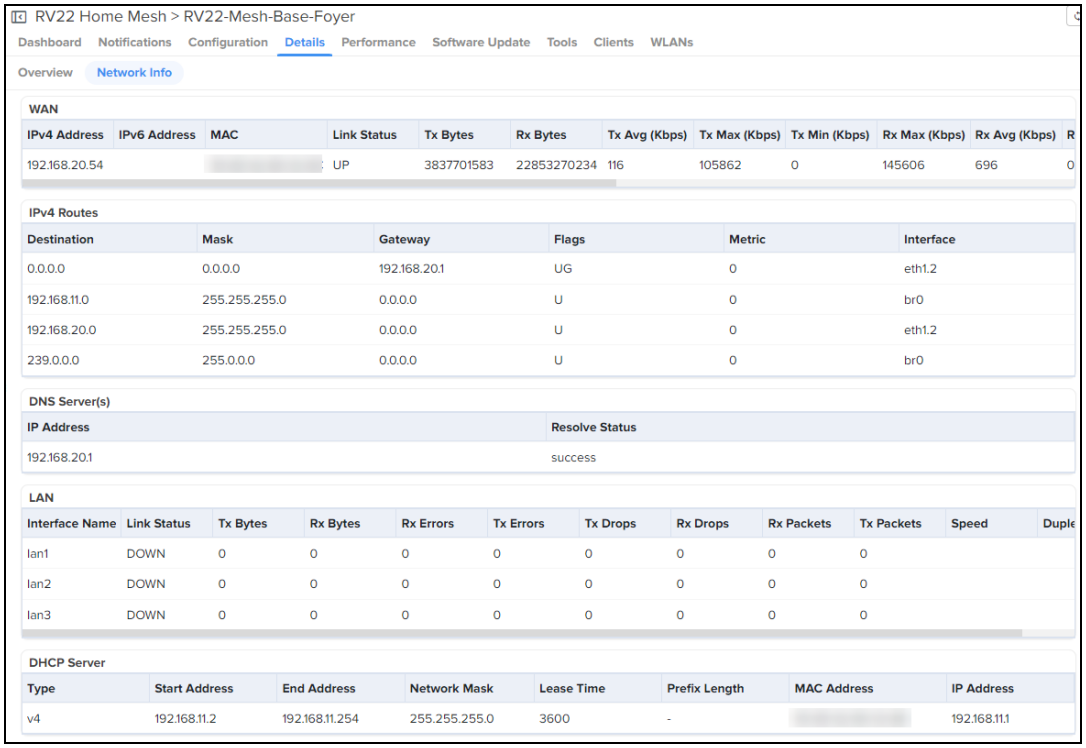


- **Network Info**

  This page displays information in the following sections:

  - **WAN**—Displays collective statistics about total number of transmitted and received data packets, data bytes, packets dropped, maximum and average speeds
  - **IPv4 Routes**—Displays the IPv4 routes configured for the router.
  - **DNS Server(s)**—Displays the details of the DNS servers.
  - **LAN**—Displays details of the LAN interfaces, their status, total number of transmitted and received data packets and size (in bytes), packet errors and drops.

- **DHCP Server**—Displays details of the DHCP servers, start and end IP address in the range used for allocation, and the lease time.



Viewing, editing, and blocking connected clients

cnMaestro allows you to view details of clients (both wired and wireless) connected to the router and edit the name of clients. You can also block certain clients that you do not want to be connected to your wireless networks.

This topic contains the following sections:

- Viewing connected clients
- Editing client host name
- Blocking clients

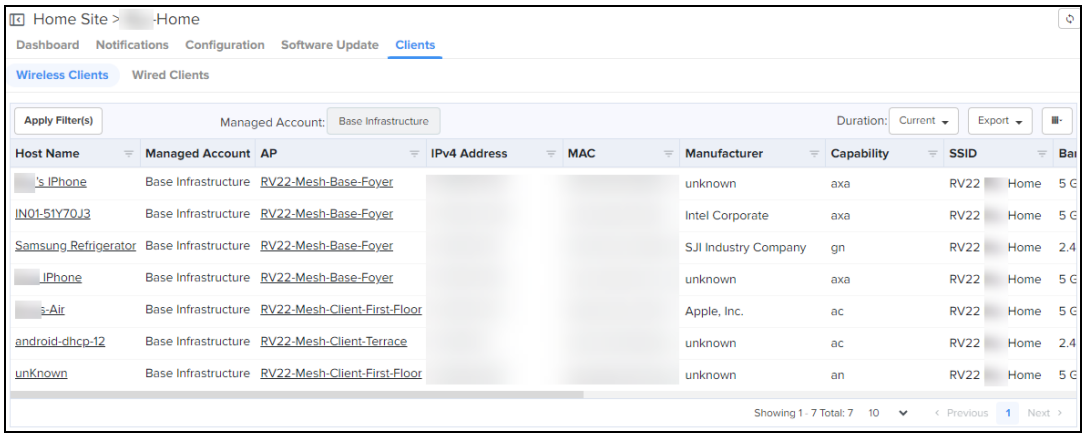
Viewing connected clients

To view the list of connected clients, both wired and wireless, navigate to **Monitor and Manage** > *<Home-Mesh-Router-name>* > **Clients** tab.

The **Details** page displays information in the following tabs:

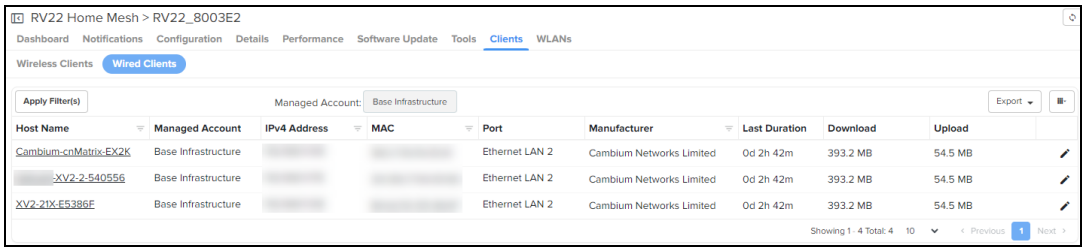
- **Wireless Clients**

  This page displays information about the wireless clients connected to the router, such as the host name, MAC address, IPv4 addess assigned, the router it is connected to, and the status of connection with the router (online, offline).



- **Wired Clients**

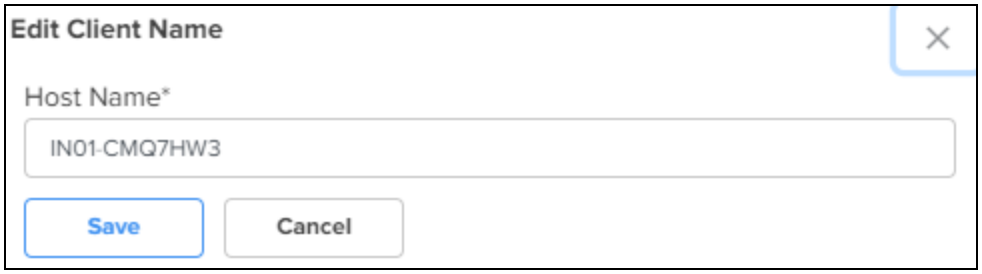
  This page displays information about the wired clients connected to the router, such as the host name, MAC address, IPv4 addess assigned, port number to which it is connected, the manufacturer of device connected, last connected duration, and the download and upload data size (in MB).



Editing a client's host name

To edit the host name of a connected client, click the edit client name ( ) icon corresponding to the client.

Enter the name in the **Host Name** field and click **Save**.



Blocking clients

To block a connected client, click the block ( ) icon corresponding to the client.

Monitoring and troubleshooting the Home Mesh Router

You can monitor and perform troubleshooting tasks on the Home Mesh Router using cnMaestro. This topic covers the following sections

- Monitoring the Home Mesh Router
- Troubleshooting the Home Mesh Router

- Upgrading the Home Mesh Router firmware

Monitoring the Home Mesh Router

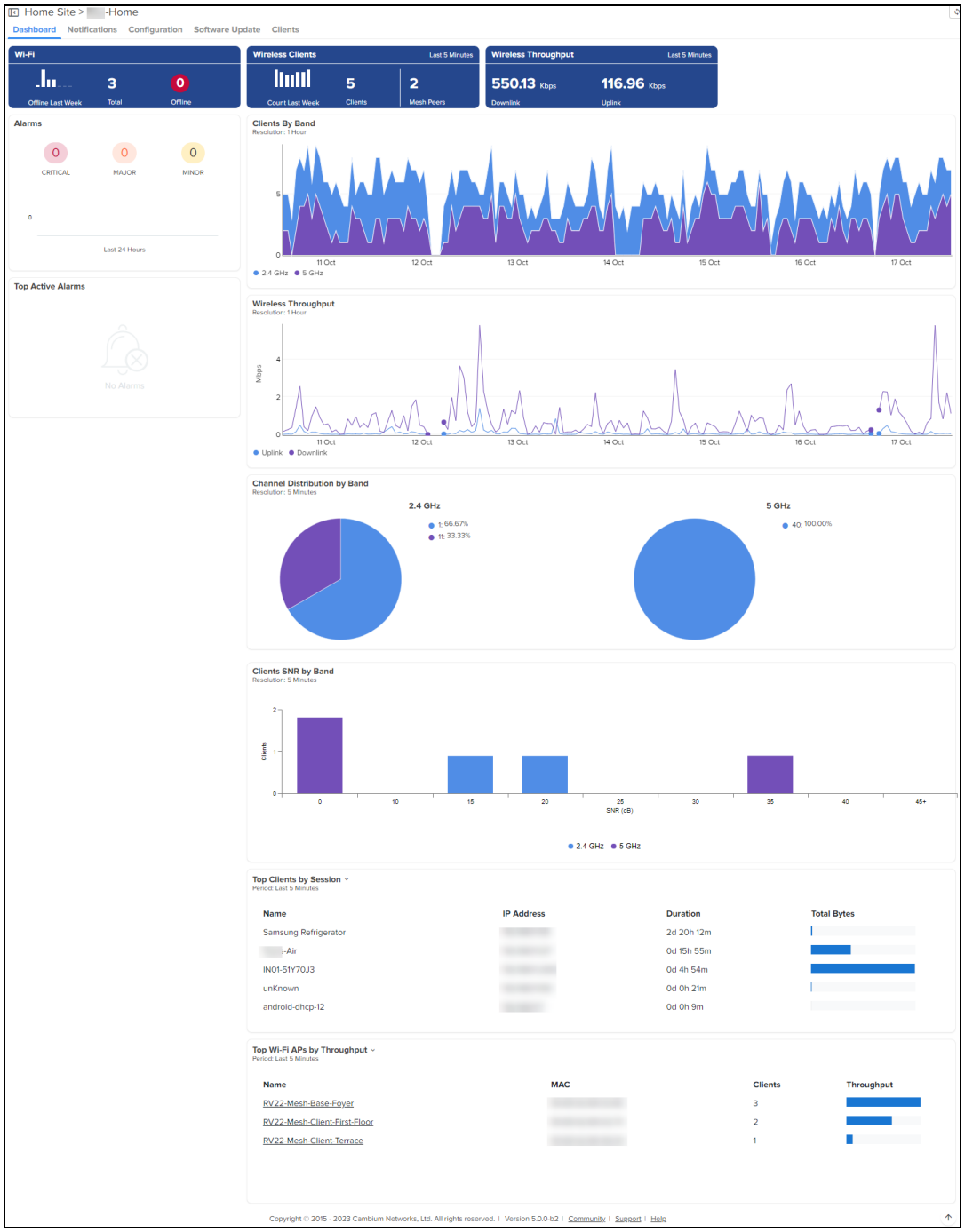
When the device is onboarded to cnMaestro, based on the deploymnet type, the router is displayed under the site that it is configured.

cUsing the following pages in cnMaestro, monitor and view details of the router and the deployment.

- Home Site Dashboard
- Notifications
- Software Update
- Performance

Home Site Dashboard

To view the site dashboard, access the **Dashboard** page under **Monitor and Manage >** <Home-site-name> **> Dashboard.**



Notifications

The Notifications page displays current alarms, previous alarms, Wi-Fi-related events, and other device-related events.

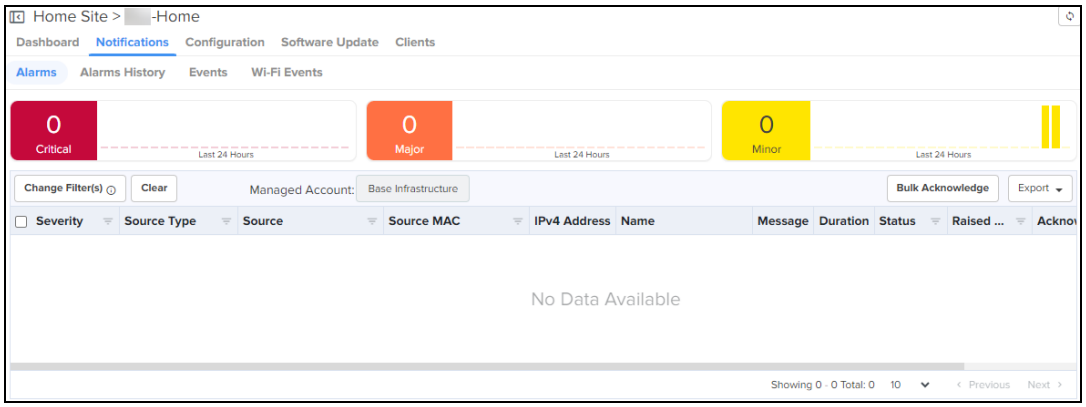
cnMaestro displays the following types of notifications:

- Alarms
- Alarms History
- Events
- Wi-Fi Events

Alarms

The Alarms page displays the number of critical, major, and minor events observed for the Home Mesh Router.You can also view the details of the events, such as severity level, name of the event, time and action taken.

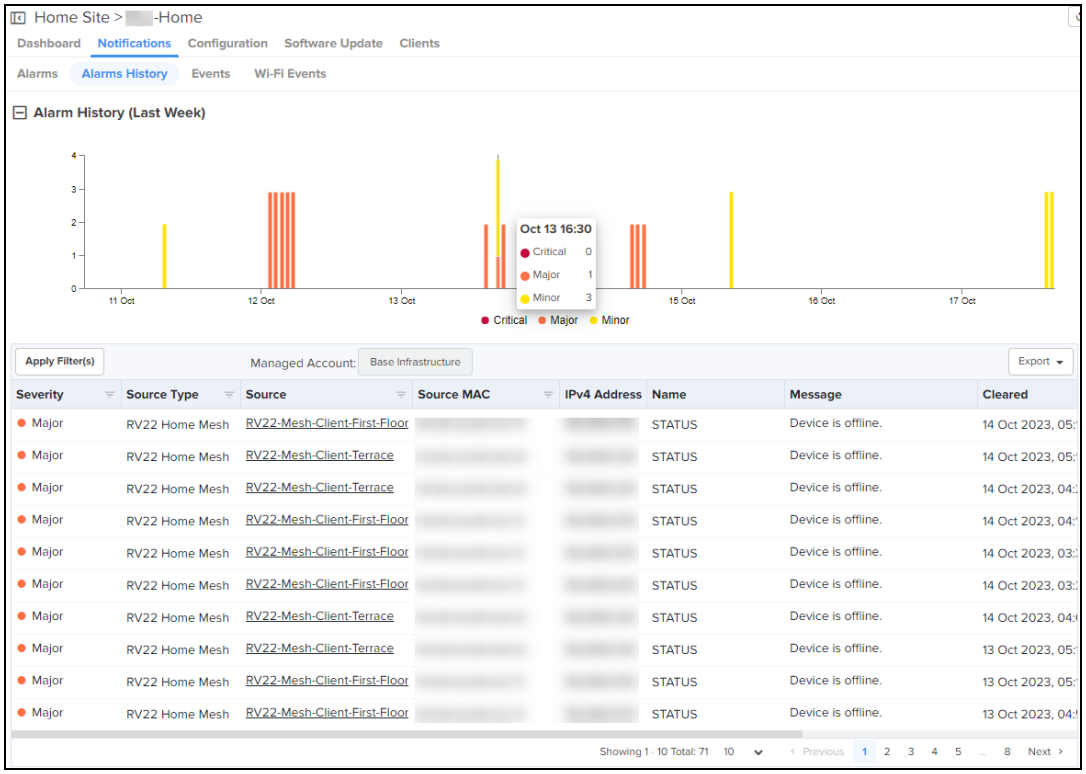
To view the alarms raised, access the **Alarms** page under **Monitor and Manage >** <Home-site-name> **> Notifications > Alarms.**



Alarms History

The Alarms History page displays the number of critical, major, and minor events observed in the previous week.

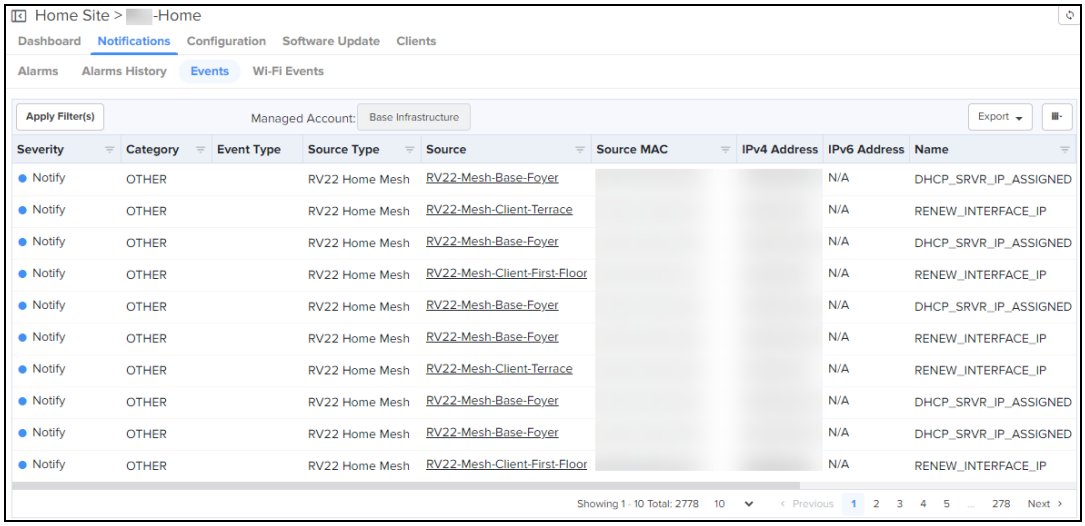
To view the alarms history displayed as a graphical representation, access the **Alarms History** page under **Monitor and Manage >** <Home-site-name> **> Notifications > Alarms History**.



Events

The Events page displays Home Mesh Router-related events, such as its status, if there was a bandwidth change, when the DHCP server IP was assigned to the connected clients.

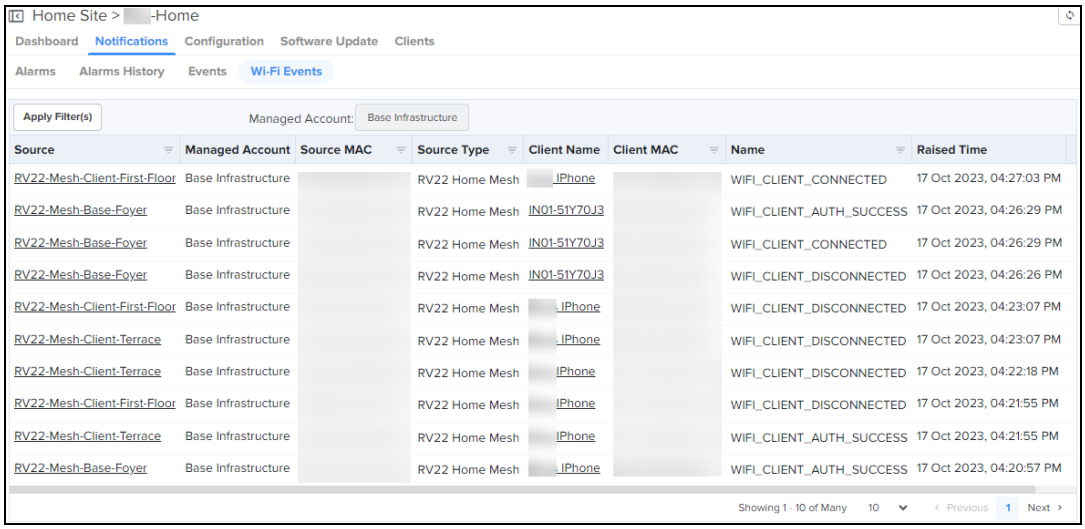
To view the events, access the **Events** page under **Monitor and Manage >** <Home-site-name> **> Notifications > Events**.



Wi-Fi Events

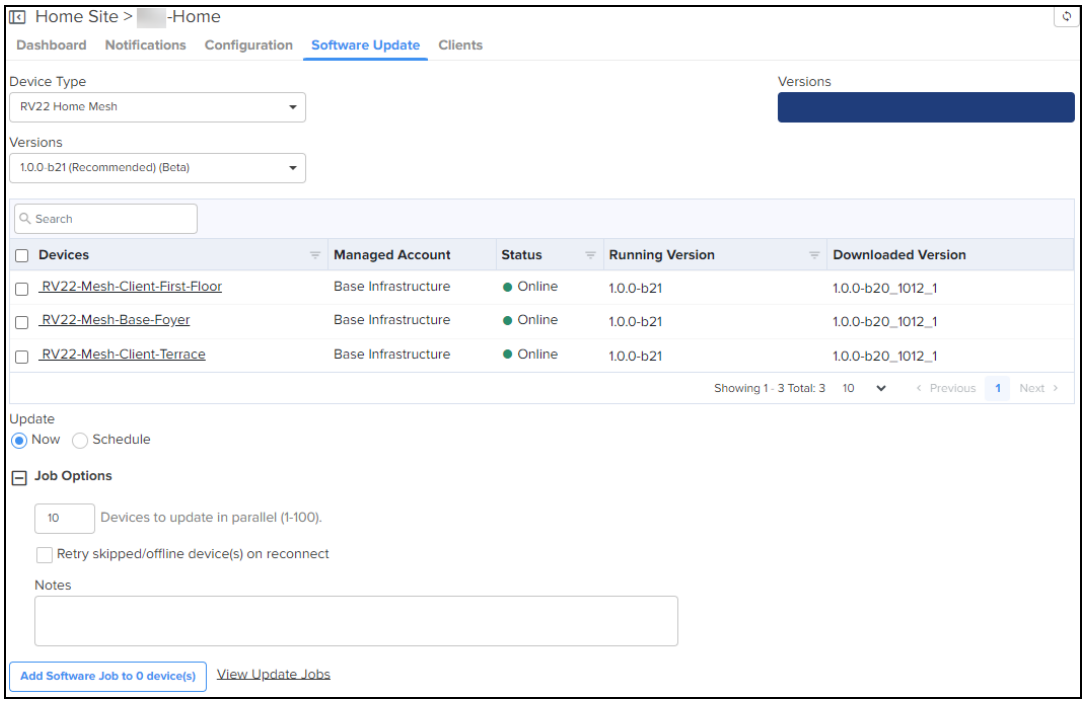
The Wi-Fi Events page displays client-related events, such as when the client connected to the network, when it was disconnected, and authentication events.

To view the Wi-Fi events, access the **Wi-Fi Events** page under **Monitor and Manage >** <Home-site-name> **> Notifications > Wi-Fi Events**.



Software Update

To upgrade the router firmware, go to the **Software Update** page. See Upgrading the Home Mesh Router firmware for more information.



Performance

To view the performace of the router, access the **Wi-Fi Events** page under **Monitor and Manage >** <Home-Mesh-Router-name> **> Performance**.

The page displays the following graphical information:

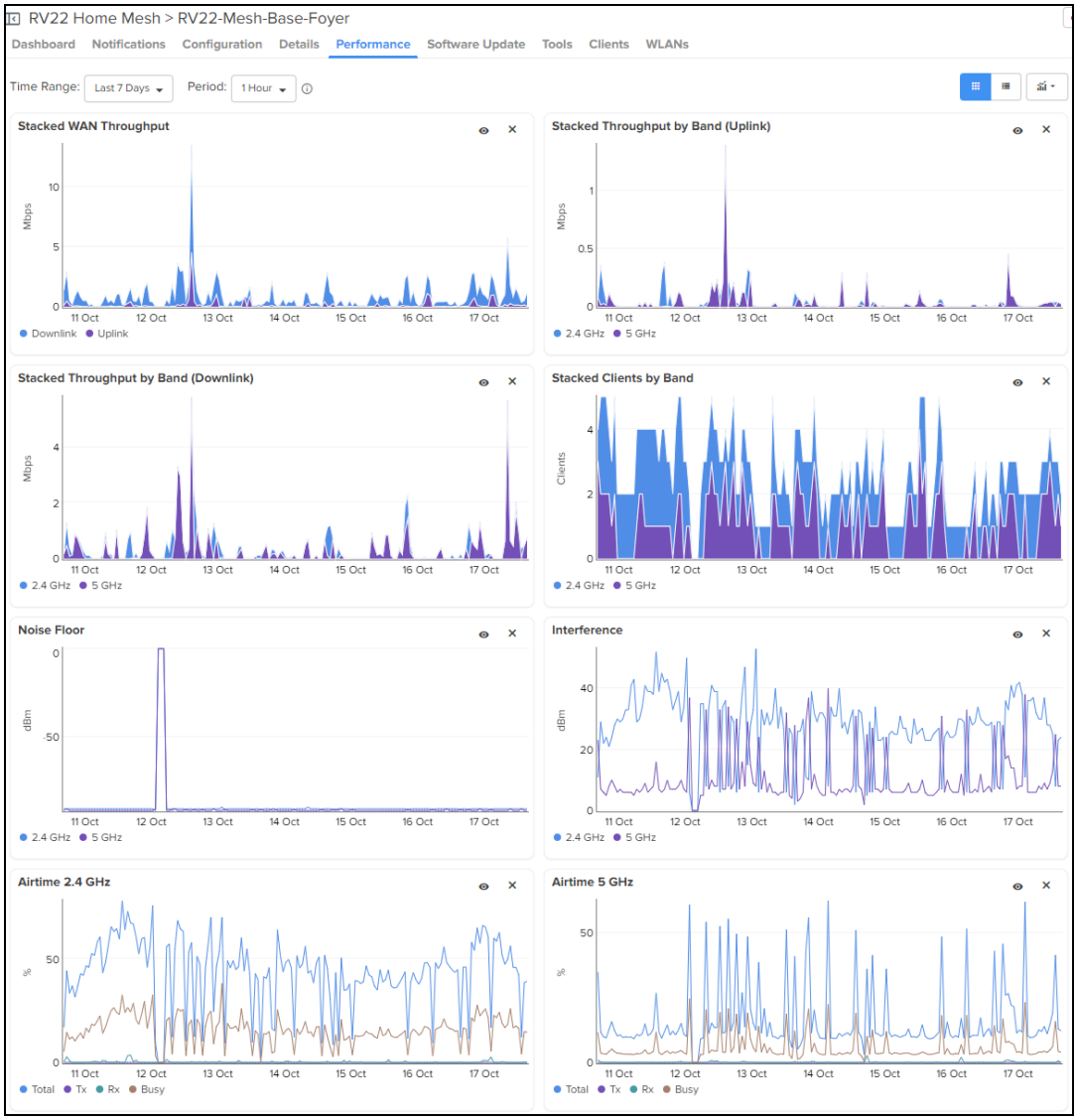
Table 97: Performance page graphs—Base and Node routers

Parameter	Description	Router (Base / Node / Both)
Stacked WAN Throughput	Hourly throughput for both downlink and uplink in the WAN interface for each band of the mesh base router.	Base only
Stacked Throughput by Band (Downlink)	Downlink speed in each band.	Both
Stacked Throughput by Band (Uplink)	Uplink speed in each band.	Both
Stacked Clients by Band	Count of number of clients connected in each band.	Both
Noise Floor	Amount of background noise (in dBm) or interference created by devices in the same frequency.	Both
Interference	Interefence (in dBm) caused by other wireless signals and devices interrupting the router's Wi-Fi signal.	Both

Parameter	Description	Router (Base / Node / Both)
Airtime 2.4 GHz	Capacity utilization (in %) of the 2.4 GHz band for effective transmission.	Both
Airtime 5 GHz	Capacity utilization (in %) of the 5 GHz band for effective transmission.	Both
Available Memory	Amount of router memory (in %) available for use.	Both
CPU	Router CPU utilization in percentage (%).	Both
SNR	Minimum, average, and maximum SNR values (in dB) for the mesh node router.	Node only
RSSI	Received Signal Strength Indicator (RSSI) value (in dBm) for the mesh node router.	Node only
Data Rate	Minimum, average, and maximum data rates (in Mbps or Gbps) provided by the mesh node router to the client devices.	Node only

Following are sample performance graphs for base and node routers:

- Performance of the base router in a mesh deployment



- Performance of the node router in a mesh deployment

Troubleshooting the Home Mesh Router

cnMaestro provides the following troubleshooting options for the router:

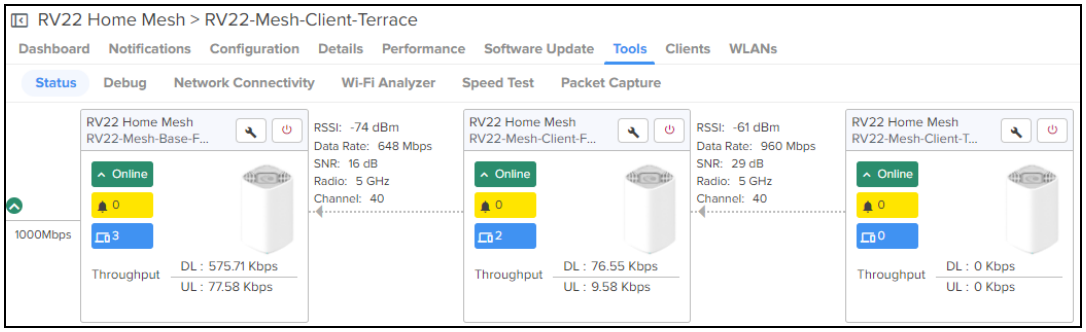
- Status
  - Downloading tech support file
- Debug

- Network Connectivity
- Wi-Fi Analyzer
- Speed Test
- Packet Capture

Status

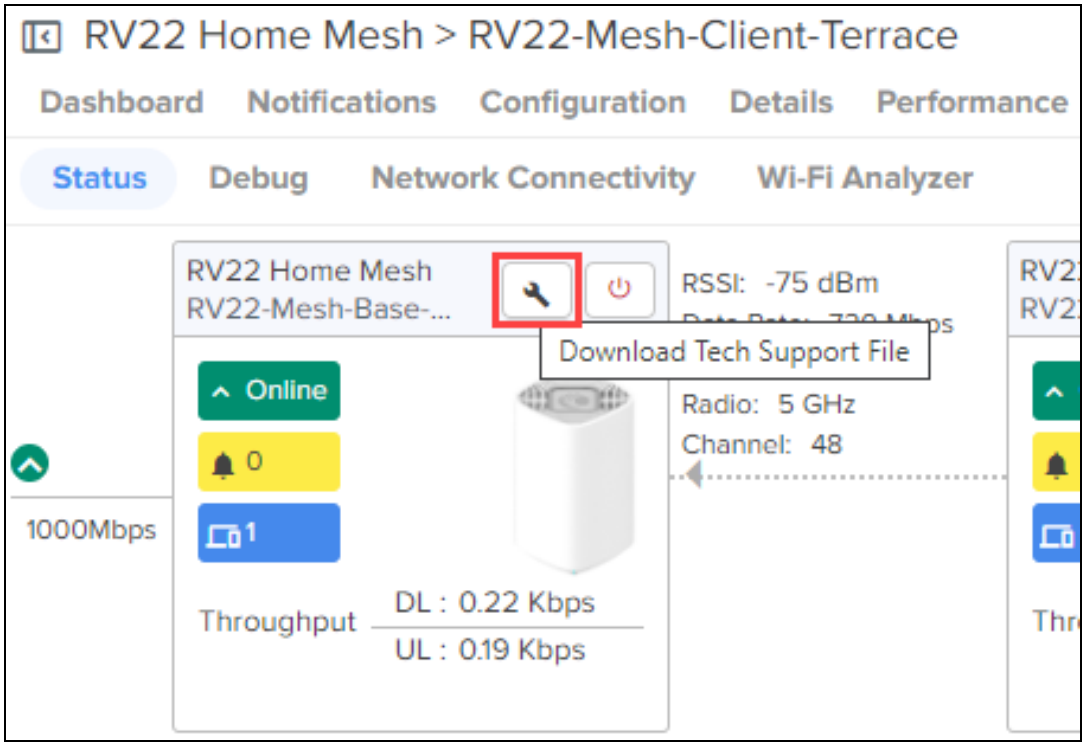
The Status page displays the status of link between the Home Mesh Router base and client devices.

To view the status of the link between the Home Mesh base and client devices, access the **Status** page under **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools.**



Downloading tech support file

To download the tech support file, click the Download Tech Support File ( ) icon on the **Status** page.



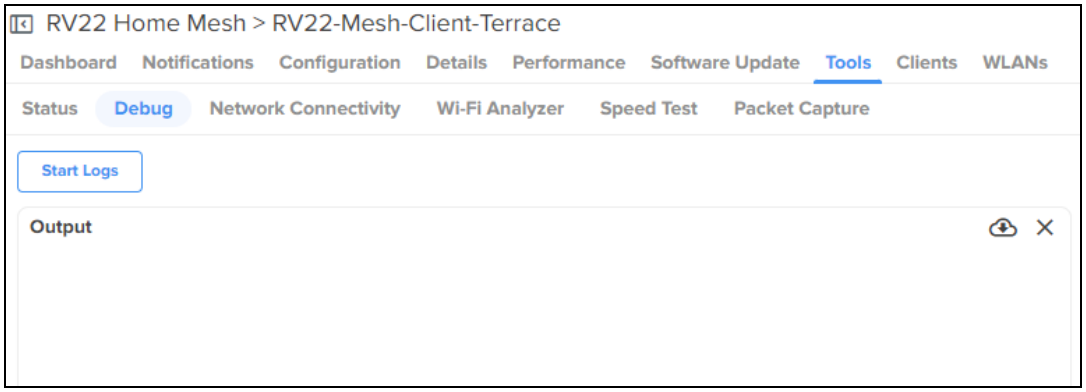
Debug

The Debug page displays log information of the Home Mesh Router. To view the debug information, complete the following steps:

1. Navigate to the **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools** > **Debug** tab.

2. Click **Start Logs**.

   The log information is displayed in the **Output** window.



Network Connectivity

The Network Connectivity page provides network connectivity information of the Home Mesh Routers.

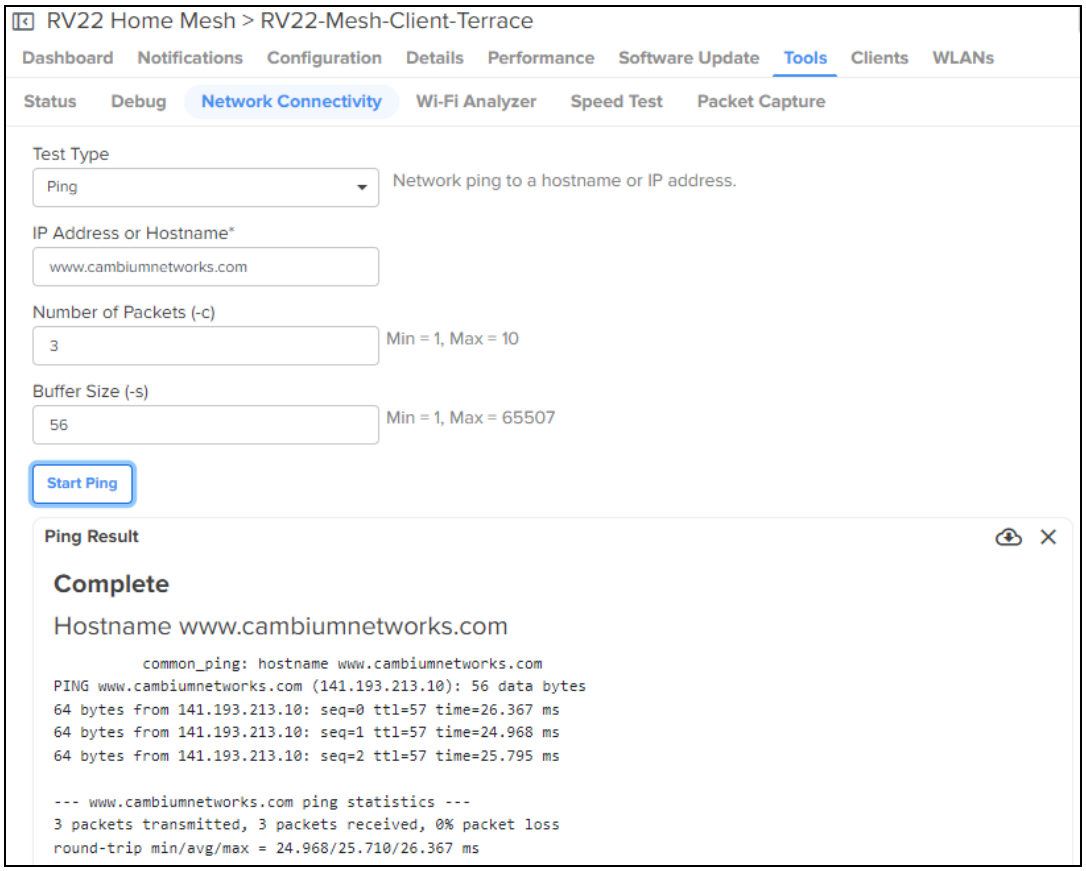
cnMaestro supports the following tests to provide connectivity information for the Home Mesh Routers:

- Ping
- DNS Lookup
- Traceroute

To test network connectivity of the router, complete the following steps:

1. Navigate to the **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools** > **Network Connectivity** tab.
2. Select the required test type from the **Test Type** drop-down list and configure the corresponding parameters required for the test.
3. Click **Start Test**.

   cnMaestro initiates the test and displays the result in the **<Test Type> Result** window.



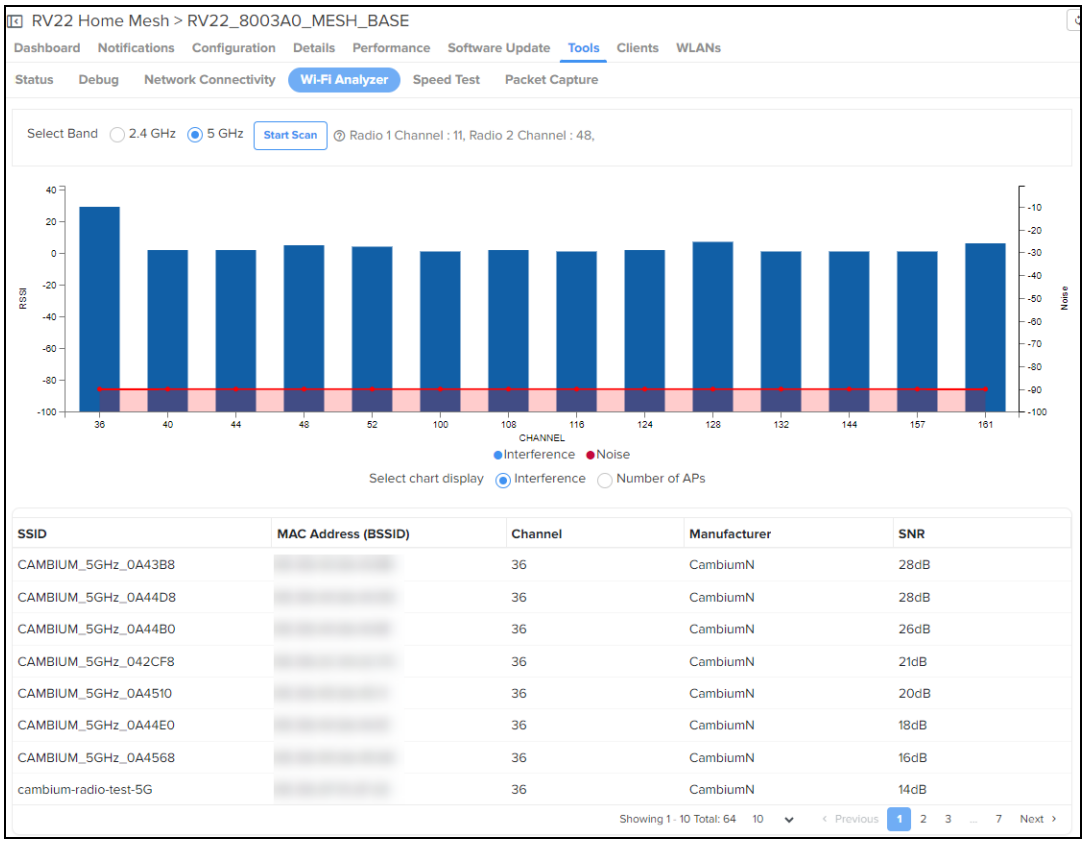
Wi-Fi Analyzer

The Wi-Fi Analyzer page displays radio traffic and signal information for the selected band. It displays the interference and noise measured for the selected band.

To view the Wi-Fi Analyzer details, complete the following steps:

1. Navigate to the **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools** > **Wi-Fi Analyzer** tab.
2. Select the required band (2.4 or 5 GHz).
3. Click **Start Scan**.

   cnMaestro analyzes the band and displays the result in a table.



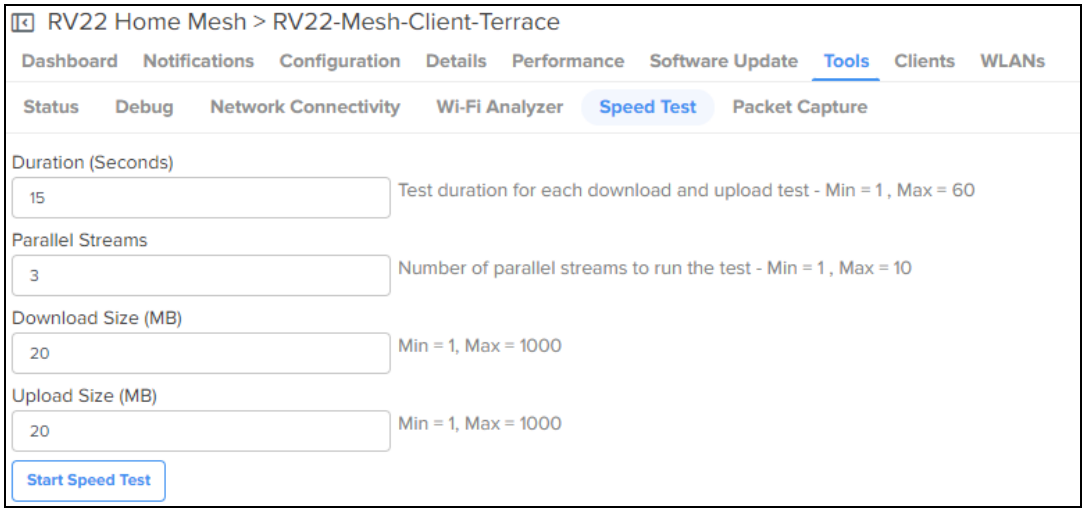
Speed Test

The Speed Test page displays the internet speed provided by the Home Mesh Router.

To know the speed of the router, complete the following steps:

1. Navigate to the **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools** > **Speed Test** tab.
2. Configure the required values for testing the speed.
3. Click **Start Speed Test**.

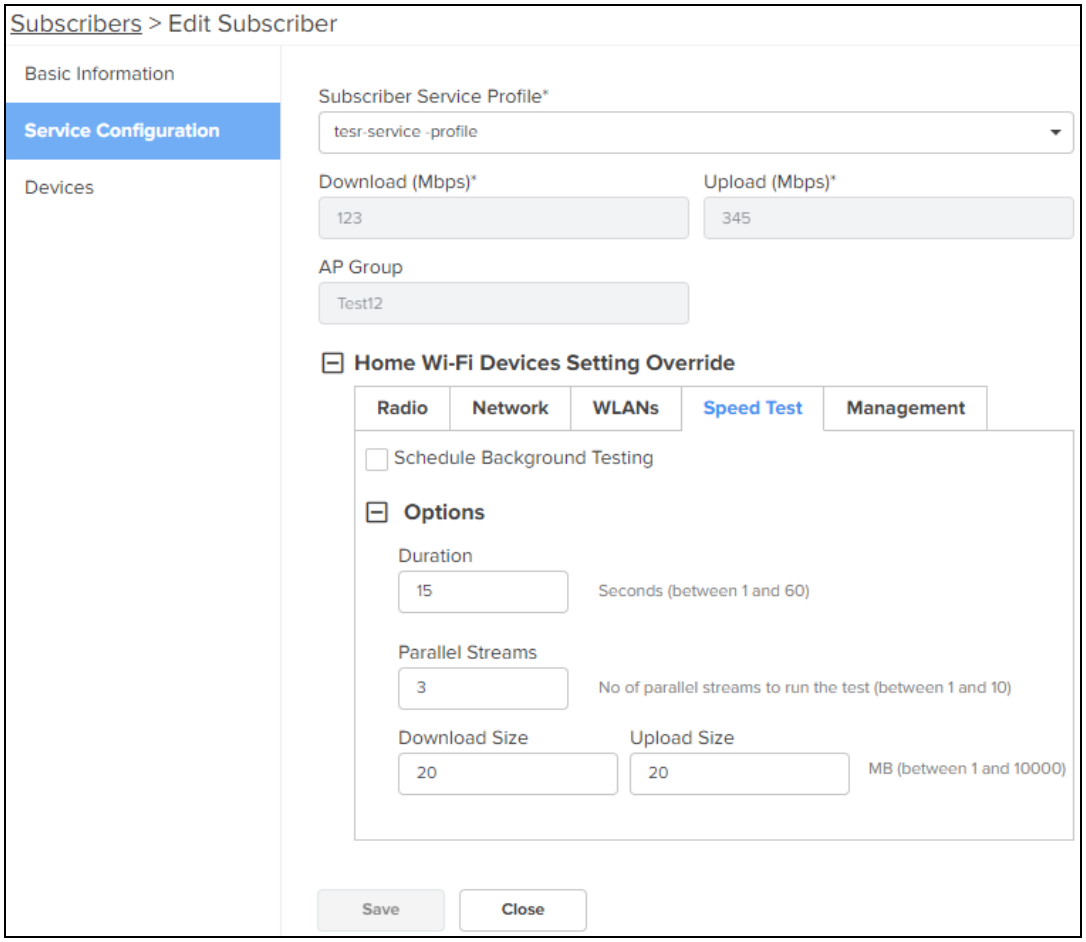
   cnMaestro checks the speed and displays both download and upload speeds in megabits per second (Mbps).



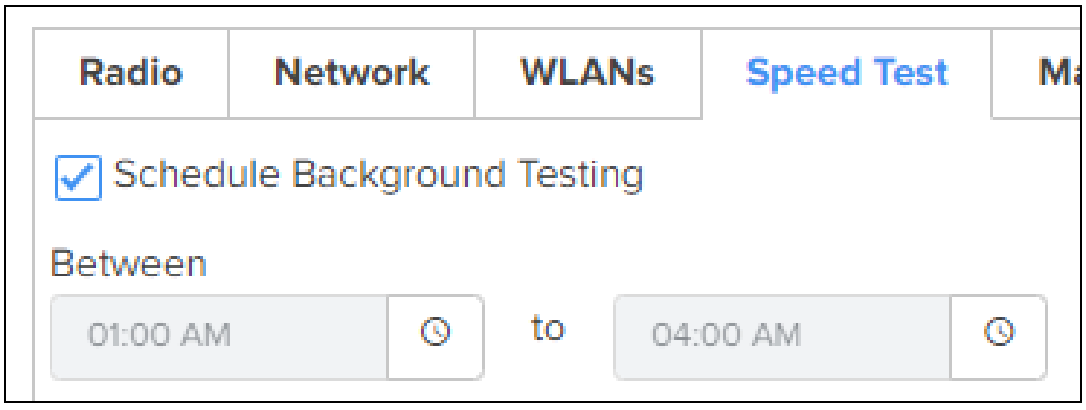
The speed test option is also available on the **Subscriber** page in the **Home Wi-Fi Devices Setting Override** section.

To avail this speed test option, complete the following steps:

1. Navigate to the **Manage Service Providers** > **Managed Subscribers** > **Subscribers** tab.
2. From the list of subscribers, click the subscriber name for which you want to configure the speed test. The **Edit <Susbcriber-name>** window is displayed.
3. Click the **Service Configuration** tab.
4. In the **Home Wi-Fi Devices Setting Override** section, click the **Speed Test** tab.



5. To schedule the speed test at a particular duration, select the **Schedule Background Testing** check box.
6. Select the start and end time for performing the speed test on the router.



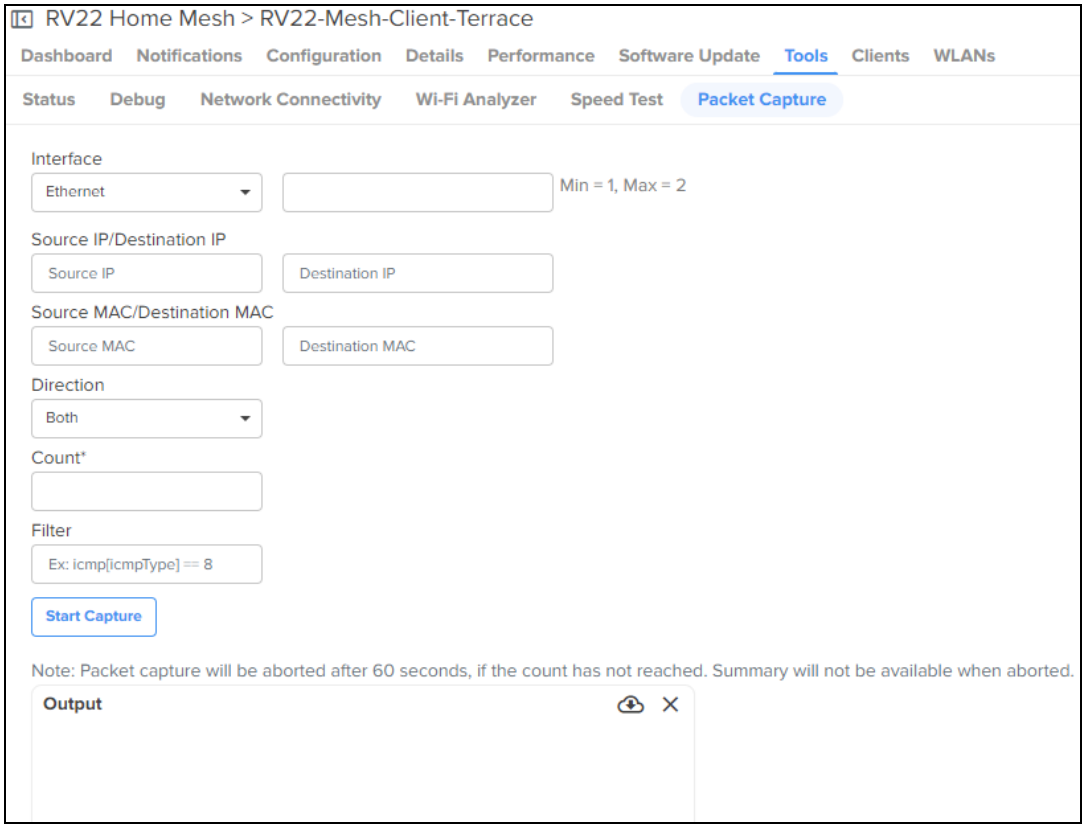
Packet Capture

The Packet Capture page allows the user to capture all packets on a specified interface.

To capture packet data, complete the following steps:

1. Navigate to the **Monitor and Manage >** <Home-Mesh-Router-name> **> Tools** > **Packet Capture** tab.
2. Select the required interface, and provide the source and destination IP address or MAC address.
3. Provide the number of packets that must be captured.
4. Click **Start Capture**.

   cnMaestro displays the information in the **Ouput** window.
5. To download the PCAP file, click the download ( ) icon.



Upgrading the Home Mesh Router firmware

To upgrade the firmware of Home Mesh routers present in a home site, complete the following steps:

1. Navigate to **Monitor and Manage >** <Home-site-name> **> Software Update**.

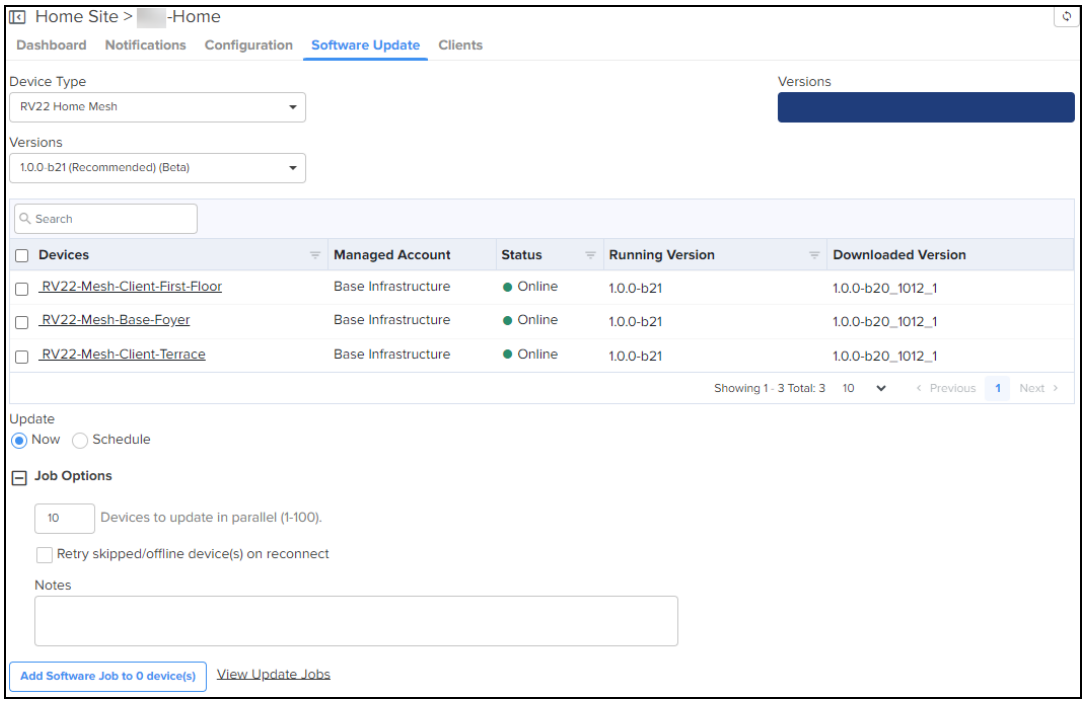
   The Software Update page appears.
2. Select **RV22 Home Mesh** from the **Device Type** drop-down list.
3. Select the software version from the **Versions** drop-down list.
4. In the list of devices table, select the check boxes corresponding to the devices for which you want to upgrade the firmware.

   You can also select one router to upgrade the firmware of only that router.
5. Select the **Now** option in the **Update** field to upgrade the firmware immediately.

   To schedule the upgrade job, select the **Schedule** option and configure the required date and time.
6. Click **Add Software Job to** <number of devices> **device(s)**.

   The upgrade is scheduled to run at the specified date and time.

   To view the status of the update jobs, click **View Update Jobs**.


Home Site > -Home
Dashboard
Notifications
Configuration
Software Update
Clients
Device Type
RV22 Home Mesh
Versions
1.0.0-b21 (Recommended) (Beta)
Versions
Search
Devices
Managed Account
Status
Running Version
Downloaded Version
RV22-Mesh-Client-First-Floor
Base Infrastructure
Online
1.0.0-b21
1.0.0-b20_1012_1
RV22-Mesh-Base-Foyer
Base Infrastructure
Online
1.0.0-b21
1.0.0-b20_1012_1
RV22-Mesh-Client-Terrace
Base Infrastructure
Online
1.0.0-b21
1.0.0-b20_1012_1
Showing 1 - 3 Total: 3
10
Previous
1
Next
Update
Now
Schedule
Job Options
10
Devices to update in parallel (1-100).
Retry skipped/offline device(s) on reconnect
Notes
Add Software Job to 0 device(s)
View Update Jobs

Analytics

This chapter covers the following topics:

- Site Analytics
- Client Analytics

Analyzing Connection Failures of Wi-Fi Clients and Poor Performance of Wi-Fi Networks

The Wi-Fi Analytics feature provides deep visibility into the health of Wi-Fi client connections, including root cause analysis of failures and possible remediations. It also provides analytics on aggregated data that can help to improve client connectivity in the Wi-Fi network.

NOTE:

This feature is currently available as a free trial to all cnMaestro X customers, but will require a separate paid subscription in the future.

This section covers the following topics:

- Overview
- Use cases
  - Resolve connectivity issues
  - Address poor performance of applications
  - Identify OS, SSID, and AP specific issues
- Accessing the Analytics X^A page
- Setting filters to view the connection data
- Viewing the connection events
  - Dashboard page
  - Analytics X^A page
    - Connection tab
    - Disconnection tab
    - Viewing a client or host-specific connection or disconnection event
    - Viewing an event-based connection or disconnection event
    - Viewing an AP-specific information

Overview

The Analytics X^A feature analyzes the Wi-Fi client connection events and helps to troubleshoot common network connectivity and performance issues such as the following:

- **Connectivity**—Association, authentication, and network connectivity failures.
- **Poor Performance**—Low RSSI, low data rate, high retry rate, and high latency in AAA, DHCP, DNS, and applications.

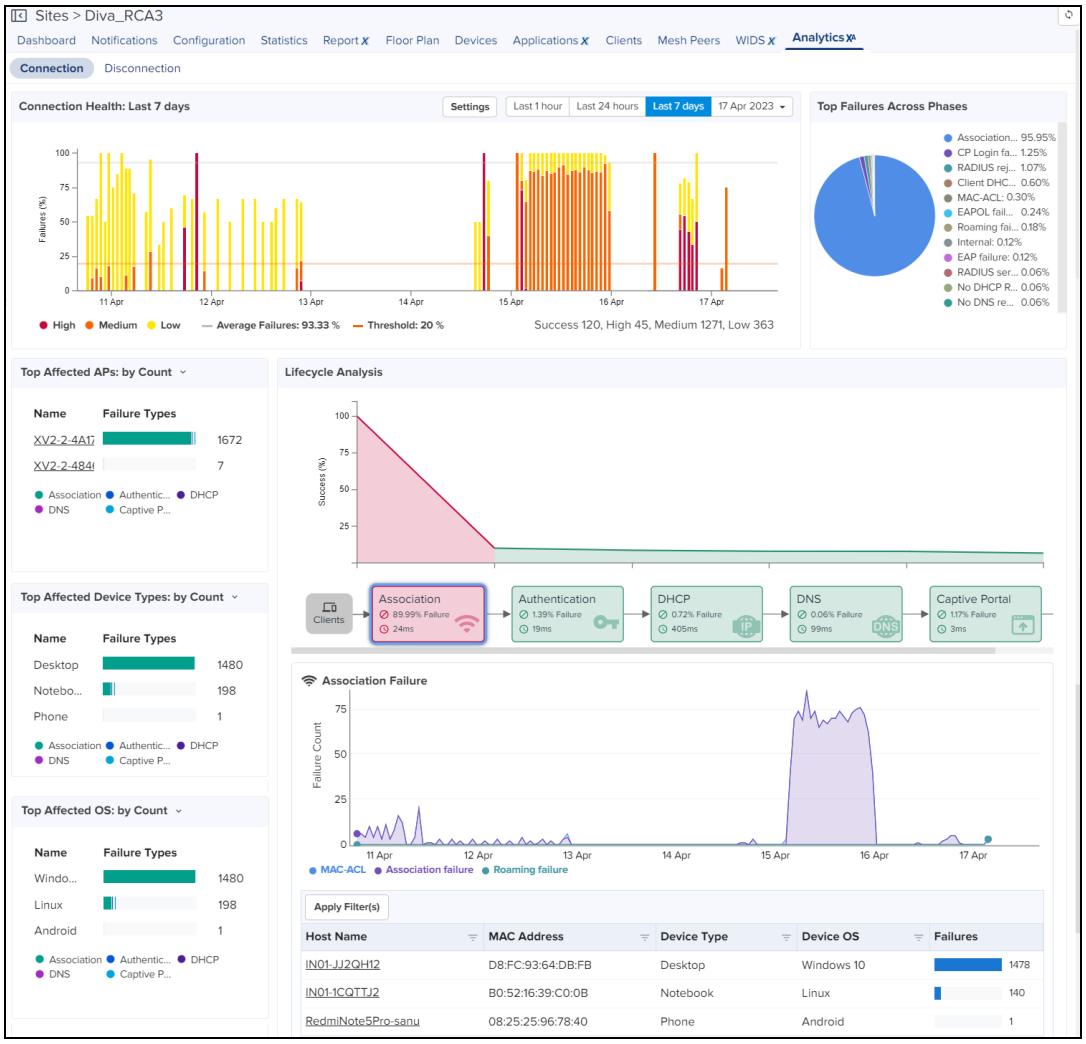
You can use this feature to detect and analyze common network problems that occur in your wireless networks.

	NOTE: **Analytics X^{A}** is supported only for XV and XE devices.

The **Analytics X^{A}** page reports the following data for the Wi-Fi clients:

- Statistics of successful connections per connection type such as new, reconnection, and roaming.
- Statistics of failed connections and disconnections, such as reason codes for association, EAP/EAPOL handshake, DHCP, DNS, and Captive Portal failures.

Figure 373 The Analytics X^{A} page



Use cases

Following are some of the **use cases**, to identify the connectivity issue and analyze the root cause:

Resolve connectivity issues

The **Analytics XA** page provides visual analytics of client connection failures in each phase such as baseline performance and key metrics in the form of graphs and tables with multiple data filters. You can easily identify the root cause based upon the phase of the Wi-Fi connection lifecycle.

- **Association**—Accessing the AP may fail if the client has low RSSI; if the request for capabilities is not supported by the AP; or if the AP is already handling the maximum number of clients.

  In such cases, you can use the **Lifecycle Analysis** widget on the **Analytics XA** page. This widget displays the statistics of 802.11 authentication/association failures in percentage. In addition, you can use the **Events** page to analyze the reason, cause, impact, and the recommended action.
- **Authentication**—Authentication may fail when 802.1X/EAP key is incorrect; the RADIUS server cannot be reached; or the WPA2-PSK or WPA3-SAE key derivation is invalid.

  In such cases, the **Lifecycle Analysis** widget displays the RADIUS authentication failure count in percentage.
- **Network connection**—When a client is successfully authenticated, it must be assigned an IP address by the DHCP server and provided networking information such as for DNS and Gateway. When the DHCP server fails, connectivity to the network cannot be established.

  In such cases, the **Lifecycle Analysis** widget can help identify that the DHCP server failure, and the **Events** page can analyze the reason and cause.
- **Aggressive roaming**—Time sensitive applications such as voice and video require uninterrupted connectivity. To ensure this, Wi-Fi clients monitor the RSSI from local APs and probe better APs when the connection degrades. The RSSI threshold at which a client moves from the current AP to another AP may be different for each client and is vendor specific. Some clients may have aggressive roaming where they move frequently across APs. This can result in increased contention in the network and longer delay for other clients connecting or transmitting data. The client drill down presents the association, authentication, and network connectivity events generated due to aggressive roaming.

  You can use the **Lifecycle** page to analyze the RSSI ranges, roam quality, and lifecycle eventsts.
- **DHCP, AAA, or DNS latency**—Each of the association, authentication, and network connectivity stages might add latency to the total connection time.

  The **Lifecycle Analysis** widget and the **Events** page display statistics for the DHCP, AAA, and DNS latencies.

Address poor performance of applications

Wi-Fi clients may use a wide range of advanced video coding (AVC) applications such as Google Meet, Microsoft Teams, Zoom, Skype, YouTube, and multiple e-commerce applications such as Flipkart and Amazon. In such scenarios, clients may experience poor network performance or network disconnection due to low RSSI or bad roam quality.

You can view the **Session Timeline** section in the **Lifecycle** page to analyze the RSSI ranges, and events such as success, failed, connected, disconnected, and roam quality. This analysis helps you to understand the cause and take recommended actions.

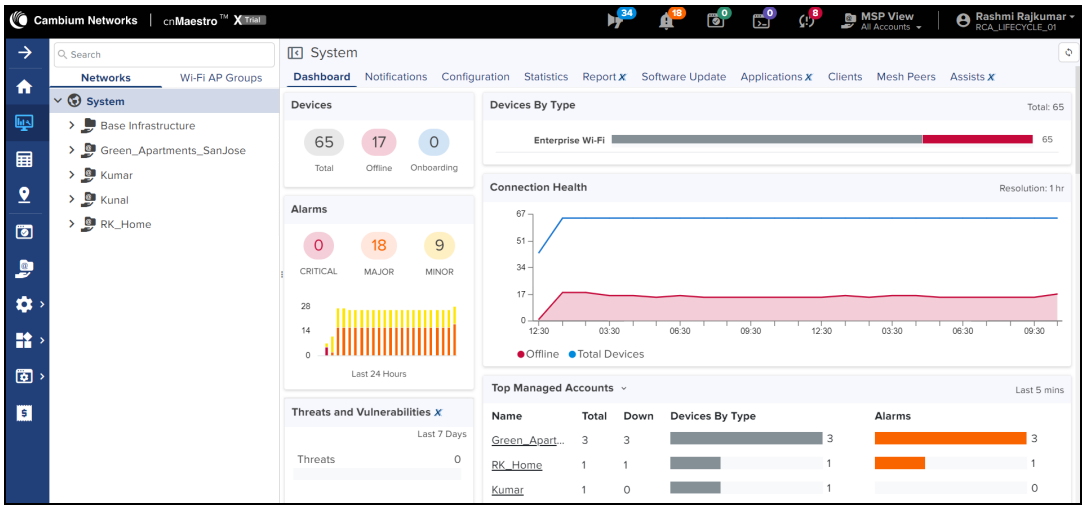
Identify OS, SSID, and AP-specific issues

Apart from run-time metrics, the **Connection Health** widget provides filters to identify performance issues with a specific vendor, operating system, and associated AP and SSID.

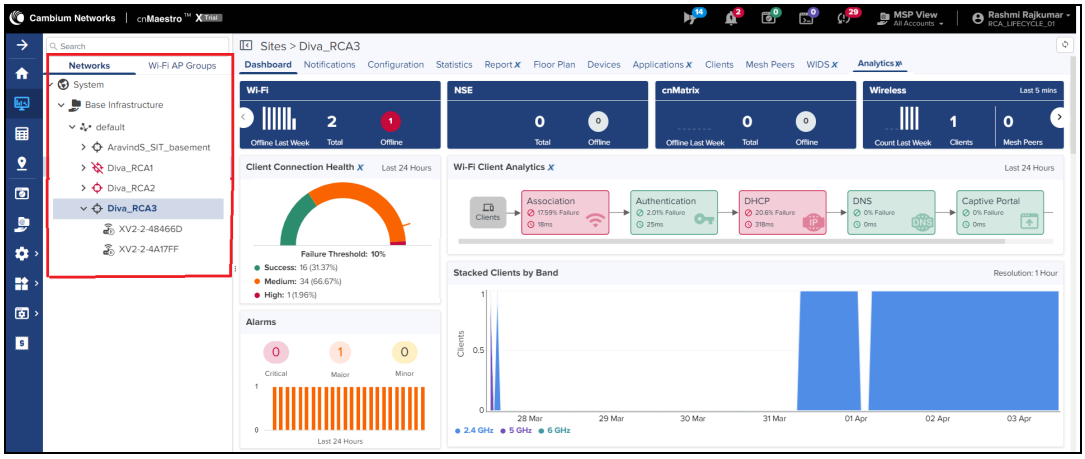
Accessing the Analytics XA page

To access the Analytics XA page:

1. On the left navigation pane, select the **Monitor and Manage** ( ) icon.



2. Select either a **System, MSP,** or **Network,** and then a **Site** node in the tree.



NOTE:

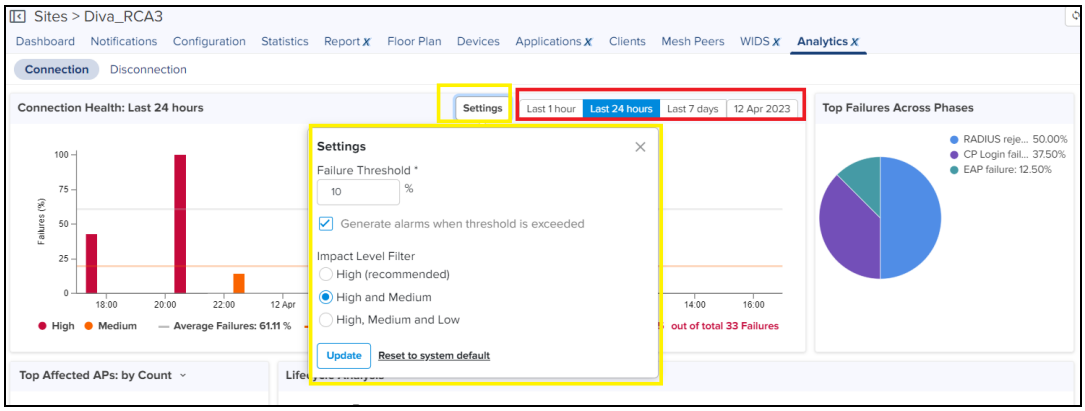
The **Analytics X^A** page is available only at site and client levels.

The **Dashboard** tab displays the default Wi-Fi connection statistics.

3. Select the **Analytics X^A** tab.

Setting filters to view the connection data

After accessing the **Analytics X^A** page, you may change the default threshold for failed connections and set the period to view the connection events such as 1 hour or 24 hours, or 7 days.



To set failure threshold and period:

1. Navigate to the **Connection** tab
2. Click **Settings** located inside the **Connection Health** widget.
3. Enter the **Failure Threshold**.

   The default value is 10% and higher. To reset the threshold, click **Reset to system default**.
4. Select the **Generate alarms when threshold is exceeded** check box to generate a System Alarm whenever the threshold is surpassed.
5. Select the **Impact Level Filter** as
   - High (recommended) or
   - High and Medium or
   - High, Medium, and Low
6. To apply the configuration changes, click **Update**.
7. To view the connection or disconnection events for a specific period, select the **Settings** filter as
   - Last 1 Hour or
   - Last 24 hours (Resolution 1 hour) or
   - Last 7 days (Resolution 1 hour) or
   - **Date**: To view the connection or disconnection data for a specific date. The **Date** filter supports today's date and dates of the last seven days.

   Based on the failure threshold, failure Impact filter, and the period, the **Dashboard** and **Analytics X**^{A} pages display the Wi-Fi client's connection data. Whenever the failure percentage exceeds the configured failure threshold, the Analytics X^{A} page automatically generates alerts.

NOTE:

Consider the following key points specific to impact level failures:

- **High impact failure**—Occurs when a client is unable to establish a connection with an access point or transmit data over a connection. These failures are typically permanent until the underlying problem is resolved. High impact failures include incorrect pre-shared key (PSK); the VLAN not being configured or present on the switch; and AP software issues.
- **Medium impact failure**—Occurs when a client is intermittently unable to connect to a network,and the time to connect is relatively short (sub-seconds). These failures may not be noticed by end users. They are caused by transient issues such as the moving client or when an access point locks the necessary information during the initial connection attempt. Medium impact failure events include fast transition (FT); authentication failure; missed packets during the four-way handshake; DHCP request process; or momentary interference from other wireless devices.
- **Low impact failure**—Occurs when a client is unable to connect to a network, without causing any noticeable impact for end users. These failures may arise due to specific wireless LAN features or configurations, such as band steering. These failures are expected, based upon the Wireless LAN protocols, and do not impact the user experience. In some cases, adjusting WLAN configuration can resolve such failure issues.

Viewing the connection events

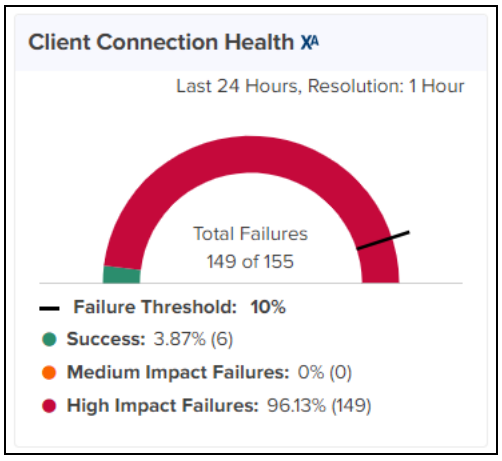
You can view and analyze the Wi-Fi connection events using the following UI pages:

- Dashboard page
- Analytics X^A page

Dashboard page

The site **Dashboard** page displays the following widgets:

- **Client Connection Health**—Displays overall statistics for connection events through a gauge/dial chart. Based on the impact level filter set on the **Analytics X^A > Settings** page, this widget displays the statistics for failed connections.

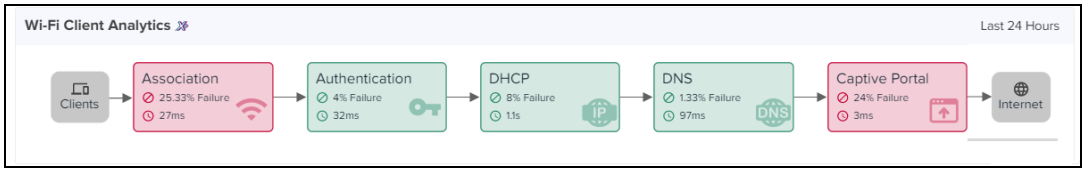


The default Impact filter for a Site is High. The resolution of this chart is 1 hour, which means every 1 hour this chart is updated. This chart displays the data based on the threshold and the impact level filter you set.

- Number and percentage of successful connections.
- Number and percentage of impact level failures for failed connections.

	NOTE: The **Client Connection Health** widget score is calculated, as follows. Score = (Failures * 100)/(Failures+Success) % Depending on the selection of the impact level filter on the **Analytics XA > Settings** page, the failure count is calculated as follows: • **High Impact**—Includes high impact failures only. • **High and Medium Impact**—Includes medium and high impact failures. • **High, Medium, and Low Impact**—Includes all failures: high, medium, and low impact.

- **Wi-Fi Client Analytics**—Indicates the percentage of failed connections at each step in the client lifecycle.



The phase-wise chart displays the current status by highlighting the phase in:

- **Red**—If the failure percentage exceeds the configured failure threshold configured in **Analytics XA> Settings** page,
- **Orange**—If the failure percentage falls within the range of 80-100% of the configured failure threshold,
- **Green** —If the failure percentage is below 80% of the configured failure threshold.

The **Wi-Fi Client Analytics** widget displays the connection state of clients to the Internet in the following phases:

- Duration in each phase indicates the average time taken by the clients in the respective phase.
- **Association**—Indicates the percentage of failed connections during the association phase.
- **Authentication**—Indicates the percentage of failed client authentications such as EAP, RADIUS, and authentication key derivation (EAPOL) failures.
- **DHCP**—Indicates the percentage of failed DHCP request/responses from/to the client.
- **DNS**—Indicates the percentage of failed DNS request/responses from/to the client.
- **Captive Portal**—Indicates the percentage of failed captive portal accesses.

	NOTE: A captive portal is a web page launched in a browser that enables access to a public network. For example, business centers, airports, hotel lobbies, coffee shops, and other public venues use captive portals to offer free Wi-Fi hotspots for internet users.

Analytics XA page

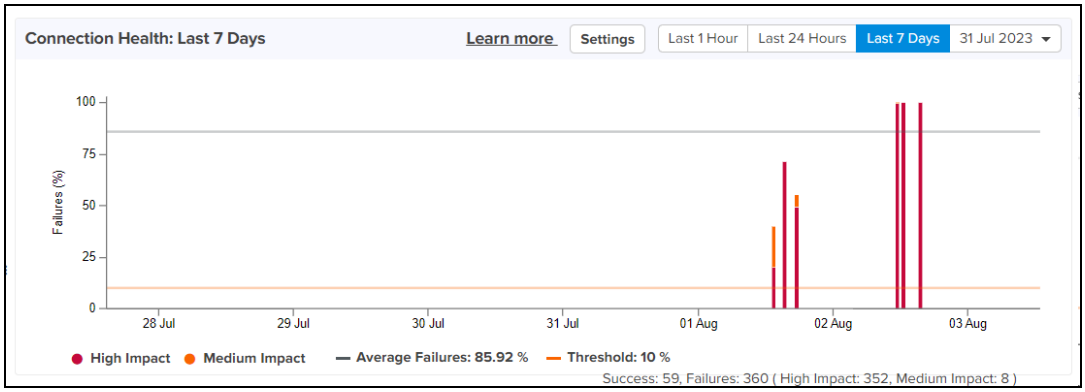
After accessing the **Analytics X** page and setting the failure threshold percentage, failure impact filter, and duration, you can analyze the connection events using the following tabs:

- Connection—Provides statistics for the connection events.
- Disconnection—Provides statistics for the disconnection events.

Connection tab

Following widgets on the **Connection** tab show connection failure events for the configured duration:

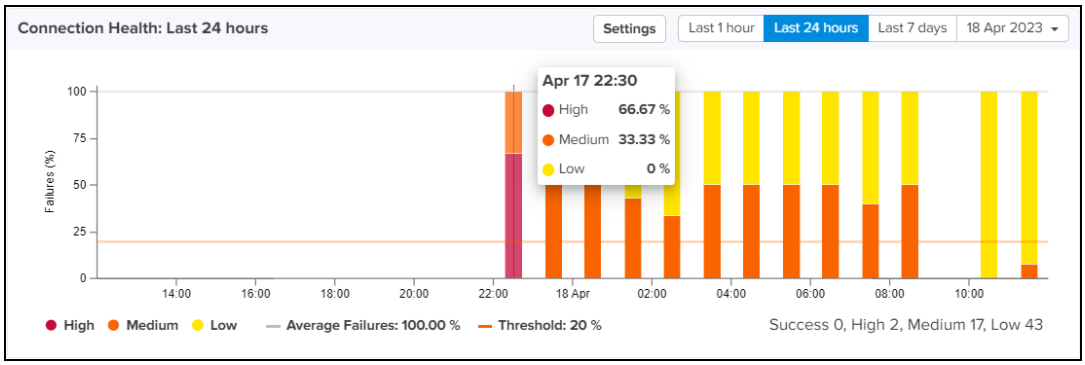
- **Connection Health**—Displays statistics of the failed connections in a bar chart, based on the threshold you set and the impact level failures in percentage.



The **Connection Health** bar chart represents the following data:

- Percentage of failed connections in a specific period for each Failure impact.
- Percentage of average failures highlighted by a grey line.
- Percentage of high, medium, and low impacted connections in different colors.
- Orange line indicates the Failure threshold percentage configured.

When you click on a bar in the chart, the chart displays the connection statistics for the selected date and time.

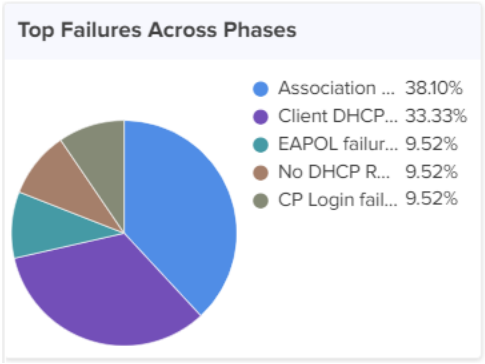


When you select a bar on the **Connection Health** chart, the following widgets display data for the selected failed connection event for the selected duration:

- Top Failures Across Phases
- Lifecycle Analysis
- Top Affected APs
- Top Affected Devices
- Top Affected OSes

	NOTE: Click the ↻ icon, located on the top right corner of the **Analytics X^A** page, to refresh the page.

- **Top Failures Across Phases**—Displays statistics of top failed connections in a pie chart, indicating failure reasons across phases in percentage.



When you select any top failure slice on the pie chart, the following widgets display data for the selected top failure:

- Lifecycle Analysis
- Top Affected APs
- Top Affected Devices
- Top Affected OSes

- **Lifecycle Analysis**—Displays statistics for failed connections that help you analyze the life cycle of an event. By default, the phase with highest failure percentage is selected and highlighted.

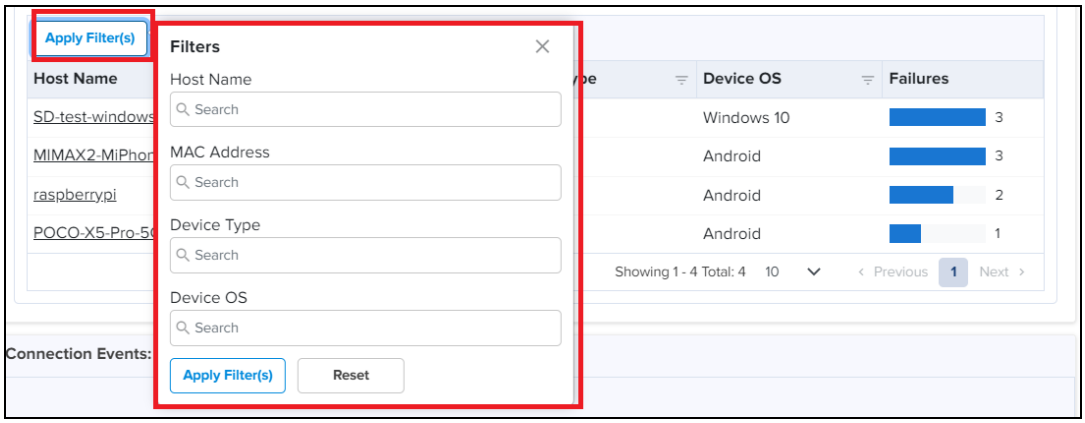
.

This **Lifecycle Analysis** widget displays data through the following formats:

- **Phase-wise chart**—Displays the phase-wise chart that indicates the percentage of failed Wi-Fi client connections. When you click on a phase, the line graph below the phase-wise chart displays the corresponding data.
- **Line graph**—Displays the count of failed connections based on the date and time.
- **Filters to view the required failed connection in detail**—Displays a detailed table to view failed connection events.

  To use filters and view the details of a failed connection, perform the following steps:

  1. Inside the **Lifecycle Analysis** widget, click **Apply Filter(s)** located below the line graph section.

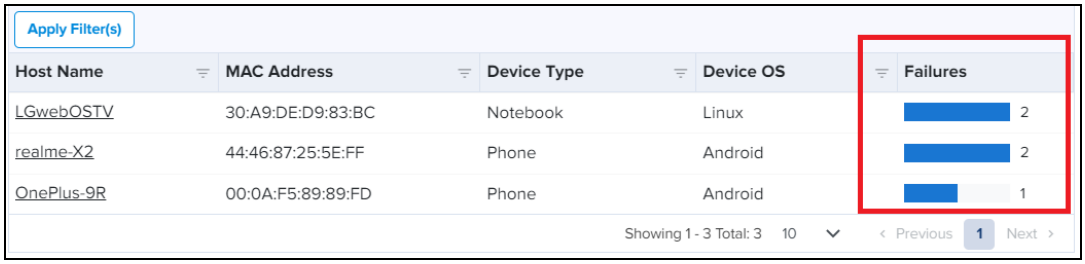


2. To search for and view data of the required client's connection event, enter one or more of the following values:

Filter name	Description
Host Name	The name of the host for which you want to view the failed connection details.
MAC Address	The MAC address of the device for which you want to view the failed connection details.
Device Type	Type of device used for the connection.
Device OS	The operating system (OS) running on the device.

3. Click **Apply Filter(s)** to apply the changes.

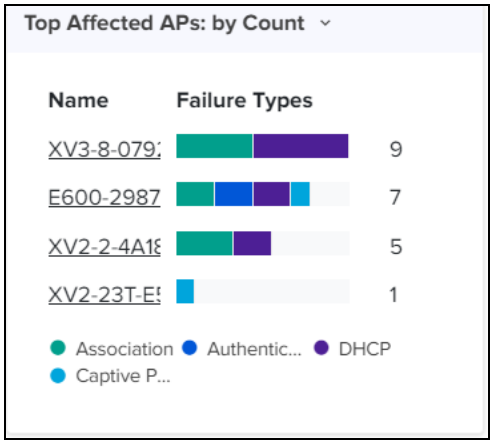
A table below the line graph displays the count of failures for the searched criteria, as shown in the following figure:



	NOTE: You can also click the icon in the table to quickly search for Mac address, device type, device OS, and failure count.

When you click on a host name, the site-specific **Clients** page appears, displaying the connection data for the selected host.

- **Top Affected APs**—Displays the name of top affected APs and the statistics for the failed connection. To view the statistics of top affected APs in percentage or count, click the icon next to the **Top Affected APs** widget title.



  Placing the cursor on any colored bar, displays the failure type and count specific to the failed connection. If you click on any AP name, the site-specific **Wi-Fi** dashboard appears with the AP or device information.

- **Top Affected Device Types**—Displays the name of top affected device types and the statistics for the failed connection in count or percentage.
- **Top Affected OS**: Displays the name of top affected OS and the statistics for the failed connection in count or percentage.
- **Connection Events : Last 1 Hour**—A table with filters displays the details of successful or failed connection events that occurred in the last one hour.

	NOTE: Failure events per AP, Device type, and OS are displayed only when an hourly bar is selected.

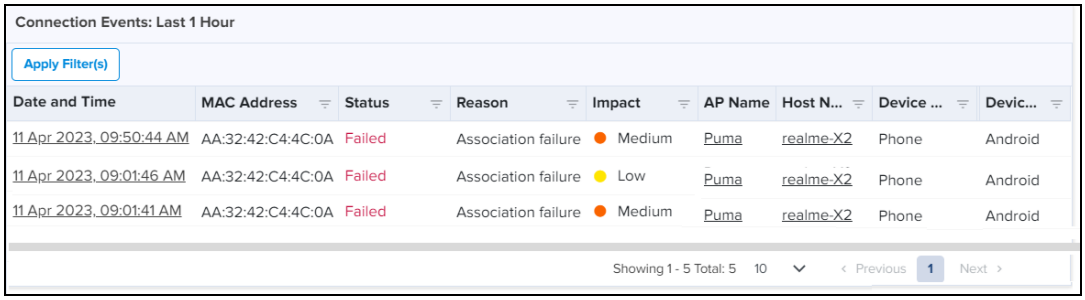
  To use filters and view the connection details for the last one hour, perform the following steps:

  1. Inside the **Connection Events : Last 1 Hour** widget, click **Apply Filters**.
  2. To search and view data for the last one hour, enter one or more of the following details:

Filter name	Description
MAC Address	The MAC address of the device with connection events.
Success	Select whether you want to view successful or failed connection events. • Success • Failed
Reason	Select the required reason type from the drop-down list such as MAC-ACL, MAC-AUTH, QoS failure, Passpoint failure, Capability mismatch, L2 Auth failure, Association failure, Roaming failure, SAE failure, Cipher failure, or TDLS failure.
Impact	Select the required impact type from the list: • Low • Medium • High
Host Name	The name of the host for which you want to view the connection state.
Device Type	The type of device used for the connection.
Device OS	The operating system (OS) running on the device.

3. Click **Apply Filter(s)** to apply the changes.

   The table displays the connection event details with date, time, and AP names for the searched criteria.



NOTE:

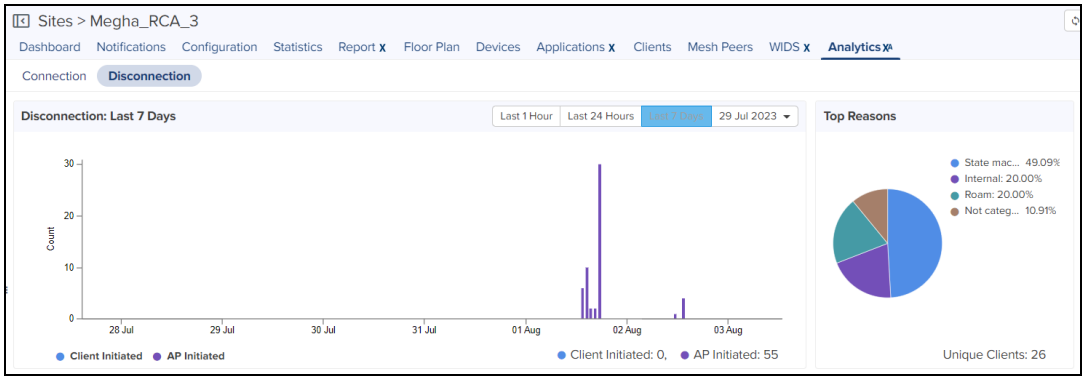
You can also click the icon in the table to quickly search for status, reason, impact level, AP name, host name, device type, and device OS.

- When you click on any date and time, the **Events** page displays connection state data for the selected date and time.
- When you click on any AP name, the site-specific **Wi-Fi** dashboard displays the AP or device information.

- When you click on a host name, the site-specific **Clients** page displays the connection data for the selected host.

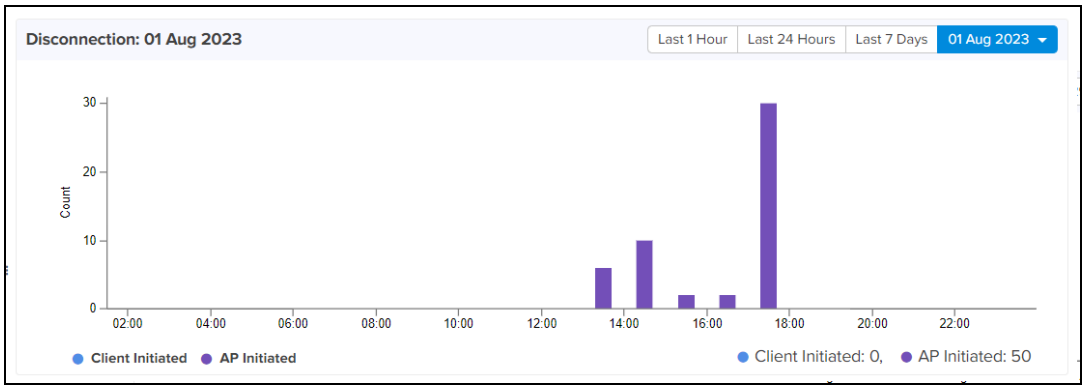
Disconnection tab

On accessing the **Analytics X^A** page, click on the **Disconnection** tab and set the time filter by choosing the required time period as last 1 hour, last 24 hours, last 7 days, or a custom date. The **Disconnection** tab displays the data for the selected time period.



The following widgets on the **Disconnection** page support root cause analysis:

- **Disconnection**—Displays the count of clients and APs initiated during the time period.



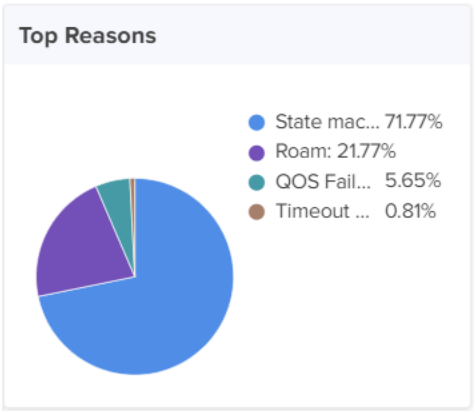
When you click on a bar in the chart, the chart displays the count of Clients and APs initiated at the specific date and time.

When you select any bar on the **Disconnection** chart, the following widgets display data for the selected disconnection event:

- Top Reasons
- Top Reporting APs
- Analytics
- Top Reporting Device Models
- Top Reporting Device Types
- Top Reporting OSes

	NOTE: Click the ↻ icon, located on the top right corner of the **Analytics X^A** page, to refresh the page.

- **Top Reasons**—Displays statistics of top failure reasons such as state machine issues, roam, QoS failures, and timeout failures.

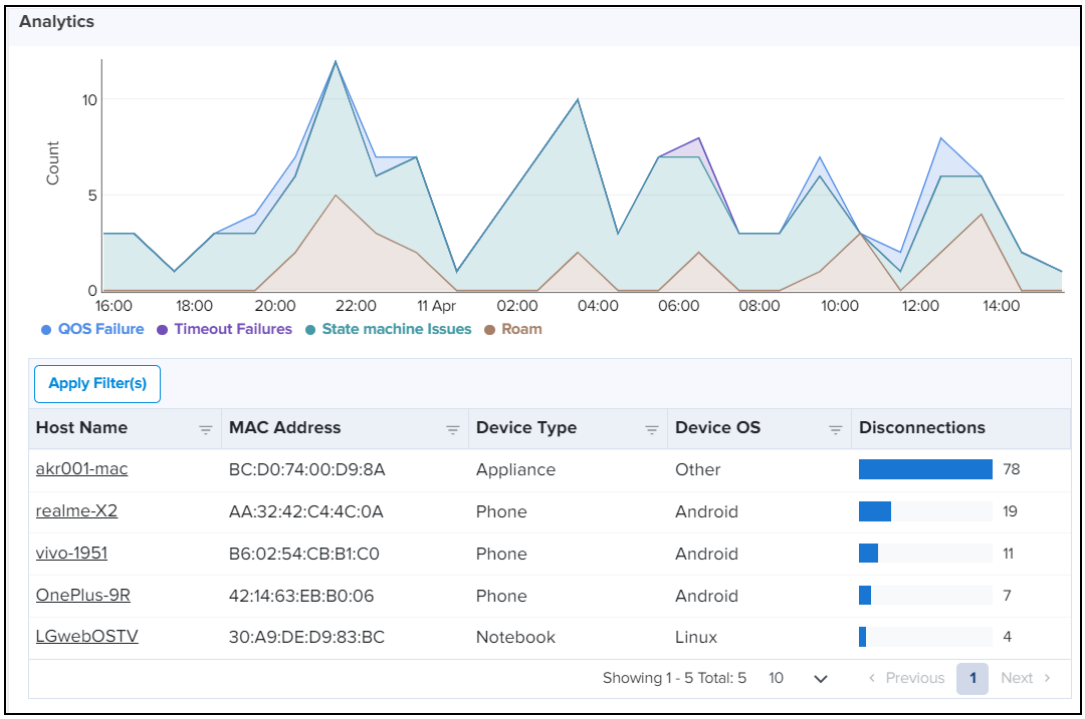


When you select any top failure slice on the pie chart, the following widgets display data for the selected top failure:

- Top Reporting APs
- Analytics
- Top Reporting Device Models
- Top Reporting Device Types
- Top Reporting OSes

	NOTE: Click the ↻ icon, located on the top right corner of the **Analytics X^A** page, to refresh the page.

- **Analytics**—Displays statistics for disconnections to help analyze failure events in detail.



This **Lifecycle Analysis** widget displays data in the following formats:

- **Line graph**: Displays the count of disconnections, including the date, time, and failure reasons in different colors.
- **Filters to view the required disconnection in detail**: A table with filters displays detailed information of a disconnection event.

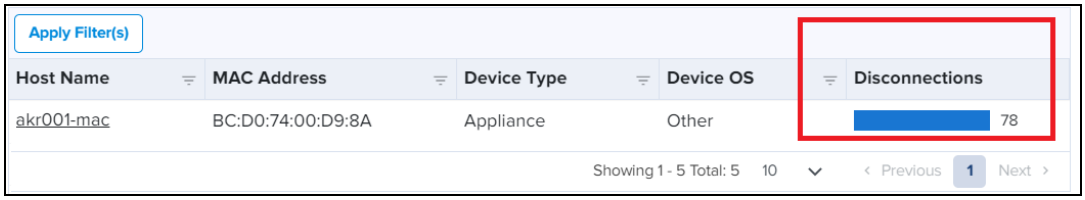
  To use filters and view the details of a disconnection event, perform the following steps:

  1. Inside the **Analysis** widget, click **Apply Filters** located below the line graph section.
  2. To search for and view data of the required client's disconnection state, enter one or more of the following:

Filter name	Description
Host Name	The name of the host for which you want to view the disconnection details.
MAC Address	The MAC address of the device for which you want to view the disconnection details.
Device Type	Type of device used for the connection.
Device OS	The operating system (OS) running on the device.

  3. Click **Apply Filter(s)** to apply the changes.

A table below the line graph section displays the count of disconnections for the searched criteria, as shown in the following figure:

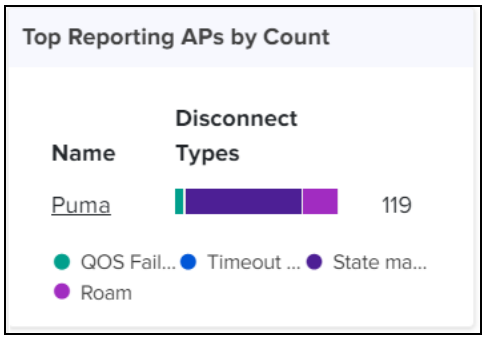


NOTE:

You can also click the icon in the table to quickly search for MAC address, device type, device OS, and disconnection count.

When you click on a host name, the site-specific **Clients** page displays the disconnection state data for the selected host.

- **Top Reporting APs**—Displays the names of top APs and the count of disconnections in different colors based on the disconnection types.



When you place your cursor on any color, you can view the reason type and count specific to the disconnection type.

- **Top Reporting Device Types**—Displays the names of the top devices and the count of disconnections in different colors based on the disconnection reasons. When you place your cursor on any color, you can view the reason type and count specific to the disconnection events.
- **Top Reporting OS**—Displays the names of top OS and the count of disconnections. Different colors are used to highlight the disconnection reasons. When you place your cursor on any color, you can view the reason type and count specific to disconnection.
- **Disconnect Events: Last 1 Hour**—A table with filters displays the data of disconnection events that occurred in the last one hour.

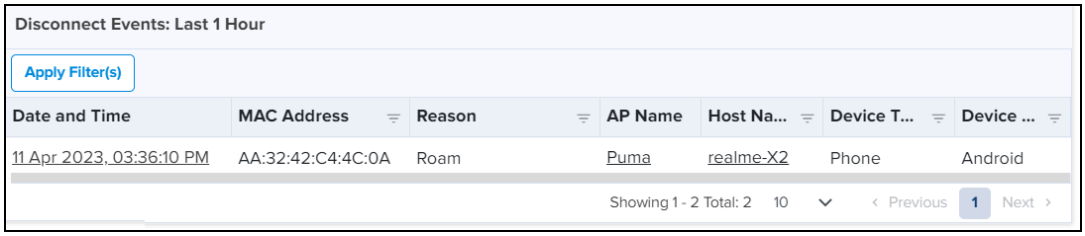
  To use filters and view the disconnection state details for the last one hour, perform the following steps:

  1. Inside the **Disconnection Events : Last 1 Hour** widget, click **Apply Filters**.
  2. To search for and view data of the disconnection events, enter one or more of the following:

Filter name	Description
MAC Address	The MAC address of the device for which you want to view the disconnection events.
Reason	Select the type of reason from drop-down list such as Unknown-disc-O, QoS failure, Radius failures, TDLS failures, timeout failures, state machine issues, AP Resource failures, AP assisted roaming, and roam.
Host Name	The name of the host for which you want to view the disconnection state.
Device Type	Type of device used for the connection.
Device OS	The operating system (OS) running on the device

3. Click **Apply Filter(s)** to apply the changes.

   The table displays the disconnection state with date, time, and AP names for the searched criteria.



NOTE:

You can also click the icon in the table to quickly search for MAC address, reason, AP name device type, device OS, and disconnection count.

- When you click on any date and time, the **Events** page displays the disconnection state data for the selected date and time.
- When you click on any AP name, the site-specific **Wi-Fi** dashboard displays the AP or device information.
- When you click on a host name, the site-specific **Clients** page displays the disconnection state data for the selected host.

Viewing a client or host-specific connection or disconnection event

You can analyze client or host-specific connection or disconnection events in detail and take appropriate actions.

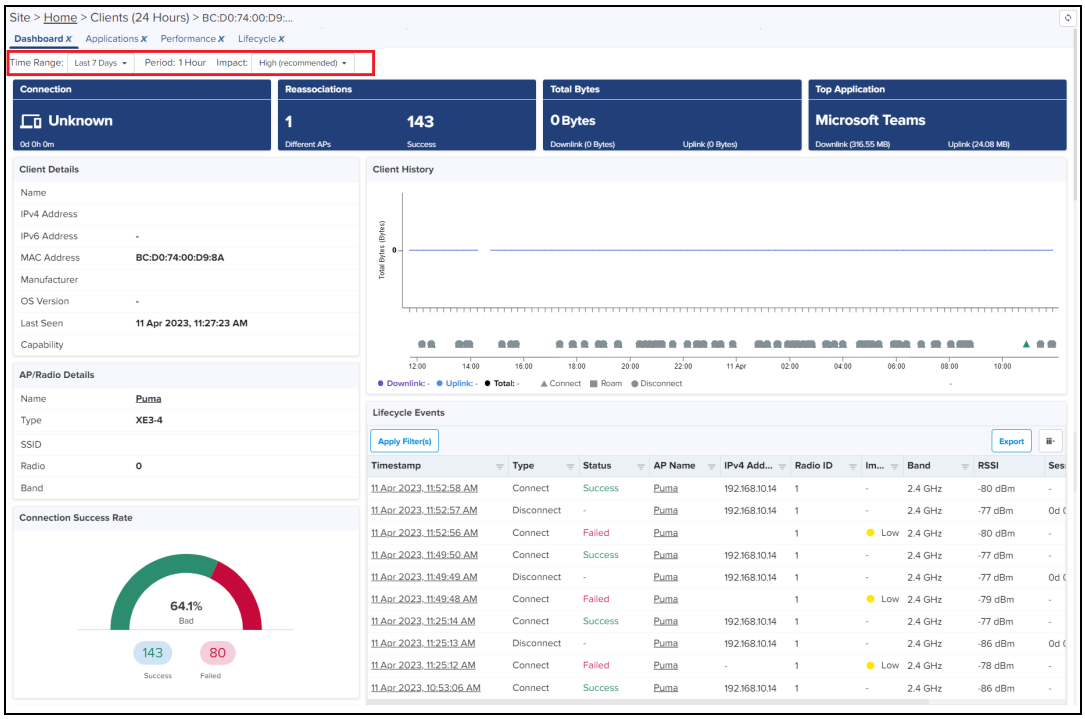
To view client or host-specific information, perform the following steps:

1. Click on a host name to view the connection or disconnection state in detail.

   You can locate the host names in the following widgets:

- **Lifecycle Analytics** on the Connection page—host names are available in a table below the line graph section.
- **Connection Events: Last 1 Hour** on the Connection page.
- **Analytics** on the Disconnection page.
- **Disconnect Events: Last 1 Hour** on the Disconnection page.

When you click the required host name, the site-specific **Clients** page displays detailed information for the selected host. The following figure is an example of the site-specific **Clients** page:



This site-specific **Clients** page contains the following tabs:

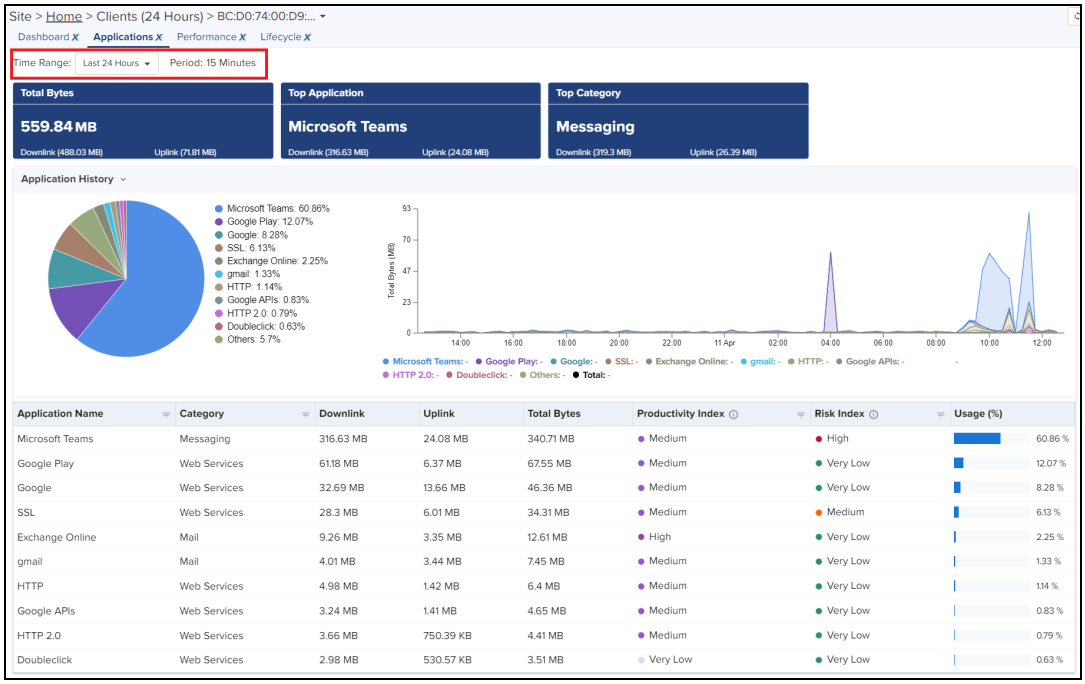
- **Dashboard**—Provides a summary of the client connection or disconnection events such as Client history or lifecycle events.

  By default, the **Dashboard** tab is visible when the site-specific **Clients** page appears. Based on the period options such as Last 24 Hours or Last 7 Days from the **Time Range** filter on the **Dashboard** page, the site-specific **Dashboard** page displays the Wi-Fi client information in the following widgets:

  - Connection
  - Reassociations
  - Total Bytes
  - Top Application
  - Client Details
  - Client History
  - AP/Radio Details
  - Lifecycle Events

- Connection Success Rate
- Top Failures Across Phases
- RSSI
- SNR
- Top Applications
- Data Rate
- Top Categories

- **Applications**—Provides detailed information of top applications used for the connection.

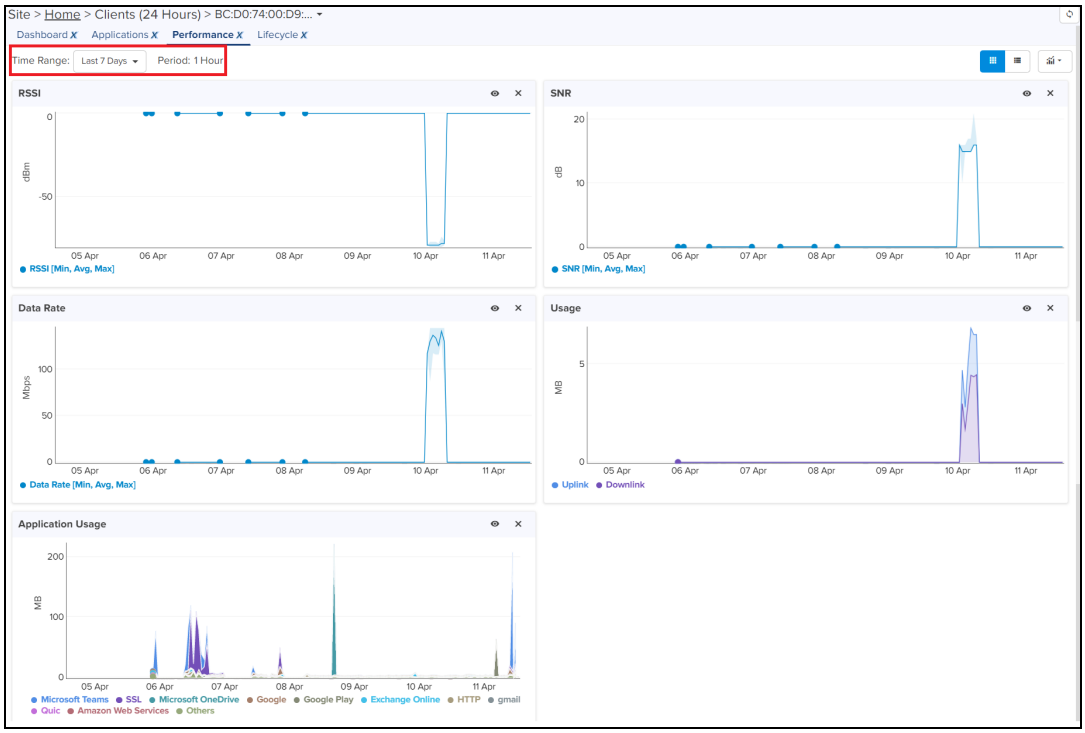


Based on the time period you select from the **Time Range** filter on the **Applications** page, the **Applications** page displays the application information for the Wi-Fi client in the following widgets:

- Total Bytes
- Top Application
- Top Category
- Application / Category History

  Click the ⌄ icon (for example, next to **Application History**) to view the history of category details.

- **Performance**—Provides detailed information of RSSI, SNR, date rate, usage in uplink and downlink, and the application usage.

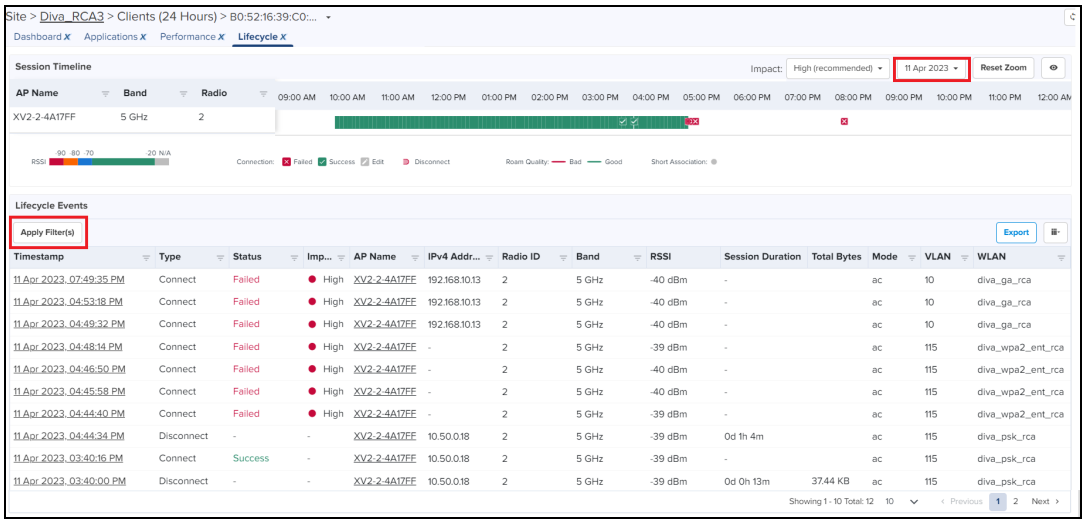


Based on the time period you select from the **Time Range** filter on the **Performance** page, the **Performance** page displays the network performance for the Wi-Fi client in the following widgets:

- RSSI
- SNR
- Data Rate
- Usage
- Application Usage

You can click the icon (Data point selector) to filter and view the required options specific to performance in the widgets.

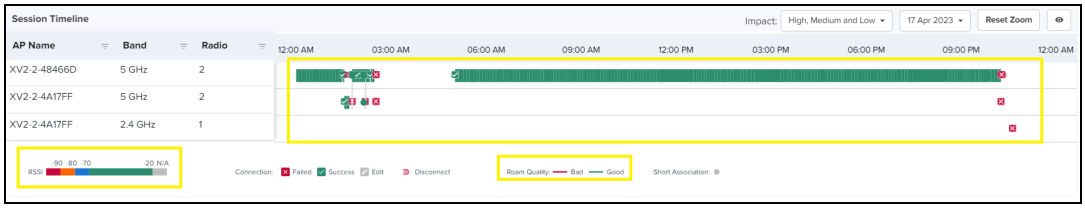
- **Lifecycle**—Provides detailed information of the client's connection or disconnection events.



Based on the date and impact levels you select from the date and **Impact** filters, the **Lifecycle** page displays the session timeline and the lifecycle events of the Wi-Fi client for the selected date.

In the **Session Timeline** section, you can find the AP names, band used, and the radio index. In addition, different indicators mark RSSI, the connection event as failed or success, the disconnection event, roam quality as bad or good, and short association.

For example, in the following UI page, the RSSI ranges and bad and good roam quality are highlighted using different colors.



- Placing the cursor on the ✅ icon, displays date and time of the succeeded event.
- Placing the cursor on the ❌ icon, displays reason and cause for the failed event.
- Clicking ✅ or ❌ icon in the **Session Timeline** section, displays the **Events** page with detailed information for the selected event.
- Clicking the disconnect ( ) icon, displays details about the event and disconnection reason.
- The short association ( ) icon denotes that the client connected and disconnected within a minute.
- The edit ( ) icon denotes that the client connection failed in DHCP, DNS or Captive portal phase in the first connection attempt but succeeded later.

	NOTE: A client connection is considered failed in DHCP, DNS, or CP, if the client fails to complete the phase within 45-60 secs.

The **Lifecycle Events** section provides detailed information of the client's connection and disconnection events such as timestamp, connection type, connection status, AP name, IPv4 address, radio ID, impact of the event, band used, RSSI, session duration, total bytes, wireless mode used, VLAN used, and WLAN details.

You can also use the filters to view and analyze the required event information. To view the required lifecycle event using filters, perform the following steps:

a. In the **Lifecycle Events** section, click **Apply Filter(s)**.

b. Enter one or more of the following details:

Filter name	Description
Timestamp	Time period for which you want to view the data: • Between • After • Before
Type	Type of event for which you want to view the data: • Roam • Connect • Disconnect
Status	State of the event: • Success • Failed
AP Name	Name of the AP that is used in the event.
IPv4 Address	The IPv4 address used for the connection.
Radio ID	ID of the radio used in the event.
Impact	Impact level of the event. • Low • Medium • High
Band	The bandwidth used for the connection.
Mode	The standard wireless mode used for the connection. For example: 802.1ac
VLAN	The VLAN ID used for the connection.
WLAN	The WLAN ID used for the connection.

	NOTE: You can also click the icon in the **Lifecycle Events** table to quickly search for type, status, AP name, IPv4 address, radio ID, impact, band, RSSI, VLAN, and WLAN.

c. Click **Apply Filter(s)**.

The table in the **Lifecycle Events** section is updated with the required information for the client or host.

You can also drill-down an event to view what went wrong during the connection or the reason for the disconnection event.

2. Analyze the data for the required client or host and take actions.

Viewing an event-based connection or disconnection event

After viewing the lifecycle events for a specific client or host, you can drill-down an event to analyze what caused a failed connection or a disconnection.

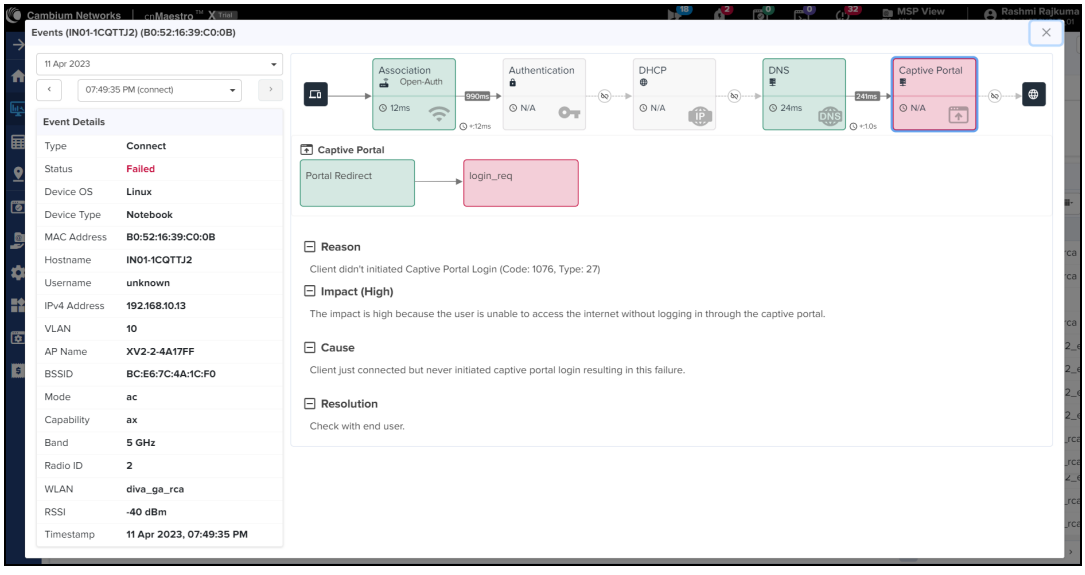
To view an event-based connection or disconnection state, perform the following steps:

1. Click **Date and Time** or **Timestamp** to view the connection or disconnection event in detail.

   You can locate a date or timestamp in the following widgets:

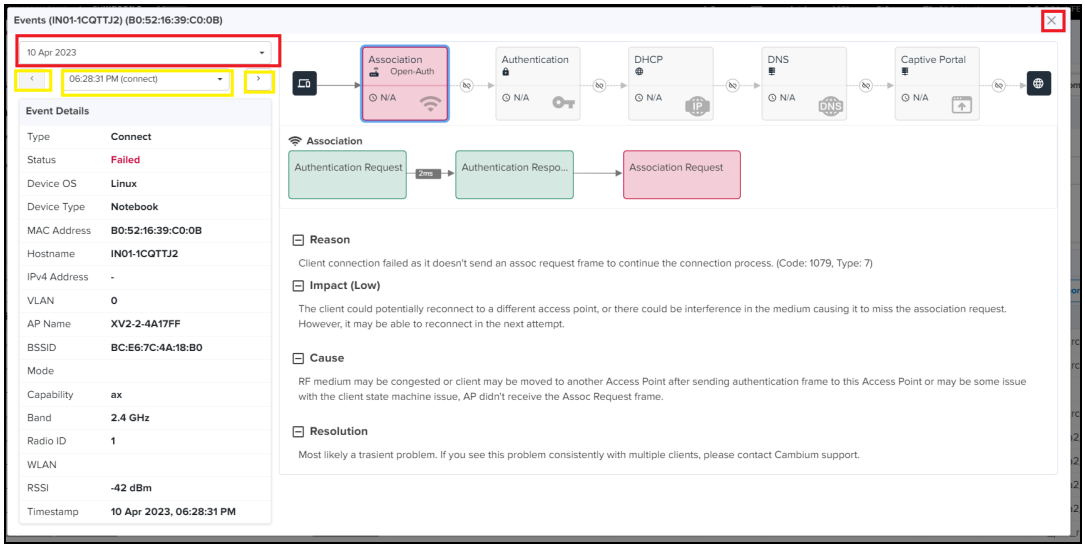
   - **Timestamp** in the **Lifecycle Events** widget available on both the **Connection** page and the **Disconnection** page)
   - **Date and Time** in the Connection Events: Last 1 hour widget on the **Connection** page
   - **Date and Time** in the Disconnect Events: Last 1 hour widget on the **Disconnection** page

   When you click on **Timestamp** or **Date and Time**, the **Events** screen displays the detailed event information.



The **Events** page provides phase-wise information with complete event details such as reason, impact, cause, and resolution. These event-based details help with troubleshooting.

2. To view an event for a specific date, you can select the required date from the date drop-down list.



Similarly, you can use **<** or **>** to view time-based events for a client. You can also select the time-based events from the drop-down list.

3. Click the ✕ icon to close the **Events** page.

Viewing an AP-specific information

You can view an AP-specific information for the required client or event and analyze the connection or disconnection data. This analysis helps identify device details used for the connection.

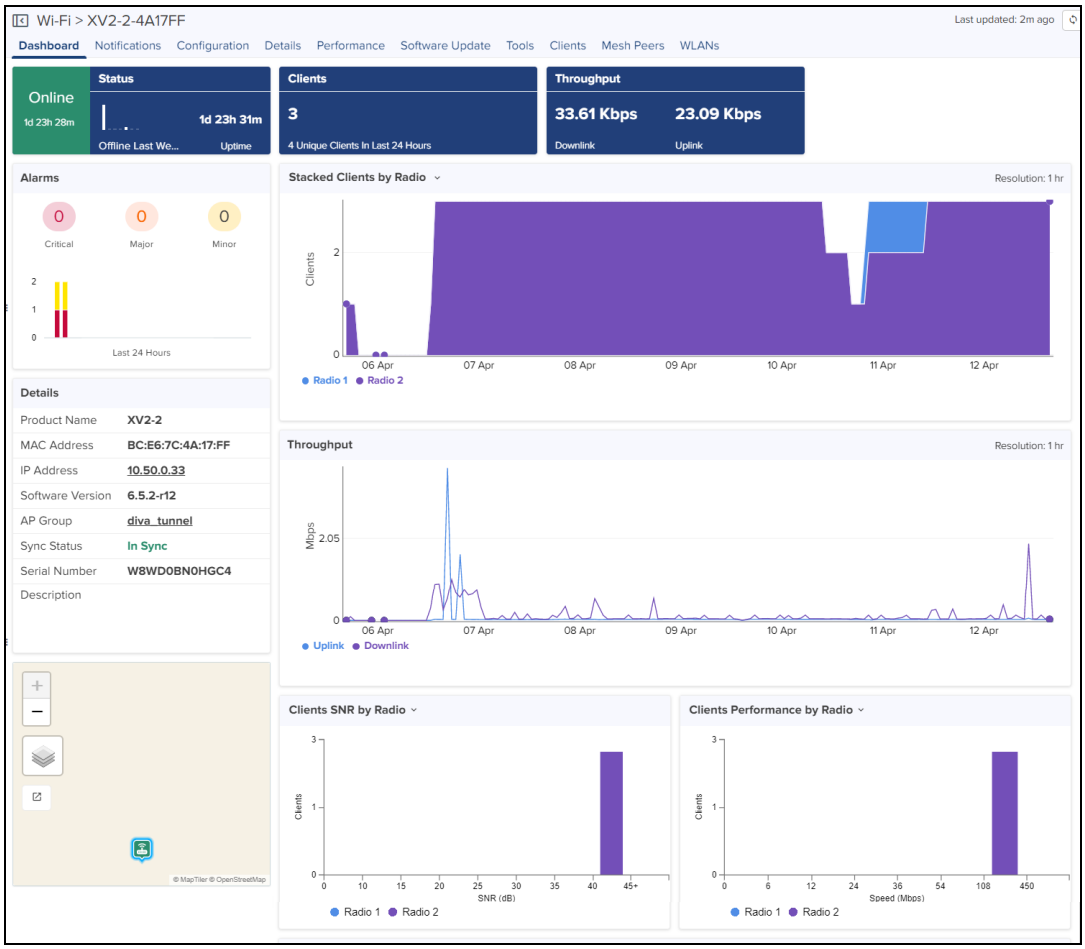
To view AP-specific information, perform the following steps:

1. Click the **AP Name** to view the data.

   You can locate an AP name in the following widgets:

   - Top Affected APs on the **Connection** page
   - Connection Events—Last 1 Hour on the **Connection** page
   - Top Reporting APs on the **Disconnection** page
   - Disconnect Events—Last 1 Hour on the **Disconnection** page
   - Lifecycle Events on both the **Connection** and **Disconnection** pages

   When you click on the required AP name, the site-specific **Wi-Fi** dashboard dispalys the AP or device information.



For more information on the AP (or device) specific dashboard, refer to the Wireless LAN Dashboards section of cnMaestro Cloud User Guide.

2. Analyze the AP data and take appropriate actions.

Managed Services

This section includes the following topics:

Managed Accounts

This section includes the following topics:

Overview

Managed Accounts allow the cnMaestro owner to partition their installation into independent accounts with their own administrators and configuration. This feature is for MSPs who want to provision a full cnMaestro account for their customers, while still maintaining control over the global deployment.

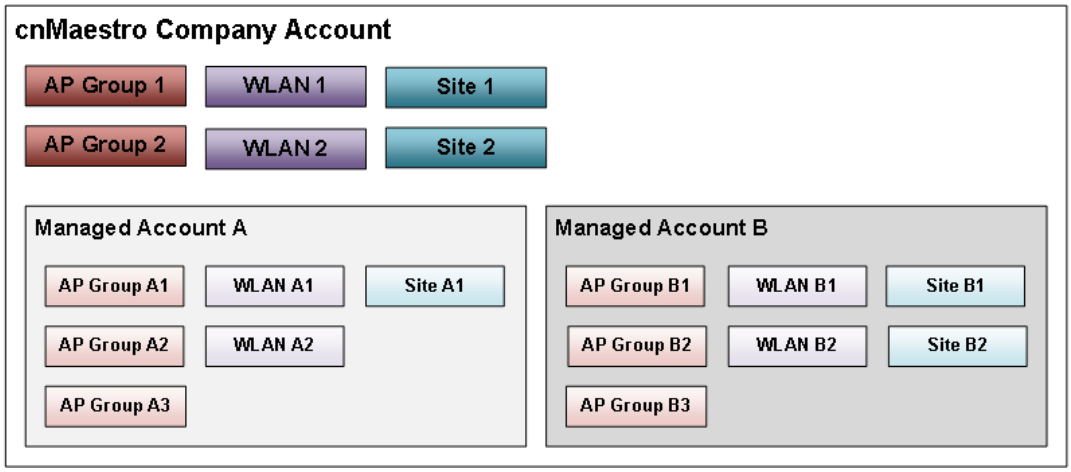
Managed Accounts

The Managed Accounts feature combines Accounts with Account Services.

Accounts

Managed Accounts group cnMaestro devices and configuration objects (such as AP Groups, WLANs, and Sites) into administration domains within a single cnMaestro deployment . Accounts are independent, and the devices added to them are configured using the objects in the Account.

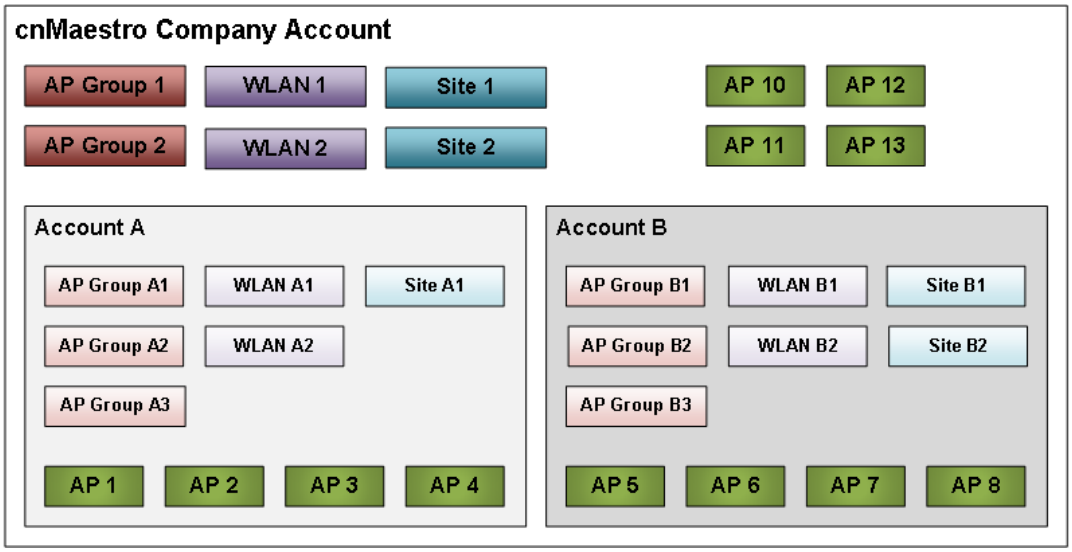
Figure 374 Accounts



Access Points

Access Points exist in the global Company Account, or they can be added to a single Managed Account. Access Points in a Managed Account are configured using the Wi-Fi Profiles in that Managed Account.

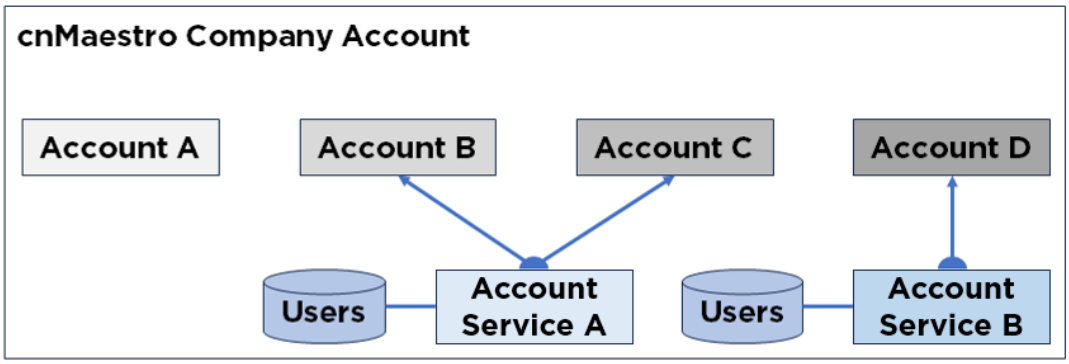
Figure 375 Access Points



Managed Account Service

A Managed Account Service creates a branded version of the cnMaestro UI. Each Account Service can be mapped to multiple Accounts.

Figure 376 Account Service



Each Managed Account Service adds the following support to an Account:

Support	Details
Administrator Database	Each Account Service has its own independent database of users who can be shared across multiple Accounts.
Custom Login URL	The path of the login URL used by the Account Service Administration can be tailored to the Account Service. The path must be unique across all cnMaestro.
Branded UI	The Account UI is customized for the Account Service through graphics, colors, and text.
Account Service Users	List of all the users mapped to the Managed Account Service. They may be mapped to zero or more associated Accounts.

Account UI

The Account UI can be customized to represent the service brand. A sample Account UI is shown below:

Figure 377 Account UI - Sample 1

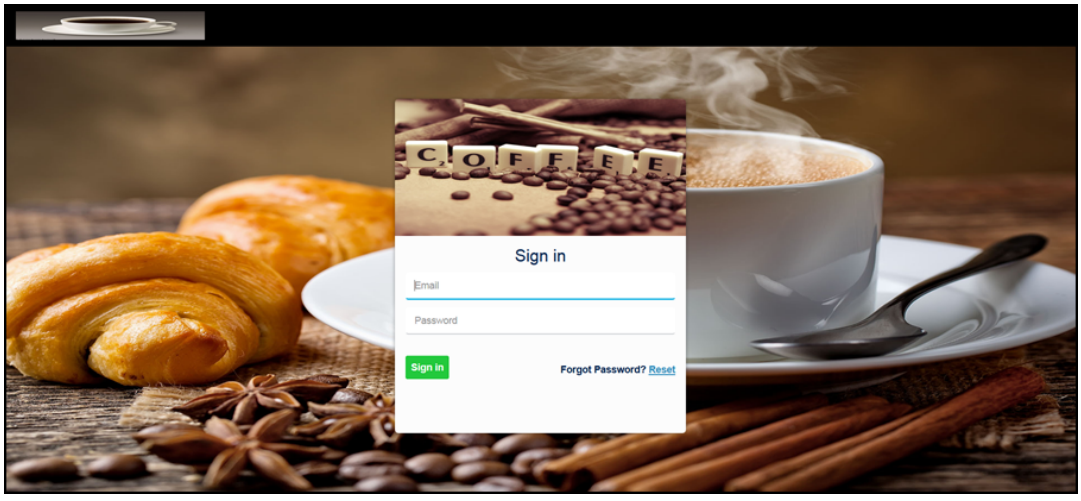
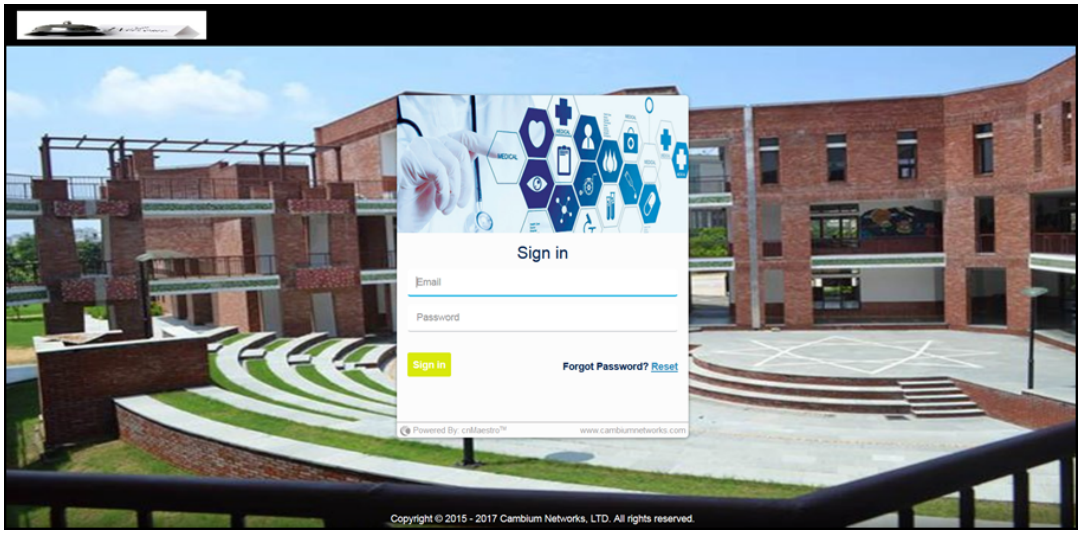


Figure 378 Account UI - Sample 2



Account Service Users (Administrators)

Account Service Users are assigned to Accounts. They access similar features as the Global cnMaestro Administrators, except they are only allowed to manage the subset of devices and objects (AP Groups, WLAN, Sites, etc.).

Account Service Users (Administrators) Roles

Account Service Users can be assigned one of three roles as shown below for each account:

- Administrator
- Monitor
- Operator

The authorizations for each Role are listed in the table below:

Table 98: Tenant Administrator Roles

Feature	Description	Administrator	Operator	Monitor
AAA Services (Global cnMaestro administrator only)	Add AAA services	None	None	None
Administration Settings (Global cnMaestro administrator only)	Change global application configuration, Onboarding settings like password change	None	None	None
API Management (Global cnMaestro administrator only)	Create API clients	None	None	None
Application	Create Networks,	All	View	View

Table 98: Tenant Administrator Roles

Feature	Description	Administrator	Operator	Monitor
Operations 1	Towers, and Sites			
Application Operations 2	Tech Dump, import/export server data, change Account Type (Enterprise or Access and Backhaul)	None	None	None
Association ACL	Configure MAC list on the controller	All	View	None
Auto-provisioning (Global cnMaestro administrator only)	Support for global auto-provisioning rules	None	None	None
Audit logs	Logs user action of different features	All	All	All
Device Operations	Reboot device, link test, connectivity test	All	All	None
Device Override	Per-device configuration changes	All	All	View
Global Configuration	Apply Configuration through Templates and AP Group	All	View	View
Guest Access Portal	Guest Access	All	View	View (Sessions)
Monitoring	Access Device Statistics Data	All	All	View
Notifications	View Alarms and Events	All	All	View
Onboarding	Approve Device Onboards	All	All	View
Reporting	Generate reports	All	All	All
Software Images (Global cnMaestro	Download device software images	All	None	None

Table 98: Tenant Administrator Roles

Feature	Description	Administrator	Operator	Monitor
administrator only)				
Software Upgrade	Upgrade device	All	All	View
System Operations	Reboot VM, change log level, system upgrade, system monitoring	None (Except System Monitoring)	None (Except System Monitoring)	None (Except System Monitoring)
User Management	Manage users, roles, and sessions	All	None	None

Configuring Managed Account Services

This section provides the following details on configuration of Account Services in cnMaestro:

- Enable Managed Accounts
- Creating Managed Account Services
- Creating Account
- Validating Account Users

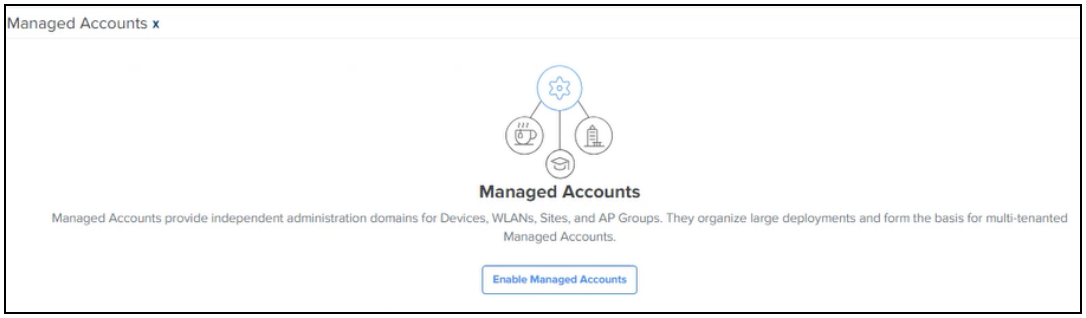
Enable Managed Accounts

By default, Account Services is disabled in the cnMaestro UI.

To enable Account Services:

1. Navigate to **Managed Services > Managed Accounts**.
2. Click the **Enable Managed Accounts.**

Figure 379 Enabling Managed Accounts



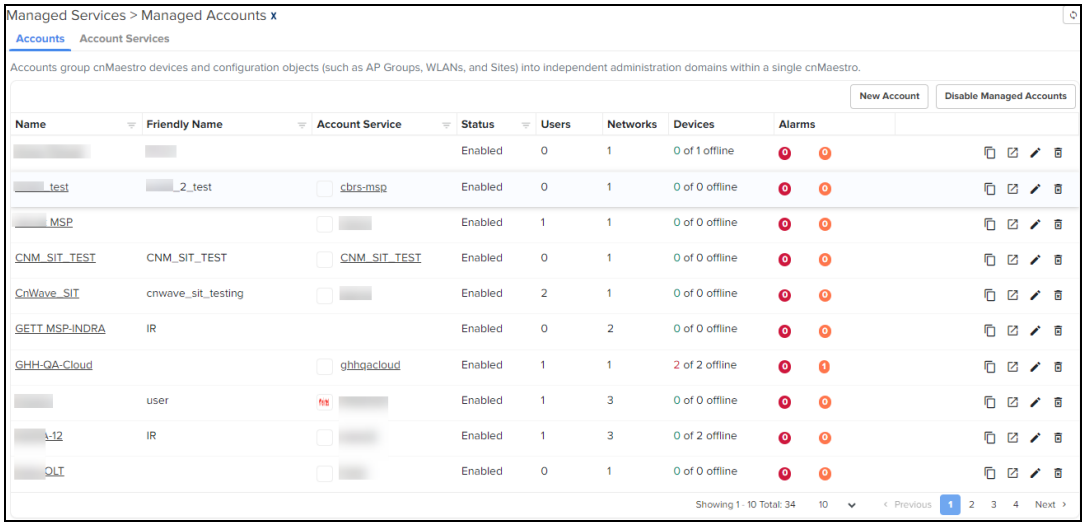
Note:

Account Services provide independent administration domains for Devices, WLANs, Sites, and AP Groups. They organize large deployments and form the basis for multi-tenanted Account Services.

Additions in the cnMaestro UI when Managed Accounts is Enabled

- Once Managed Accounts is enabled, **Accounts** and **Account Services** tabs appear in the cnMaestro UI.

Figure 380 Accounts and Account Services tabs

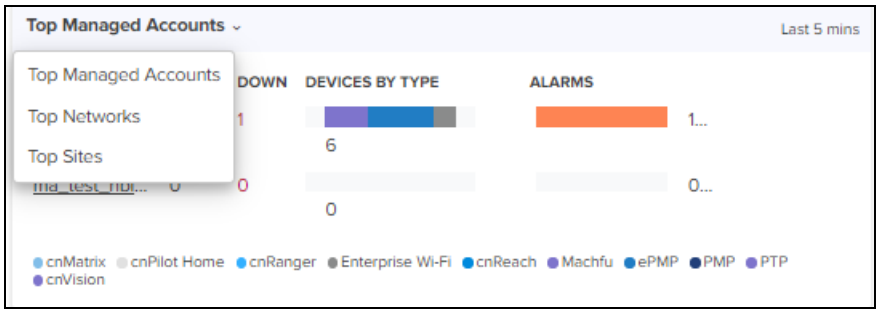


- The Header adds a select box that allows the Global Administrator to enter the context of Account selected.

Figure 381 Managed Accounts Component in Header

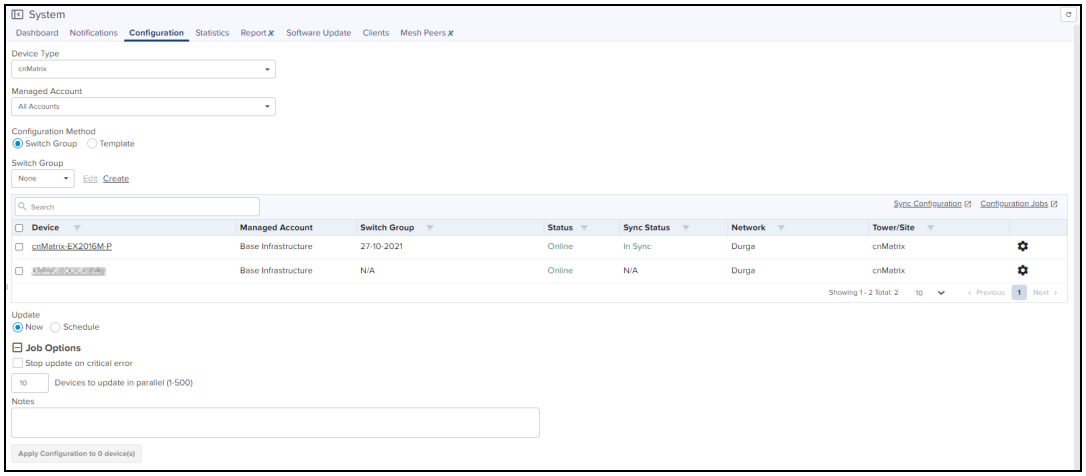
- The System Dashboard adds a Health component for Top Managed Accounts.

Figure 382 Dashboard > Top Managed Accounts



- Global tabs in the UI are updated with a Managed Account column.

Figure 383 Managed Account Column



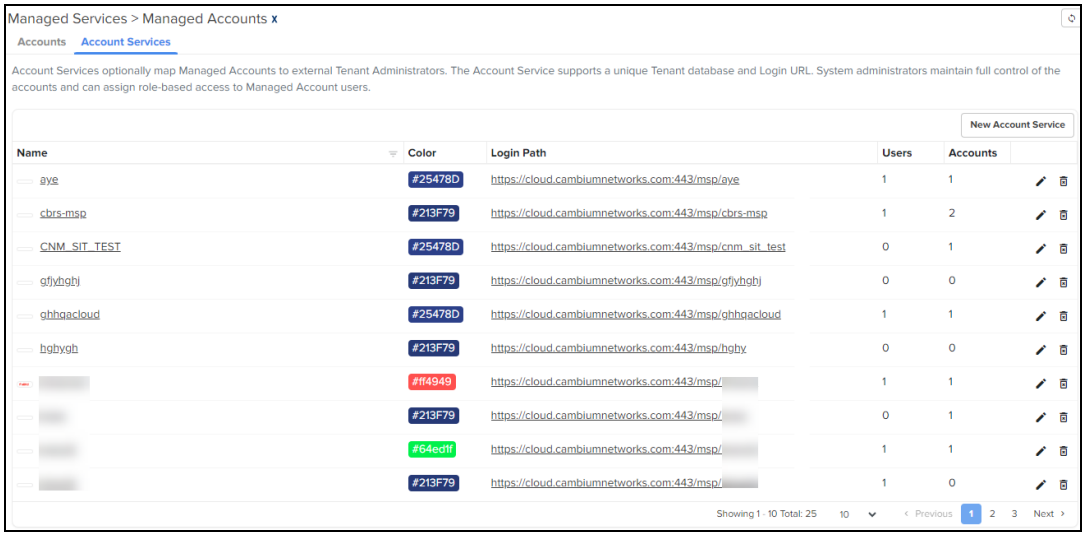
Creating Managed Account Services

The user can create an Account Service and map it to an Account. The Account Service supports an independent user database and a customized user interface. There is a default Account Service, so creating a new one is optional.

To create an Account Service:

1. Navigate to **Managed Services > Managed Accounts** > **Account Services** tab.

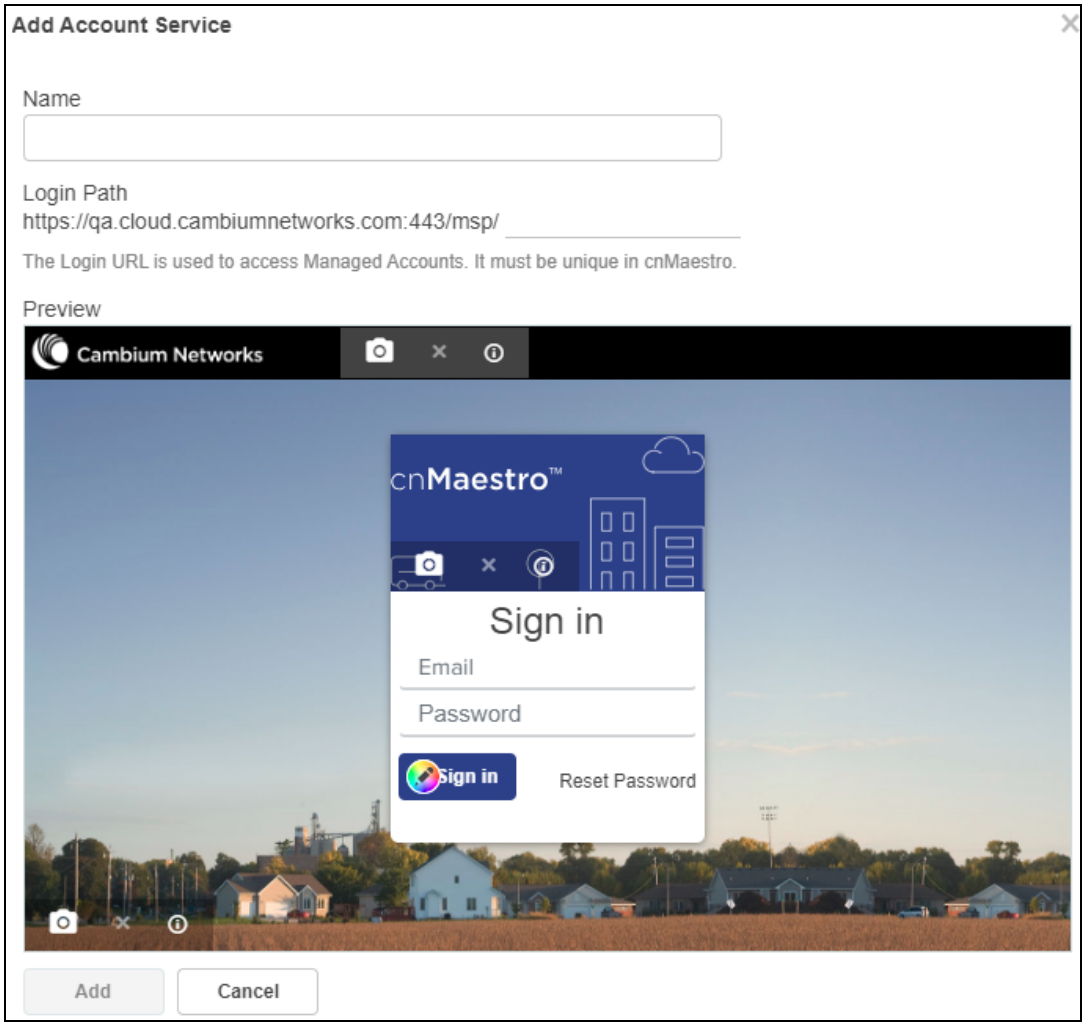
Figure 384 Account Services Tab



2. Click **New Account Service.**

   The **Add Account Service** window is displayed.

Figure 385 Add Account Service Window



3. Enter the following details:

Table 99: Parameters in the Add Account Service Window

Parameter	Description
Name	Name of the service. This name is visible to Account Administrators. A maximum of 64 characters are supported for the name.
Login Path	Account Administrators log into cnMaestro using a standard URL with an additional Path that defines the Account Service. For example: https://<cnmaestro cloud URL>/msp/<branded_service_path> **Note:** • The Path name must be unique across all Account Service accounts hosted of Cambium Cloud. • A maximum of 16 characters are supported for the path name.

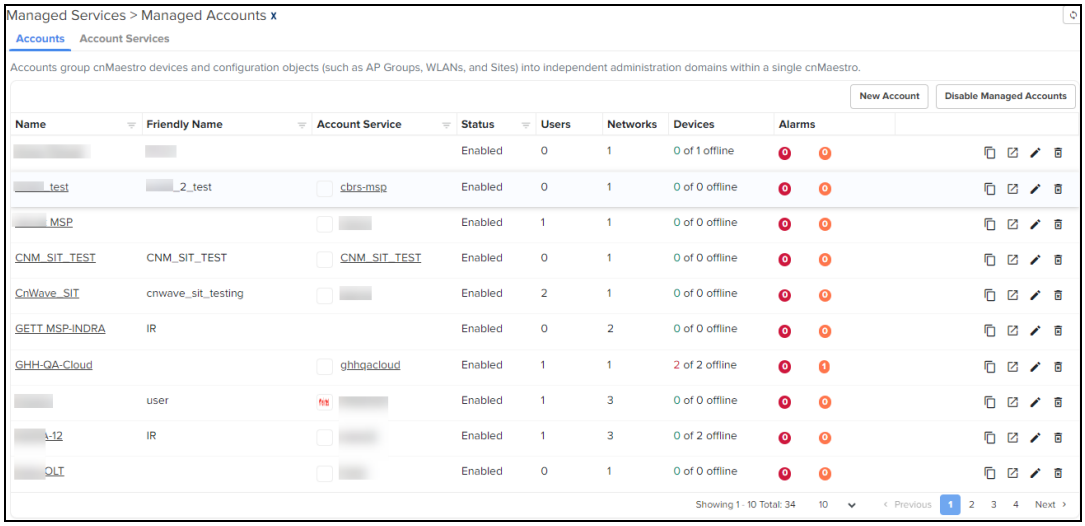
4. Click **Add**.

Creating Account

To create an Account:

1. Navigate to **Managed Accounts** > **Accounts** tab.

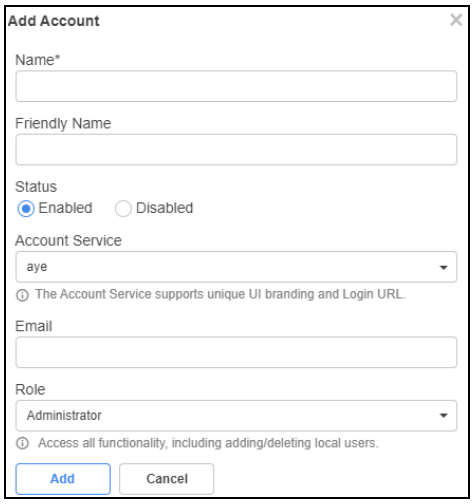
Figure 386 Accounts Tab



2. Click **New Account**.

The **Add Account** window is displayed.

Figure 387 Add Account window



3. Enter the following details:

Table 100: Parameters in the Add Account Window

Parameter	Description
Name	Name of the Account. This is sent in the invitation email when users are invited to the account.
Friendly Name	The Friendly Name will be sent in the invitation email.
Status	Determines whether the account is enabled or disabled. When an account is disabled,

Table 100: Parameters in the Add Account Window

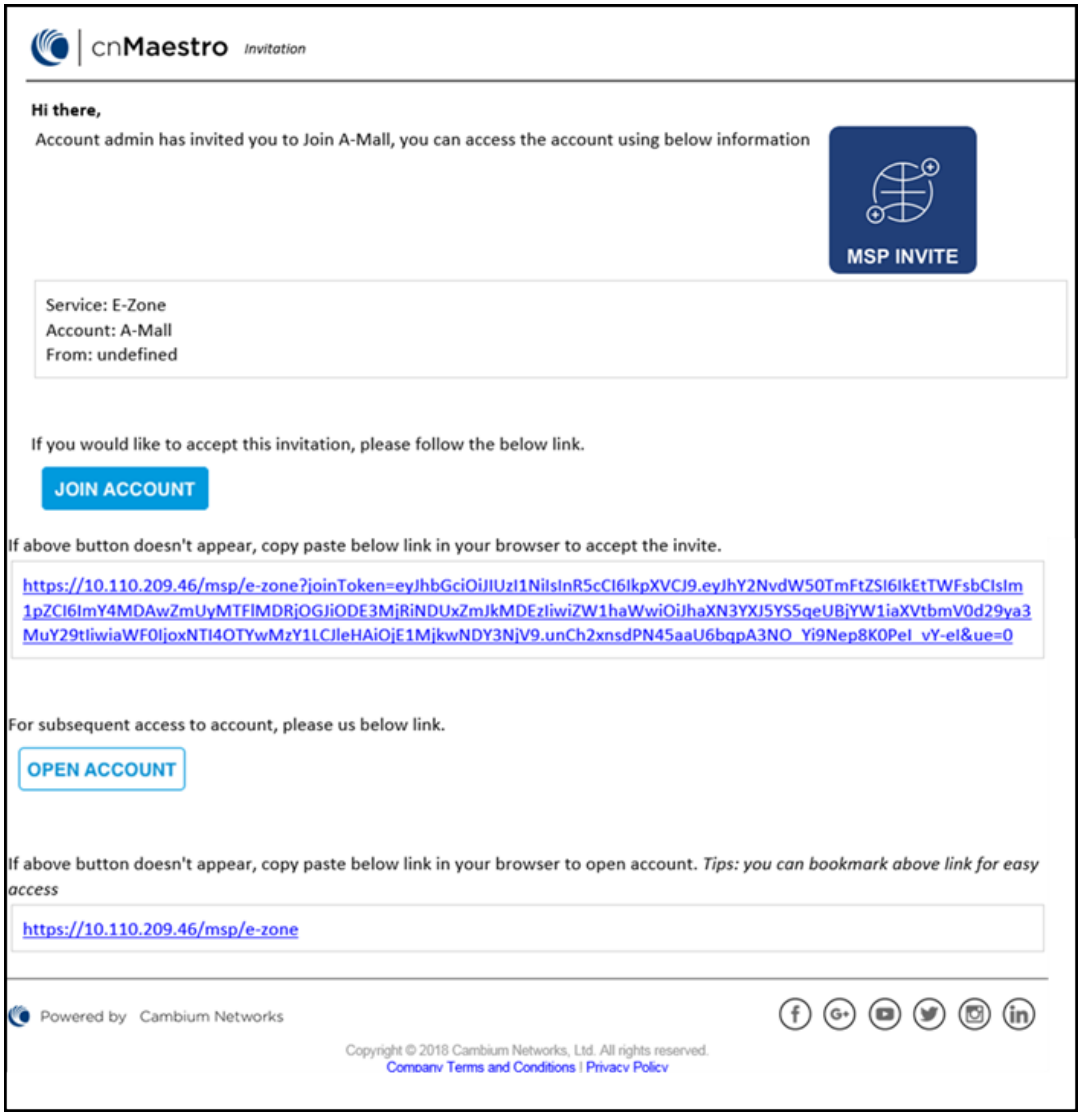
Parameter	Description
	all Account Users (users) are logged out.
Account Service	The Account Service used for branding and authentication.
Email	The email address of the first Account User. You can add more users after the account has been created.

4. Click **Add**.

Validating Account Users

Once an Account is created, the Account User is sent an email invitation. The email provides directions on how to access the Account UI and set their password.

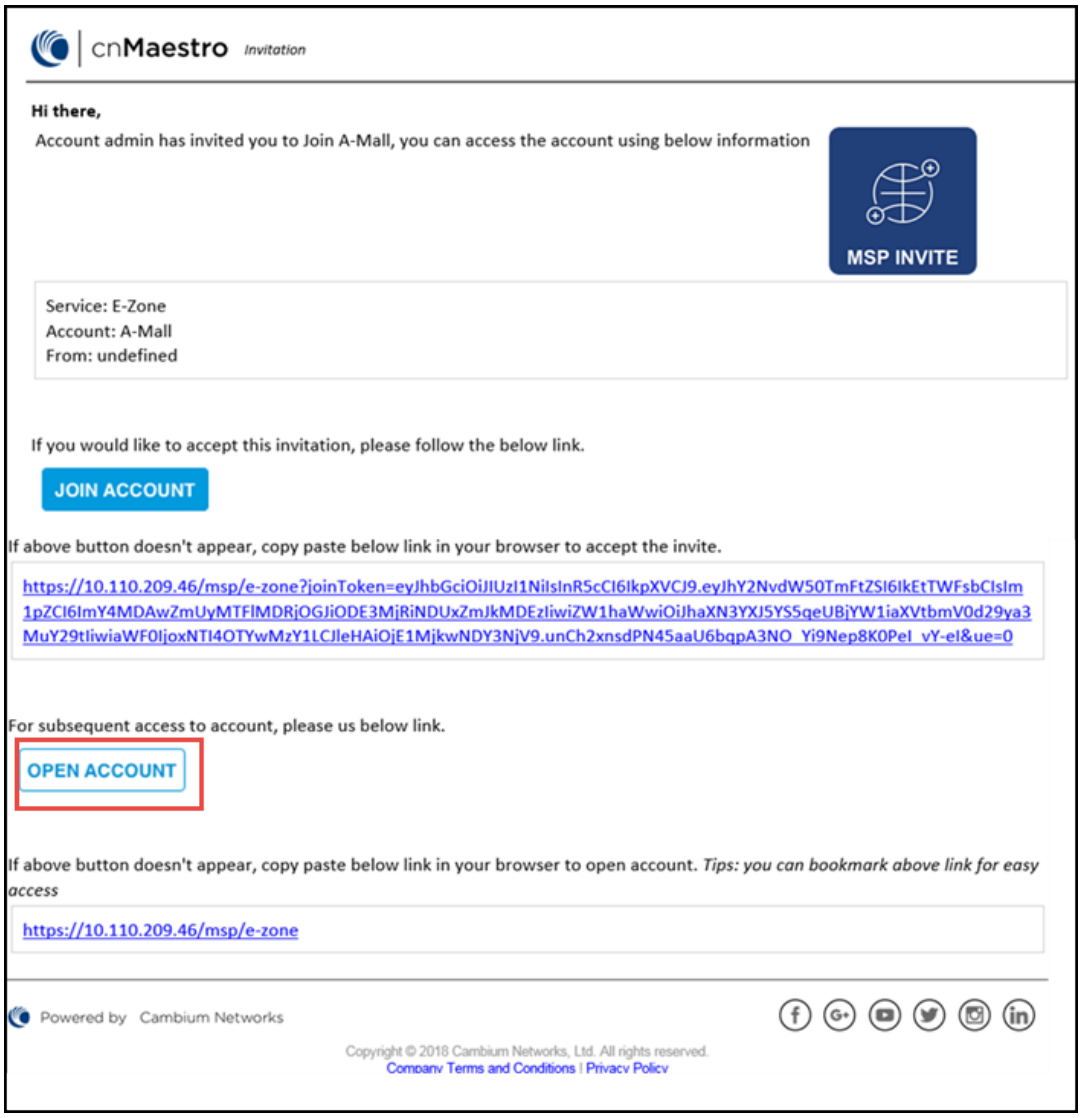
Figure 388 Sample Email Invitation



Check Email for Invite

An email is sent inviting the Account User to view their new Managed Account. It has a link that must be clicked to enable access.

Figure 389 Checking Account Administrator User Email



Create Account in Account Service

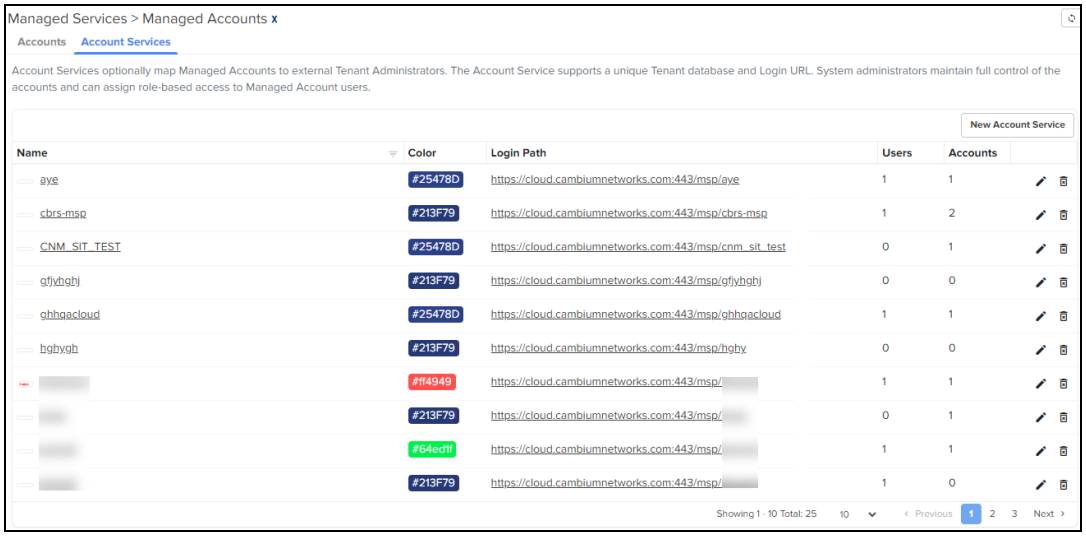
Clicking the link prompts the user to create a new Account or use an existing Account.

	NOTE: If a user already has an Account in the Account Service, they can use their existing email login to accept the invite for the new Account. In the global cnMaestro UI, switching between accounts is accomplished using the choice box in the UI header (upper right).

Login to the Accounts UI

Once the Account Administrator (User) is created, use the URL listed in the **Login Path** column to login.

Figure 390 A Sample Login URL



Managed Account Administration

Overview

Once Managed Accounts are enabled, there are three ways to administrator the Accounts.

- System View
- Account View
- Account Administrator (User) View

Important Points to Remember

Please note the following points for Account Services administration:

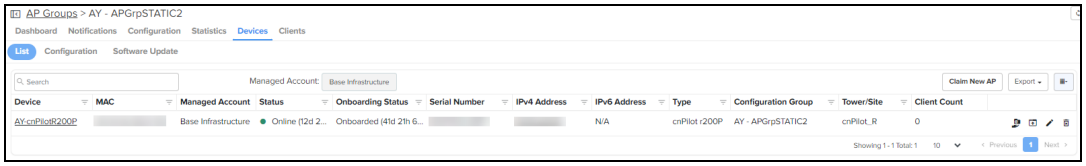
NOTE:

- When a device is moved from one Account to other, it goes offline for one minute before appearing online. Only active alarms are moved to the new account and other data is retained in the old account.
- The Managed Accounts feature can be disabled only if all devices in Accounts are deleted or moved to Base Infrastructure account.
- Administrators of Accounts do not have access to the settings page of the server to change the account type.
- When Global Super Administrators trigger Configure/Software/Reports Jobs, the Account users cannot view them.
- When Account Users trigger Configure/Software/Reports Jobs, they are reflected under the Global Super Administrator view along with respective Job IDs enrolled in the respective Accounts.
- The devices that have not started Software/Configure Jobs cannot be moved across Accounts.
- The Global Super Administrator and the Account Administrator cannot trigger a Software or Configure Job simultaneously on the same device.
- The Lock AP configuration can be enabled only by the Global Super Administrator. But whenever a device configuration is changed outside of cnMaestro by either a Global Super Administrator or an Accounts Administrator, the Auto Synchronization Job starts automatically with the configuration job ID as in Accounts and reflects in both the Global Super Administrator and Accounts Administrator accounts.

System View

At the System level, one can view APs, AP Groups, or Sites across all Managed Accounts in a single, unified table. This allows one to review the status of all accounts in context to each another. The following figure displays the AP table, and specifies which APs are mapped to Accounts.

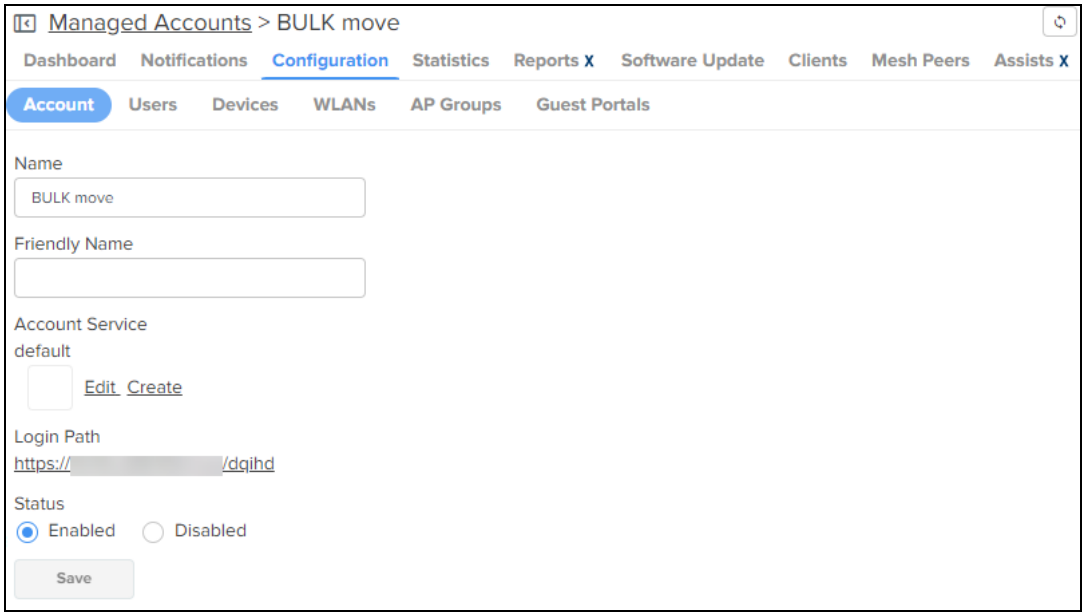
Figure 391 System View



Account View

The **Managed Accounts** > **Accounts** page allows you to select individual Accounts, which launches the Account View. This provides full status and configuration for all components of the Account, including Dashboard, Notifications, Configuration, Software Update, Reports, Clients, etc.

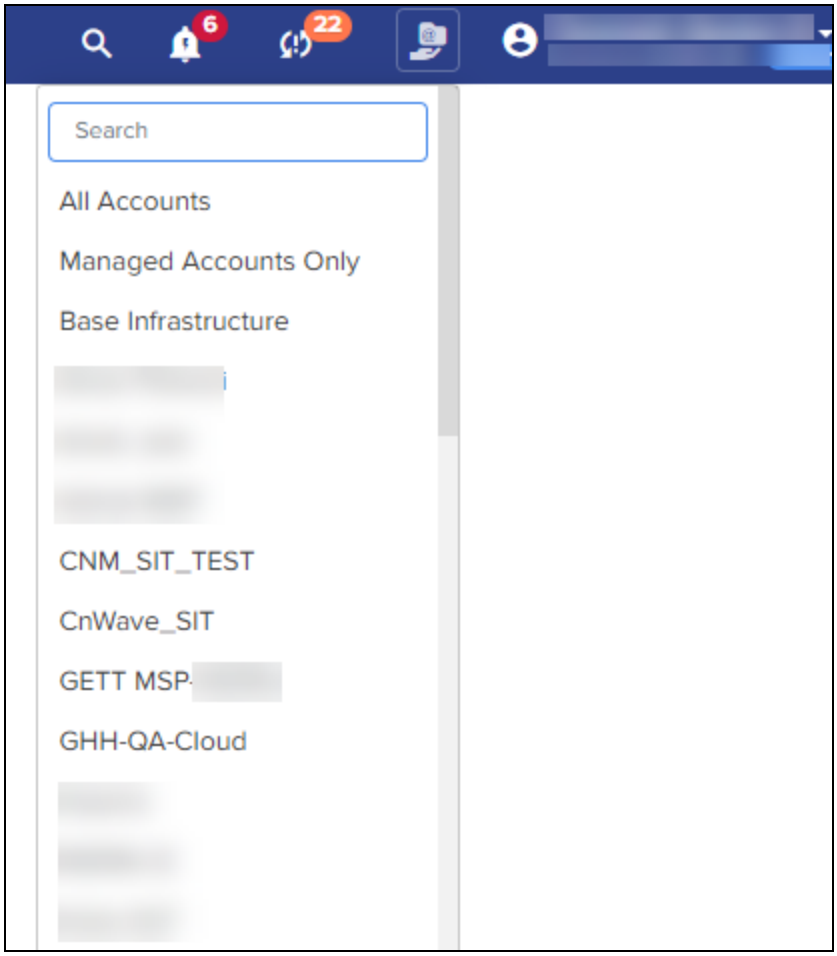
Figure 392 Account View



Account Administrator (User) View

The Account Administrator View presents the branded Account UI, without having to explicitly log into it. It is accessed through the Account drop-down in the UI header. Selecting a specific Account (rather than **All**) updates the UI to the Account Administrator's view. From here, the Global Administrator can update the configuration and monitor issues.

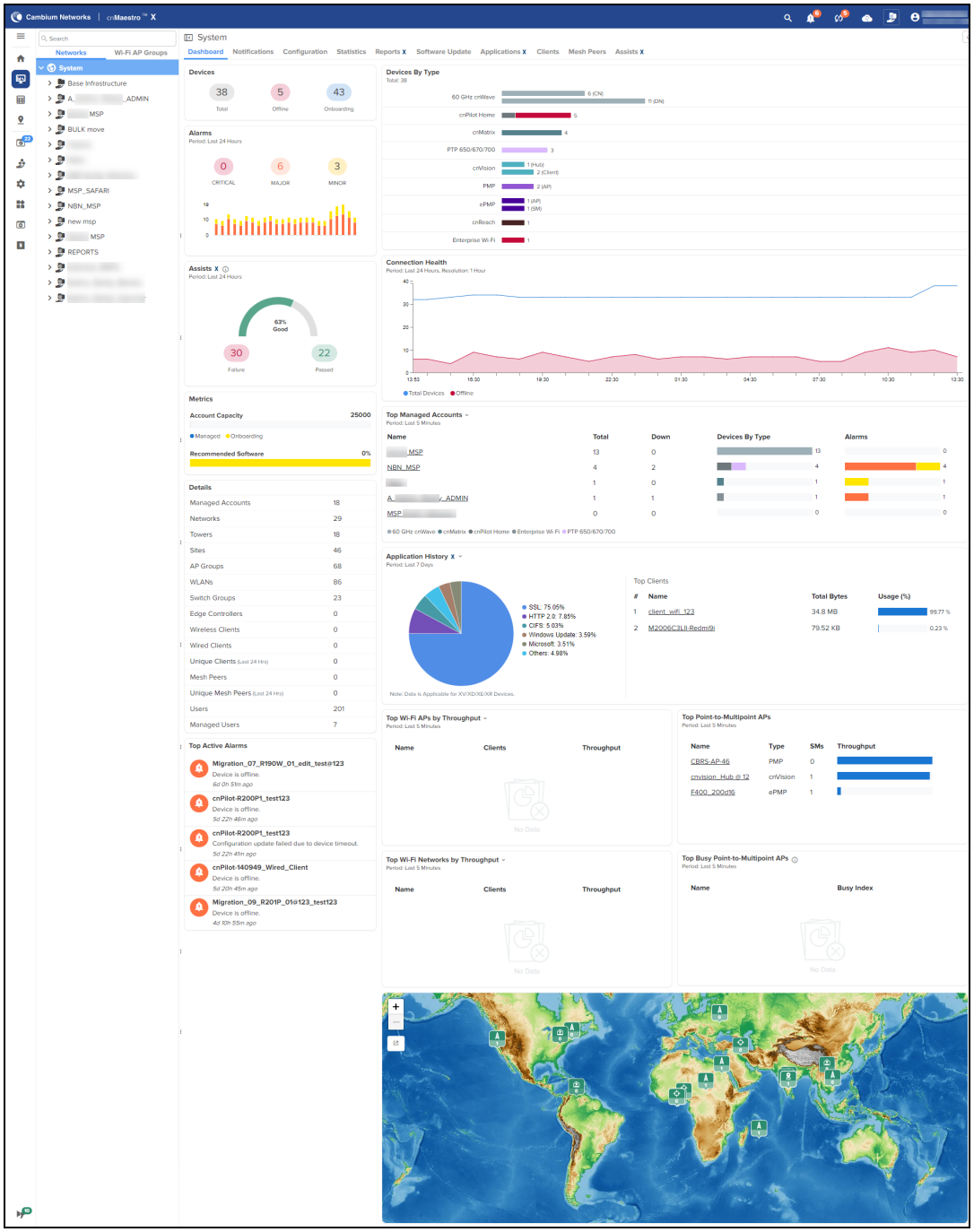
Figure 393 Managed Account Administrator (User) View



System Dashboard

The System Dashboard integrates Accounts into the global health component. It ranks the top Accounts based upon device count.

Figure 394 System Dashboard



Account Administration

AP Groups, WLANs, and Switch Groups have three types of accessibility scope as shown below:

Table 101:

State	Description
Base Infrastructure	The object is only available for the global account.
Managed Account	The object belongs to a Managed Account.
Shared	The object is shared among all Managed Accounts. It can be mapped to devices in the Account, but it cannot be modified. To change the configuration, it needs to be copied into the Account and then updated.

NOTE:
Once the scope has been configured on an object, it cannot be changed.

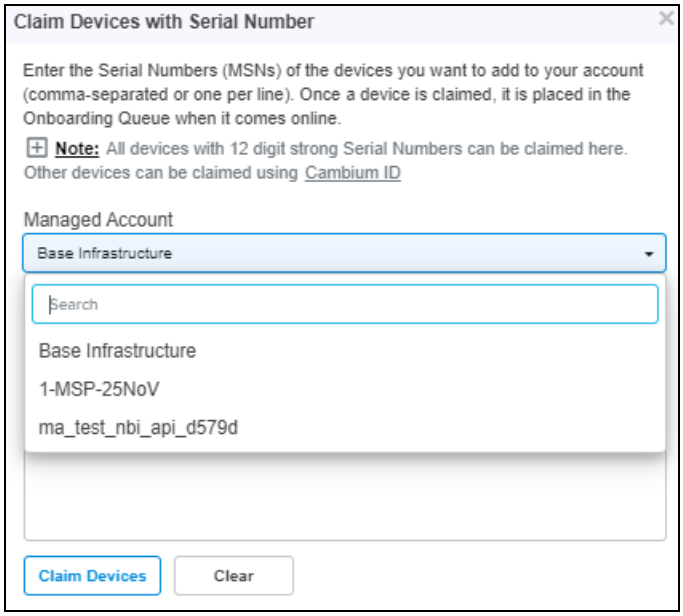
Device Management

Devices are added at the global System level or within Managed Accounts. Devices added at the System level can be moved into Accounts at a later time.

System Onboarding

Onboarding at the global System level supports both MSN and Cambium ID. In the example below, a Management Account can be selected for all devices onboarded in the MSN batch.

Figure 395 System Onboarding



Device Onboarding

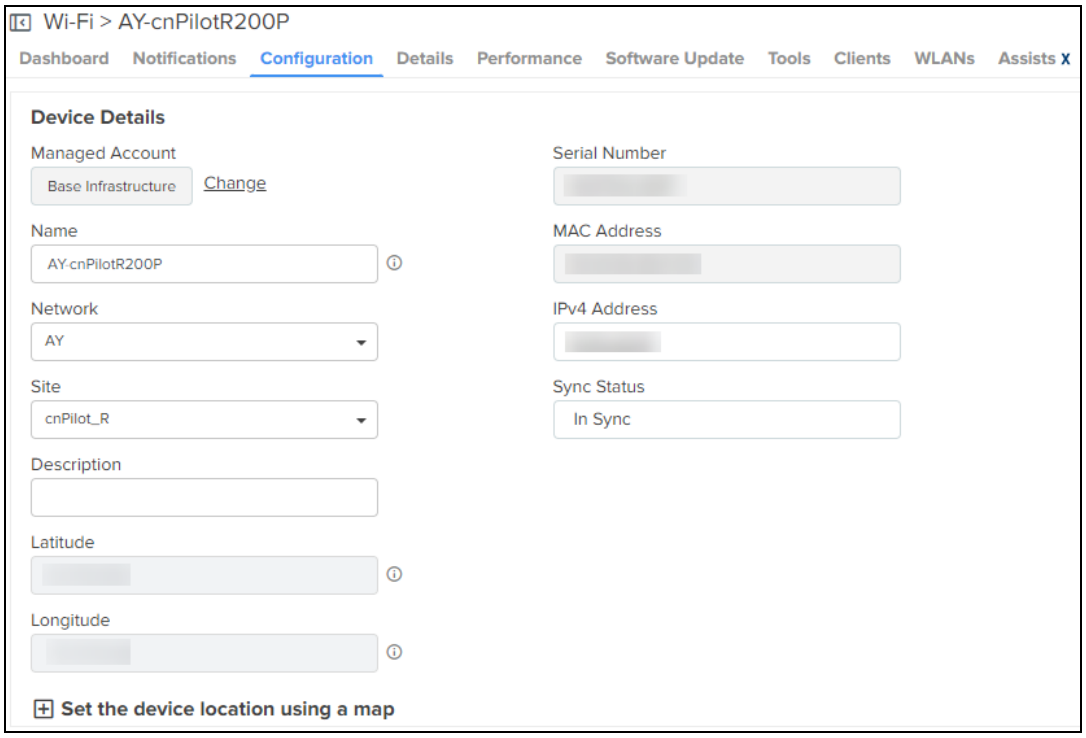
Onboarding devices through the Managed Account UI automatically places the devices in the Account.

NOTE:
cnMaestro supports onboarding through either MSN or Cambium ID. Within Accounts, only MSN onboarding is supported.

Moving a Device Between Accounts

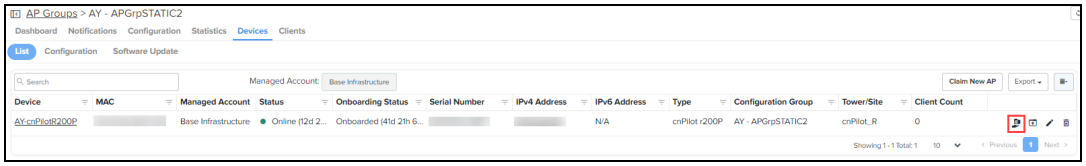
You can move a device from one Managed Account to another by using the **Change** option in the device configuration page.

Figure 396 Moving a Device Between Accounts



In Enterprise view, the device can be moved between Accounts using the **Managed Account** ( ) icon in the **AP Groups** > *<AP-group-name>* > **Devices** > **List** tab.

Figure 397 Moving a device between Accounts in Enterprise View

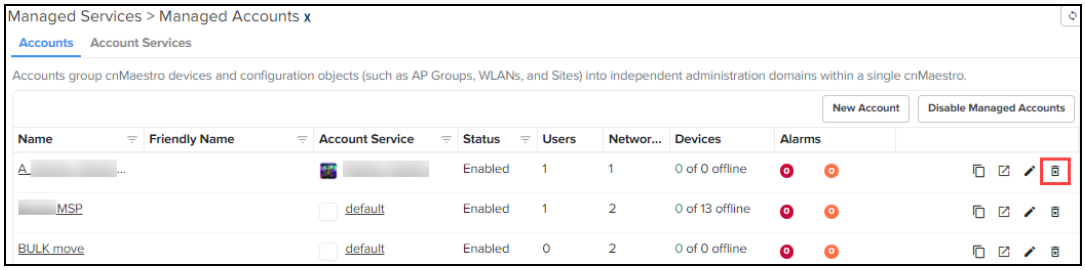


Account Deletion

	NOTE: All devices must be removed from the Account before deleting the account.

To delete a Managed Account, navigate to the **Account Services** page and click the delete icon.

Figure 398 Account Deletion



Disabling the Managed Accounts feature

The Managed Accounts feature can be disabled within the system only after all the devices are deleted or moved to the Global context. By disabling Account Services, the Account field will be disabled across all the tables such as Clients, Notifications, Inventory, etc.

NOTE:
In the current release, only the global administrator of On-Premises account has control on the following features:

- Association ACL
- Auto-Provisioning
- Scheduled Backup
- Server Settings
- SMTP Server
- SNMP Configuration

Network Services

This section includes the following topics:

API Client

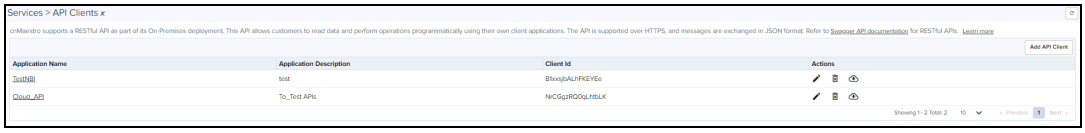
Overview

The cnMaestro RESTful API allows customers to manage their deployment programmatically using their own client applications. The API is supported over HTTPS, and messages are exchanged in JSON format. Modern programming languages have rich support for RESTful interfaces.

	NOTE: cnMaestro currently provides monitoring data over the API (such as inventory, statistics, events, and alarms).

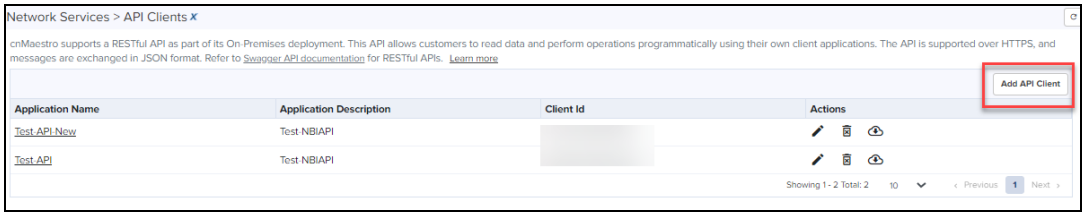
API Clients

API Clients are external applications that access the RESTful API over HTTPS using OAuth 2.0 Authentication. They require a Client ID and Client Secret for access, both of which are detailed later in this chapter. For more information, refer to RESTful API Specification.

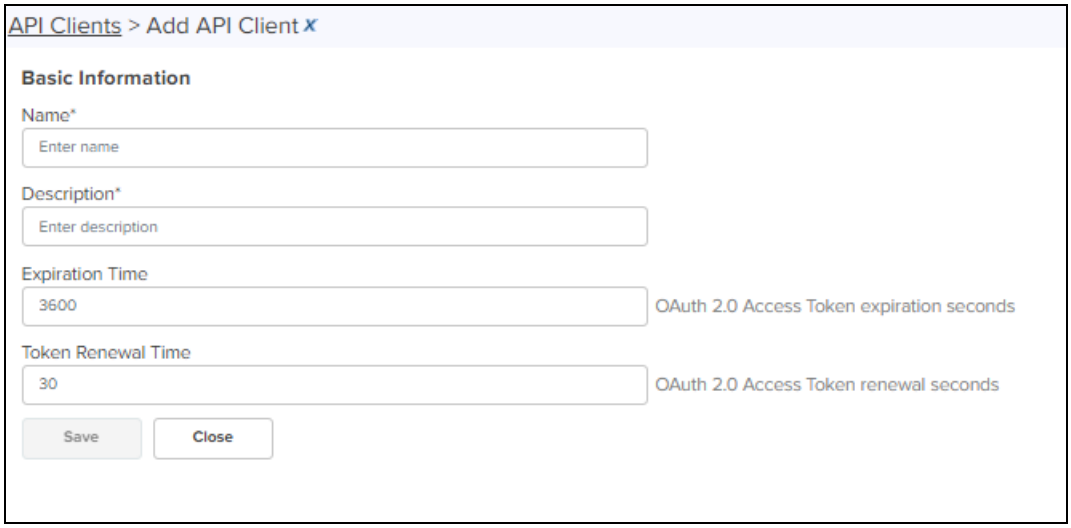


To add **API Client**:

1. Navigate to **Network Services > API Clients**.



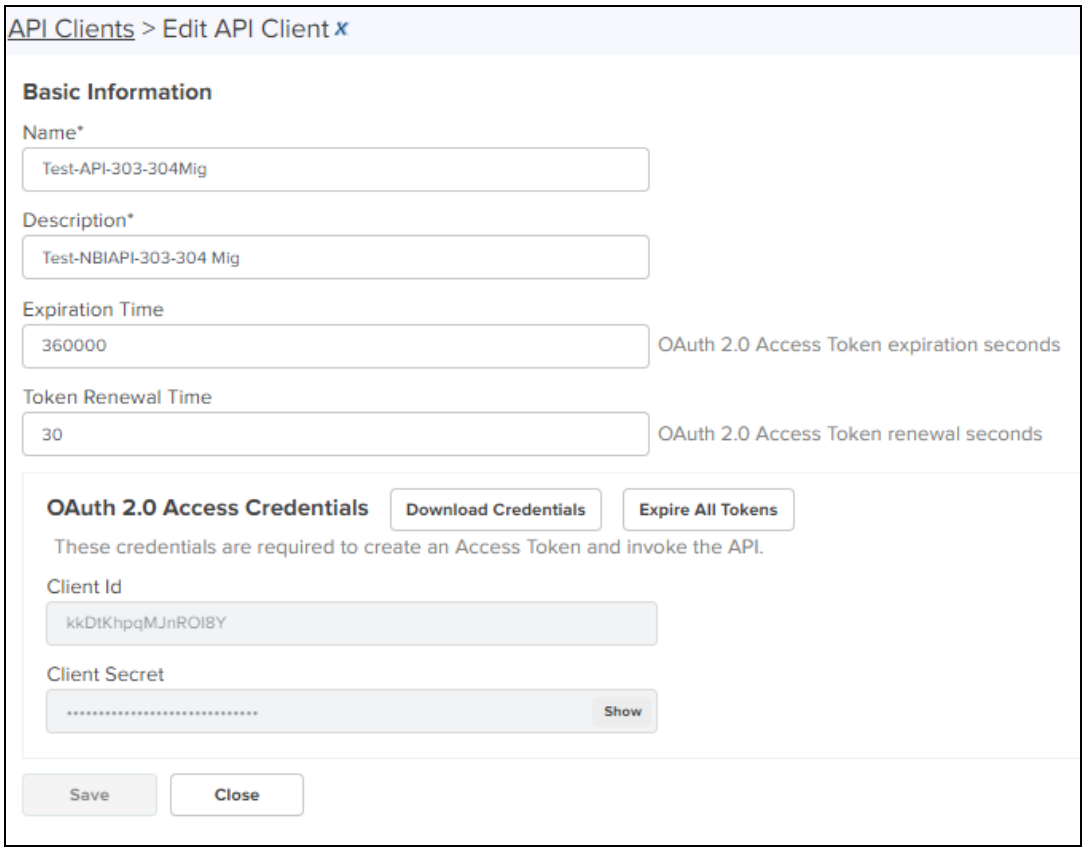
2. Click **Add API Client**.



3. Enter **Name**.
4. Enter **Description**.

5. Enter **Expiration Time**.
6. Enter **Token Renewal Time**.
7. Click **Save**.

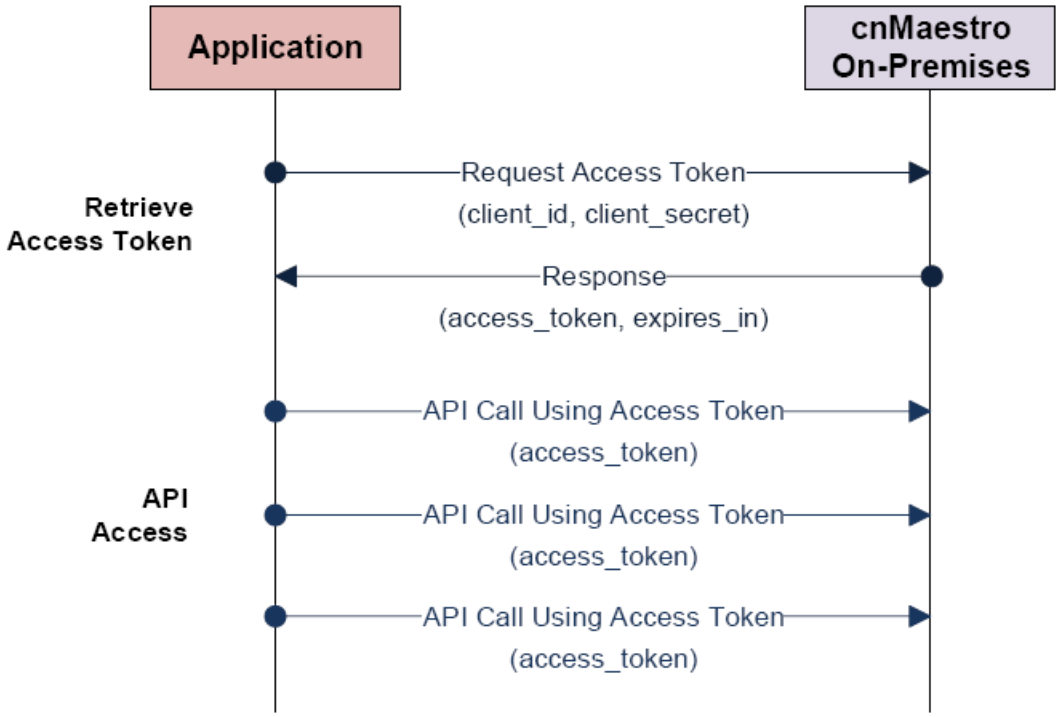
Once the API Clients is added you can able to view or download credentials shown in the **OAuth 2.0 Access Credentials.**



RESTful API Specification

Authentication

API Authentication uses OAuth2. The client retrieves an Access Token to start the session. It then sends API requests until the Access Token times out, at which point the token can be regenerated.



Establish a Session

A session is created by sending the Client ID and Client Secret to the cnMaestro server. These are generated in the cnMaestro UI and stored within the application. The Client ID defines the cnMaestro account and application, and the Client Secret is a private string mapped to the specific application. The Client Secret should be stored securely.

If the session is established successfully, an Access Token is returned along with an expiration string. The Access Token is used to authenticate the session. The expiration is the interval, in seconds, in which the Access Token remains valid. If the Access Token expires, a new session needs to be created.

API Access

The application sends the Access Token, in every API call. The token is sent in an Authentication header. Details are provided later in this document.

Session Expiration

If a token expires, an expiration error message is returned to the client. The client can then generate a new token using the Client ID and Client Secret. The token expires immediately if the Client API account is deleted. The default expiration time for a token is 3600 seconds (1 hour). The session expiration is configurable in the UI.

Rate Limiter

The Rate Limiter API request helps in improving the availability of API based services by avoiding resource starvation.

This API calculates the rate limit per customer based on various factors such as system configuration, number of devices onboarded, Network, Towers, Sites, etc.

The API limits the number of NBI API calls to a single cnMaestro account per minute. Once the limit is reached, the API receives a standard HTTP Response Status code such as 429 or 503.

HTTP Response Status Code	Response Headers	Explanation	Action to be taken
429	RateLimit-Limit: 10	Number of API calls allowed for the cnMaestro account per minute	If the **RateLimit-Remaining** value is 0, then the client application waits for the number of seconds to **Reset-RateLimit** before sending the next subsequent API requests
	RateLimit-Remaining: 0	Number of remaining API calls for the current minute is zero	
	RateLimit-Reset: 35	Number of seconds remaining to reset the rate limit	
503	Retry-After	Number of seconds during which users wait before retrying	If the value of **Retry-After** is greater than 0, then the client application waits for the number of seconds to **Retry-After** before sending the next subsequent API requests

The following table below displays the approximate limit calculated by the system on a 4 vCPU, 8 GB RAM Cloud instance.

Devices	GET	POST/Others
101	10	3
501	24	3
1001	47	5
2001	92	10
4001	163	17

Example of a Python client:

```
import sys
import requests
import json
import base64
import time

HOST = # host here
CLIENT_ID = # client id here
CLIENT_SECRET = # client secret here
TOKEN_URL = # token url here

# Retrieve access parameters (url, access_token, and expires_in).
def get_access_parameters(token_url, client_id, client_secret):
    """
    Authenticates to API.
    Parameters:
        `token_url` - Endpoint to authenticate to\n
        `client_id` - Auth client id\n
        `client_secret` - Auth client secret\n
    Returns:
        `(access_token, expiry)`
    """
    data = "%s:%s" % (client_id, client_secret)
    encoded_credentials = base64.b64encode(data.encode('ascii')).decode('ascii')
    headers = {
      "Authorization":"Basic %s" % encoded_credentials,
      "Content-Type":"application/x-www-form-urlencoded"
    }
    body = "grant_type=client_credentials"
    r = requests.post(token_url, body, headers=headers, verify=False)
    print ("Status Code: %s" % r.status_code)
    return r.json()['access_token'], r.json()['expires_in']

def call_api(method, host, path, access_token):
    """
    Makes HTTP call to an API with given method.
```

```
    Parameters:
        `method` -
 method for the new Request object: GET, OPTIONS, HEAD, POST, PUT, PATCH, or DELETE\n
        `host` - host for the url\n
        `path` - path for the url\n
        `access_token` - a valid access token for header
    Returns:
        `(response_status_code, headers, body)`
    """
    api_url = "https://%s%s" % (host, path)
    headers = {
      "Authorization":"Bearer %s" % access_token,
    }
    response = requests.request(method=method, url=api_
url, headers=headers, verify=False)
    headers = response.headers
    body = response.json()
    response_status_code = int(response.status_code)
    return response_status_code, headers, body


def main():


    try:
        # Getting the access token using client id and client secret
        access_token, expires_in = get_access_parameters(TOKEN_URL, CLIENT_ID, CLIENT_
SECRET)


        # For the purpose of the example, let's send 100 requests back to back
        for i in range(100):
            # Calling the endpoint with GET method
            status_code, header, body = call_api
('GET', HOST, '/api/v2/devices/statistics', access_token)
            # identifying any client or server side error codes
            client_errors = (status_code - status_code%100) == 400
            server_errors = (status_code - status_code%100) == 500


            # handling error status code
```

```
        if client_errors or server_errors: # check for all 400 and 500 responses
            print("Failure: [%s]-[%s]" %(status_code, (json.dumps(body, indent=2))))
            # For 429, wait until `RateLimit-Reset` seconds
            if (status_code == 429):
                sleep_time = 10 # default wait time
                # try block prevents any dict value exception
                try:
                    # Reading the header
                    sleep_time = int(header["RateLimit-Reset"])
                except: pass
                # if sleep_time is not greater than 0, defaulting to 10 seconds
                sleep_time = sleep_time if sleep_time > 0 else 10
                print("Sleeping for %d seconds" % sleep_time)
                # sleeping the main thread
                time.sleep(sleep_time)
            if (status_code == 503):
                sleep_time = 10 # default wait time
                # try block prevents any dict value exception
                try:
                    # Reading the header
                    sleep_time = int(header["Retry-After"])
                except: pass
                # if sleep_time is not greater than 0, defaulting to 10 seconds
                sleep_time = sleep_time if sleep_time > 0 else 10
                print("Sleeping for %d seconds" % sleep_time)
                # sleeping the main thread
                time.sleep(sleep_time)
        else:
            # process response
            print("Success: [%s]" %(json.dumps(body, indent=2)))

except Exception as E:
    print("Failure: [%s]"%E)
    sys.exit()
```

```
if __name__ == "__main__":
    main()
```

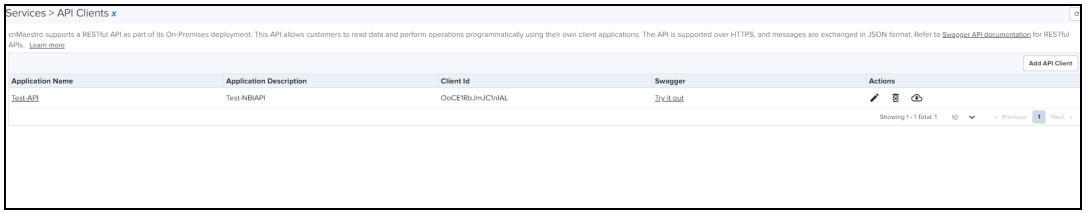
Swagger API

Introduction

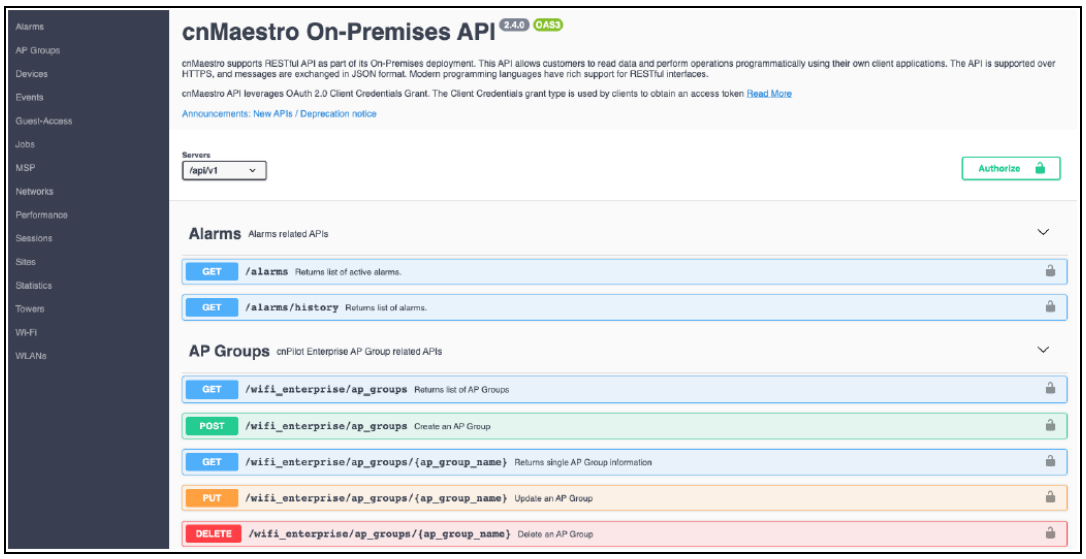
The RESTful API documentation is supported through Swagger, which allows visualization and interaction with the API resources.

To access Swagger, perform the following steps:

1. Navigate to **Services > API Client** grid.
2. Click **Swagger API documentation**.



Sample Swagger UI



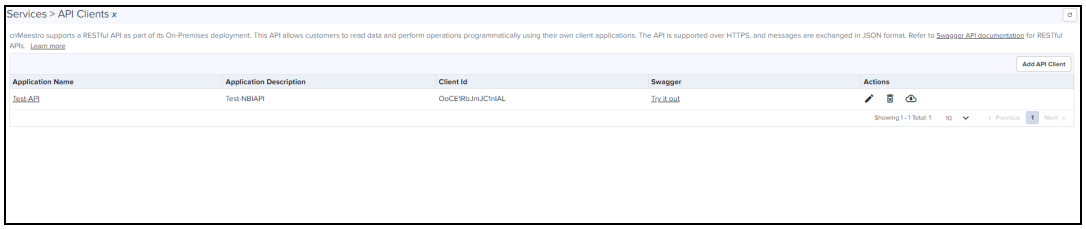
Generating Client ID and Client Secret

cnMaestro User Interface

To create the Client Id and Client Secret in the cnMaestro UI, perform the following steps:

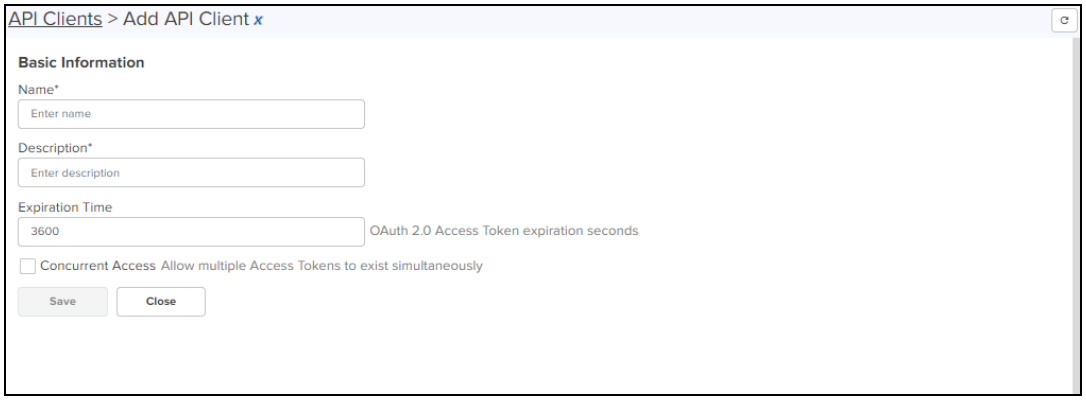
1. Navigate to **Services > API Client**.

   Each client application should be added as an API Client.



2. Click **Add APIClient** to add a client.

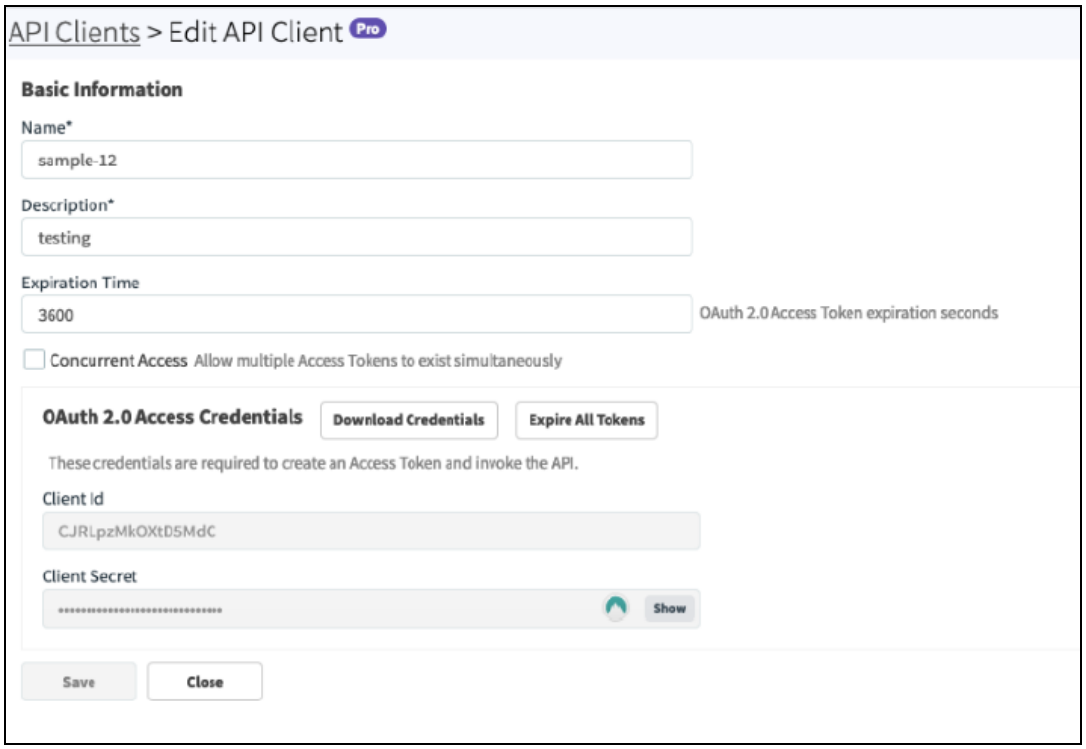
   Add API Client window pops up.



3. Enter **Name** and **Description**.
4. Click **Save**.

Download the Client Id and Client Secret

You can download and store the Client ID and Client Secret by clicking **Download Credentials**. The Client Id is required to create an API session.



API Session

Introduction

The cnMaestro API leverages the Client Credentials section of the OAuth 2.0 Authorization Framework (RFC 6749). An API session can be created using any modern programming language. The examples below highlight how messages are encoded and responses returned.

Retrieve Access Token

Access Token Request (RFC 6749, section 4.4.2)

To generate a session, the client should retrieve an Access Token from cnMaestro. This is done by base64 encoding the **Client_ID** and **Client_Secret** downloaded from the cnMaestro UI and sending them to the cnMaestro server. The **Authorization** header is created by base64 encoding these fields as defined below.

NOTE:

The fields are separated by a colon (:).

```
Authorization: Basic BASE64(<client_id>:<client_password>)
```

In the body of the **POST** the parameter **grant_type** must be set to **client_credentials.**

```
POST /api/v2/access/token HTTP/1.1
Host: server.example.com
Authorization: Basic czZCaGRSa3F0MzpnWDFmQmF0M2JW
Content-Type: application/x-www-form-urlencoded

grant_type=client_credentials
```

Alternatively, the credentials can be passed within the body of the **POST** without using the **Authorization** header.

```
POST /api/v2/access/token HTTP/1.1
Host: server.example.com
Content-Type: application/x-www-form-urlencoded

grant_type=client_credentials&client_id=s6BhdRkqt3&client_secret=7Fjfp0ZBr1KtDRbnfVdmIw
```

Access Token Response (RFC 6749, section 4.4.3)

The response returned from cnMaestro includes the Access_Token that should be used in subsequent requests. The **expires_in field** defines how many seconds the token is valid.

```
HTTP/1.1 200 OK
Content-Type: application/json;charset=UTF-8
Cache-Control: no-store
Pragma: no-cache
{
  "access_token":"2YotnFZFEjr1zCsicMWpAA",
  "token_type":"bearer",
  "expires_in":3600
}
```

Sample 200 response body.

```
HTTP/1.1 200 OK
Content-Type: application/json;charset=UTF-8
Cache-Control: no-store
Pragma: no-cache
{
  "access_token": "290eeaba71d3f4885405eac2fd18a4f3c300448d",
  "expires_in": 3600,
  "token_type": "bearer",
  "redirect_uri": https://10.110.241.252
}
```

NOTE:

The returned **redirect_uri** should be used to generate the session.

Error Response (RFC 6749, section 5.2)

If there is an error, an HTTP 400 (Bad Request) error code is returned along with one of the following error messages as shown below:

Table 102: Error Responce

Message	Details
`invalid_request`	Required parameter is missing from the request.
`invalid_client`	Client authentication failed.
`unauthorized_client`	The client is not authorized to use the grant type sent.
`unsupported_grant_type`	The grant type is not supported.

An example error response is below:

```
HTTP/1.1 400 Bad Request
Content-Type: application/json;charset=UTF-8
Cache-Control: no-store
Pragma: no-cache
{
   "error": "invalid_request"
}
```

Access Resources

When the **Access_Token** is retrieved, API requests are sent to cnMaestro server using the format below. The **Access_Token** is sent within the HTTP **Authorization** header.

```
GET /api/v2/devices
Accept: application/json
Authorization: Bearer ACCESS_TOKEN
```

API Details

HTTP Protocol

HTTP Response codes

Table 103 lists the response codes that are supported in cnMaestro and may be returned through the HTTP protocol.

Table 103: HTTP Response codes returned

Code	Description	Use in cnMaestro
200	OK	Standard response for successful HTTP requests.
400	Bad Request	Status field in request validation related errors.
401	Unauthorized	User tried to access a resource without authentication.
403	Forbidden	An authenticated user tries to access a non-permitted resource.
404	Not Found	Server could not locate the requested resource.
405	Method Not Allowed	A method (GET, PUT, POST) is not supported for the resource.
413	Payload Too Large	The request is larger than the server is willing to handle
422	Unprocessable Entity	The server understands the request but cannot process it.
429	Too Many Requests	The client has sent too many requests in a given interval.
431	Request Header Fields Too Large	The header fields are too large to be processed.
500	Internal Server Error	A server-side error happened during processing the request.
501	Not Implemented	The request method is not recognized.
502	Bad Gateway	Internal server error that may require a reboot.
503	Service Unavailable	Internal server error that may require a reboot.

HTTP Response codes

Table 104 lists the HTTP request codes supported in cnMaestro.

Table 104: Request Headers

Header	Details
Accept	Set to application/json
Authorization	Used in every API request to send the Access Token. Example: Authorization: Bearer <Access-Token>
Content-Type	Set to application/json

REST Protocol

Resource URLs

The format for cnMaestro path and parameters are the following:

Access a collection of resources:

```
/api/{version}/{resource}?{parameter}={value}&{parameter}={value}
```

Access a single resource:

```
/api/{version}/{resource}/{resource_id}?{parameter}={value}&{parameter}={value}
```

Access a sub-resource on a collection (this is also possible on single resources):

```
/api/{version}/{resource}/{sub-resource}?{parameter}={value}&{parameter}={value}
```

For example – read the statistics for MAC, Type, and IP on all devices:

```
/api/v2/devices/statistics?fields=mac,type,ip_wan
```

Version

The version is equal to v2 in this release.

Resource

Resources are the basic objects in the system. Examples include:

Table 105: Resource

Context	Details
alarms	Current active alarms.
alarms/history	Historical alarms, including active alarms.
devices	Devices, including ePMP, PMP, and WiFi.

Context	Details
events	Historical events.
msp	MSP managed services.
networks	Configured networks.
sites	Configured WiFi sites.
towers	Configured Fixed Wireless towers.

Sub-Resources

Sub-Resources apply to top-level resources. They provide a different view of the resource data, or a filtered collection based upon the resource. Examples include:

Table 106: Sub-Resources

Context	Details
alarms	Alarms mapped to the top-level resource.
alarms/history	Historical alarms mapped to the top-level resource.
clients	Wireless LAN clients mapped to the top-level resource.
devices	Devices mapped to the top-level resource.
events	Events mapped to the top-level resource.
mesh/peers	Wireless LAN mesh peers mapped to the top-level resource.
operations	Operations available to the top-level resource
performance	Performance data for the top-level resource.
statistics	Statistics for the top-level resource.

Responses

Successful Response

In a successful HTTP 200 response, data is returned using the following structure. The payload is presented in JSON format.

The request URL is:

```
/api/v2/devices?fields=mac,type&limit=5
```

```
{
 "paging": {
   "offset": 0,
   "limit": 5,
   "total": 540
 },
 "data": [
   {
     "mac": "C1:00:0C:00:00:21",
     "type": "wifi-home"
   },
   {
     "mac": "C1:00:0C:00:00:18",
     "type": "wifi-home"
   },
   {
     "mac": "C1:00:0C:00:00:12",
     "type": "wifi-home"
   },
   {
     "mac": "C1:00:0C:00:00:15",
     "type": "wifi-home"
   },
   {
     "mac": "C1:00:0C:00:00:06",
     "type": "wifi-home"
   }
  ]
}
```


Error Response

Error Responses return a message and an error cause.


```
{
  "error": {
    "message": "Missing required property: stop_time \n Missing required property: start_
time",
    "cause": "InvalidInputError"
  }
}
```


Parameters

Most APIs can filter the data and limit the number of entries returned. The parameter options are listed below. The specific fields and the appropriate values vary for each API.

Field selection

Field selection is supported through the optional **Fields** parameter, which can specify the data to return from the server. If this parameter is missing, all available fields will be returned.

Table 107: Fields

Parameter	Details
fields	Define exactly what fields should be returned in a request. The names are provided as a comma-separated list.

Fields can limit which JSON parameters are returned as shown below:

Example: To retrieve name, type and location information for all devices.

Request:

```
/api/v2/devices?fields=mac,type
```

Response:

```
{
  "paging": {
    "total": 3,
    "limit": 100,
    "offset": 0
  },
  "data": [
    {
      "mac": "00:44:E6:34:89:48",
      "type": "wifi-enterprise"
    },
    {
      "mac": "00:44:16:E5:33:E4",
      "type": "wifi-enterprise"
    },
    {
      "mac": "00:44:26:46:32:22",
      "type": "wifi-enterprise"
    }
  ]
}
```

Filtering

A subset of fields support filtering. These are defined as query parameters for a particular resource, and they are listed along with the API specification.

Table 108 describes the standard filtering parameters as shown below:

Table 108: Filtering

Field	Details
network	(Devices) Configured Network name.
severity	(Alarms, Events) Alarm or Event severity (critical, major, minor, notice).
site	(Devices) Configured Site name.
state	(Alarms) Alarm state (active, cleared).
status	(Devices) Device status (online, offline, onboarding).
tower	(Devices) Configured Tower name.
type	(Devices) Device type (60ghz-cnwave, cnreach, cnmatrix, epmp, pmp, wifi-enterprise, wifi-home, wifi, ptp) (wifi includes wifi-home and wifi-enterprise).

Filters can be used simultaneously for **Resources** and **Sub-Resources**.

Example: Retrieve all WiFi devices that are online.

Request:

```
/api/v2/devices?type=wifi&status=online
```

Response:


```
{
  "paging": {
    "total": 1,
    "limit": 100,
    "offset": 0
   },
   "data": [
     {
       "ip": "233.187.212.38",
       "location": {
         "type": "Point",
         "coordinates": [
           77.55310127974755,
           12.952351523837196
         ]
       },
       "mac": "C1:00:0C:00:00:24",
       "msn": "SN-C1:00:0C:00:00:24",
       "name": "Hattie",
       "network": "Bangalore",
       "product": "cnPilot R201",
       "registration_date": "2017-05-23T21:28:37+05:30",
       "status": "online",
       "site": "Bangalore_Industrial",
       "type": "wifi-home",
       "hardware_version": "V1.1",
       "software_version": "2.4.4",
       "status_time": 1495560086
     }
   ]
}
```


Time Filtering

Events, Alarms, and Performance data can be filtered by date and time using ISO 8601 format.

Example: January 12, 2015 UTC would be encoded as **2015-01-12.**

Example: January 12, 2015 1:00 PM UTC would be encoded as **2015-01-12T13:00:00Z.**

If the parameters that are described in the Table 109 are not specified, then the start or stop times will be open-ended.

Table 109: Time Filtering

Parameter	Details
start_time	Inclusive start time of interval.
stop_time	Inclusive stop time of interval.

Sorting

Sorting is supported on a subset of fields within certain requests. Sort is used to specify sorting columns. The sort order is ascending unless the path name is prefixed with a '-', in which case it would be descending.

Table 110: Sort

Parameter	Details
sort	Used to get the records in the order of the given attribute.

Example: To retrieve devices in sorted (ascending) order by name.

Request:

```
/api/v2/devices?sort=name
```

Example: To retrieve devices in sorted (descending) order by mac.

Request:

```
/api/v2/devices?sort=-mac
```

Pagination

The limit and offset query parameters are used to paginate responses.

Table 111: Pagination

Parameter	Details
limit	Maximum number of records to be returned from the server.
offset	Starting index to retrieve the data.

Example: To retrieve the first 10 ePMP devices

Request:

```
/api/v2/devices?offset=3&limit=1
```

Response:

```
{
  "paging": {
    "total": 6,
    "limit": 1,
    "offset": 3
  },
  "data": [
    {
      "status": "online",
      "product": "cnPilot E400",
      "network": "Mumbai",
      "software_version": "3.3-b14",
      "registration_date": "2017-04-28T08:57:33+00:00",
      "site": "Central",
      "hardware_version": "Force 200",
      "status_time": "3498",
      "msn": "Z834275ABCDH",
      "mac": "00:04:36:46:34:AA",
      "location": {
        "type": "Point",
        "coordinates": [
          0,
          0
        ]
      },
      "type": "wifi-enterprise",
      "name": "E400-4634AA"
    }
  ]
}
```

Internal Response limits

When clients try to access a resource type without pagination, the server will return the first 100 entries that match the filter criteria. The response will always carry metadata to convey total count and current offset and limit. Maximum number of results at any point is 100 even when the provided is more than 100.

Example: To retrieve all devices.

Request:

```
/api/v2/devices
```

Response:

```
{
  data: {devices: [ {name: 'ePMP_5566', type:'ePMP', location:'blr'} , {….}… ] },
  paging:{
    "limit":25,
    "offset":50,
    "total":100
  }
}
```

The response returns the following values in the paging section:

Table 112: Internal Response limits

Parameter	Details
limit	Current setting for the limit.
offset	Starting index for the records returned in the response (begins at 0).
total	Total number of records that can be retrieved.

Access API

Token (basic request)

POST

`/api/v2/access/token`

The access API generates token using the **Client ID** and **Client Password** created in the cnMaestro UI. The token can be leveraged by API calls through the expiration time. Only one token is supported for each Client ID at any given time.

Request

Table 113 describes about the header and its values as shown below:

Table 113: **Headers**

Header	Value
Accept (optional)	application/json.
Authorization	Basic czZCaGRSa3F0MzpnWDFmQmF0M2JW.
Content-Type	application/x-www-form-urlencoded.

The **client_id** and **client_secret** are encoded and sent in the Authorization header. The encoding is:

```
BASE64(client_id:client_secret)
```

Body

The body needs to have the **grant_type**.

```
grant_type=client_credentials
```

Response

The response returns credentials for API access.

Body

Name	Details
access_token	Access token to return with each API request.
expires_in	Time in seconds that the API session will remain active.
token_type	This will always be bearer.

```
{
   "access_token":"2YotnFZFEjr1zCsicMWpAA",
   "token_type":"bearer",
   "expires_in":3600
}
```

Example

Request

curl https://10.110.134.12/api/v2/access/token \

```
 -X POST -k \
 -u 8YKCxq72qpjnYmXQ:pcX5BmdJ2f4QLM5RfgsS4jOtxAdTRF \
 -d grant_type=client_credentials
```

Response

```
{"access_token":"d587538f445d30eb2d48e1b7f7a6c9657d32068e","token_type":"
 bearer","expires_in":86400}
```

Token (alternate request)

POST

`/api/v2/access/token`

An alternative form is supported in which the **client_ID** and **client_secret** are sent in the body, rather than the Authorization header.

Request

Headers

Header	Value
Accept (optional)	application/json
Content-Type	application/x-www-form-urlencoded

Body

```
grant_type=client_credentials&client_id=s6BhdRkqt3&client_secret=7Fjfp0ZBr1KtDRbnfVdmIw
```

Response

The response to both forms is the same.

Body

Name	Details
access_token	Access token to return with each API request.
expires_in	Time in seconds that the API session will remain active.
token_type	This will always be bearer.

```
{
   "access_token":"2YotnFZFEjr1zCsicMWpAA",
   "token_type":"bearer",
   "expires_in":3600
}
```

Example

Request

curl https://10.110.134.12/api/v2/access/token \

```
 -X POST -k \
 -d grant_type=client_credentials \
 -d client_id=8YKCxq72qpjnYmXQ \
 -d client_secret=pcX5BmdJ2f4QLM5RfgsS4jOtxAdTRF
```

Response

```
{"access_token":"ee4e077cf457196eb4d27cf6f02686dc07763059","token_type":"
bearer","expires_in":86400}
```

Validate Token

GET

`/api/v2/access/validate_token`

Verify if an Access Token is valid and return the time remaining before it expires.

Request

HTTP Headers

Header	Value
Accept (optional)	application/json
Authorization	Bearer <ACCESS_TOKEN>

Response

Body

Name	Details
expires_in	Time in seconds that the API session will remain active.

```
{
   'expires_in': 86399
}
```

Example

Request

curl https://10.110.134.12/api/v2/access/validate_token \

```
 -X GET -k \
 -H "Authorization: Beareree4e077cf457196eb4d27cf6f02686dc07763059"
```

Response

```
{"expires_in":85643}
```

Selected APIs

Overview

cnMaestro APIs are defined within the Swagger specification, accessed here https://docs.cloud.cambiumnetworks.com/api/5.0.0/index.html. This section only presents additional details for the Device, Statistics and Performance APIs, which have unique responses based upon Device Type, and are difficult to present within Swagger.

cnMaestro v2 API

Beginning with cnMaestro 3.0.0, the API version changes from **v1** to **v2**. The **v1** version will be supported through 3.1.0, but Cambium recommends updating existing API code to use **v2**. For most commands, swapping v1 in the URL with v2 should be sufficient. However, the following APIs may need to be rewritten while moving to v2.

- AP Groups
- Devices
- Statistics
- Performance
- Mesh Peers
- Operations

There are Unique API responses such as:

- Device API Response (v2 Format)
- Statistics API Response (v2 Format)
- Performance API Response (v2 Format)

Devices API Response (v2 Format)

Name	Details	ePMP	PMP	Wi-Fi	cnReach	cnVision	PTP	PTP 8xx	cnMatrix	60 GHz cnWave	cnWave 5G Fixed
ap_group	AP Group			X							
cbrs_state	CBRS state		X								
cbrs_status	CBRS status		X								
config.sync_reason	Configuration synchronization reason	X	X	X	X	X	X	X	X		
config.sync_status	Configuration synchronization status	X	X	X	X	X	X	X	X		
config.variables	Device is mapped to configuration variables	X	X	X	X	X	X	X	X		
config.version	Current configuration version	X	X	X	X	X	X	X	X		
country	Country	X	X	X		X					
country_code	Regulatory band						X				
description	Description	X	X	X	X	X	X		X	X	
hardware_version	Hardware version	X	X	X	X	X	X	X	X	X	
inactive_software_version	Inactive software version	X	X	X	X	X	X	X	X		X
ip	IP address	X	X	X	X	X	X	X	X	X	X
ipv6	IPv6	X		X		X				X	X
last sync	Last Synchronize							X			

Name	Details	ePMP	PMP	Wi-Fi	cnReach	cnVision	PTP	PTP 8xx	cnMatrix	60 GHz cnWave	cnWave 5G Fixed
	d										
last_reboot_reason	Reason for the last reboot (see 24.1)	X	X	X	X	X	X		X		X
link_symmetry	Link symmetry						X				
location	Location	X	X	X	X	X	X	X	X	X	X
mac	MAC address	X	X	X	X	X	X	X	X	X	X
managed_account	Managed account name	X	X	X	X	X	X	X	X	X	X
maximum_range	Maximum range (KM)	X	X			X	X				
mode	Mode type							X			X
msn	Manufacturer serial number	X	X	X	X	X	X	X	X	X	X
name	Device name	X	X	X	X	X	X	X	X	X	X
network	Network	X	X	X	X	X	X	X	X	X	X
onboarding.error_code	Error code of the device if it fails to on-board	X	X	X	X	X	X	X	X	X	X
onboarding.state	On-boarding state of the device.	X	X	X	X	X	X	X	X	X	X
online	Offline or online	X	X	X	X	X	X	X	X	X	X
product	Product	X	X	X	X	X	X	X	X	X	X

Name	Details	ePMP	PMP	Wi-Fi	cnReach	cnVision	PTP	PTP 8xx	cnMatrix	60 GHz cnWave	cnWave 5G Fixed
	name										
registration_date	Registration date	X	X	X	X	X	X	X	X	X	X
role							X				
site	Site			X					X	X	
site_id	Site unique identifier			X					X	X	
software_version	Active Software version	X	X	X	X	X	X	X	X		X
status	Status (online, offline, onboarding).	X	X	X	X	X	X	X	X	X	X
status_time	Uptime/downtime time interval (sec)	X	X	X	X	X	X	X	X	X	X
temperature	Temperature							X			
tower	Tower	X	X		X	X	X	X	X		X
type	Device type (epmp, pmp, wifi-home, wifi-enterprise, cnreach, ptp, cnmatrix, 60ghz-cnwave)	X	X	X	X	X	X	X	X	X	X

Devices onboarding error codes

Error Codes	Details
ERR_UNSUPPORTED_DEVICE	Claiming {{type}} devices is not currently supported.
ERR_NON_ENTERPRISE_WIFI_TYPE	Only cnPilot Enterprise (ePMP Hotspot), Enterprise Wi-Fi (E-Series and XE/XV-Series) and cnMatrix devices are allowed into Enterprise account.
ERR_NON_WIFI_TYPE	Cannot claim non Wi-Fi device under a Site.
ERR_UNSUPPORTED_TYPE	Unsupported device type in current account view - {{view}}.
ERR_UNKNOWN_DEVICE	Unknown Device.
ALREADY_CLAIMED	Device already claimed.
LTE_CLAIMED	cnRanger devices are not supported in production accounts.
ERR_INVALID_MSN	Invalid Serial Number.
ERR_OWNER_DIFFERENT	Device is claimed into another account.
ERR_INTERNAL	System encountered an internal error; please try again later. If the problem persists, contact support.
ERR_INVALID_MAC	Invalid MAC.
ERR_DUPLICATE_KEY	The device is already claimed.
UNPROCESSABLE	Device state does not allow to cloud sync.
CBRS_ERROR_DEVICES	MAC is already claimed. It cannot be claimed on CBRS.
SUBSCRIPTION_FAIL	Device could not acquire slot.
SUBSCRIPTION_FAIL_FEATURE_MISMATCH	Device is mapped to another onprem instance.
SUBSCRIPTION_FAIL_TOO_MANY_ASSOCS	Device is mapped to another onprem instance.

Statistics API Response (v2 Format)

Statistics API Response v2 format are shown for the following devices:

- 60 GHz cnWave
- cnMatrix
- cnReach
- Fixed Wireless
- PTP
- PTP 820/850
- Wi-Fi
- cnWave 5G Fixed

60 GHz cnWave

General

Name	Details	Mode
cpu	CPU utilization	All
last_sync	Last synchronization (UTC Unix time milliseconds)	All
mac	MAC address	All
IP	IP address	All
managed_account	Managed account name	All
memory	Available memory	All
mode	Device mode	All
name	Device name	All
network	Network	All
site	Site name	All
site_id	Site ID	All
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
sync_mode	Radio Sync mode [RF, GPS, None]	All
type	Device type	All

Networks

Name	Details	Mode
ipv6	IPv6 address	All

Radios (Array format)

Name	Details	Mode
radios[].channel	Channel	All
radios[].id	Radio Id	All
radios[].mac	Radio MAC	All

Name	Details	Mode
radios[].rx_bps	Receive bits per second	All
radios[].sync_mode	Radio Sync mode [RF, GPS, None]	All
radios[].tx_bps	Transmit bits per second	All

Ethernet Ports (Array format)

Name	Details	Mode
ethports[].port	Port name	All
ethports[].rx_pkts	Received packets	All
ethports[].rx_errors	Received packets errors	All
ethports[].rx_pkts_drop	Dropped received packets	All
ethports[].speed	Port speed and duplex	All
ethports[].tx_pkts	Transmitted packets	All
ethports[].tx_errors	Transmitted packets errors	All
ethports[].tx_pkts_drop	Dropped transmitted packets	All

cnMatrix

General

Name	Details
cpu	CPU utilization
config_version	Configuration version
last_sync	Last synchronization (UTC Unix time milliseconds)
mac	MAC address
managed_account	Managed account name
memory	Available memory
mode	Device mode
name	Device name
network	Network

Name	Details
site	Site name
site_id	Site unique identifier
status	Status [online, offline, claimed, waiting, onboarding]
status_time	Uptime/downtime interval (seconds)
tower	Tower name
type	Device type

Networks

Name	Details
ip	IP address

cnReach

General

Name	Details	Mode
config_version	Configuration version	All
connected_sms	Connected SM count	All
last_sync	Last synchronization (UTC Unix time milliseconds)	All
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
tower	Tower name	All
type	Device type	All

Networks

Name	Details	Mode
ip	IP address	All

Radios (Array format)

Name	Details	Mode
radios[].device_id	Device ID	Radios
radios[].id	Radio Id	Radios
radios[].linked_with	Linked with	Radios
radios[].mac	Radio MAC	Radios
radios[].margin	Margin	Radios
radios[].mode	Radio mode [ap, ep, rep]	Radios
radios[].neighbors	Radio neighbors	Radios
radios[].network_ address	Network address	Radios
radios[].noise	Average noise (dB)	Radios
radios[].power	Transmit power	Radios
radios[].rssi	RSSI value (dB)	Radios
radios[].rx_bytes	Receive bytes	Radios
radios[].software_ version	Current software version.	Radios
radios[].temperature	Radio temperature	Radios
radios[].type	Radio type [ptp, ptmp]	Radios
radios[].tx_bytes	Transmit bytes	Radios

Fixed Wireless (cnVision, ePMP and PMP)

General

Name	Details	cnVision	ePMP	PMP
ap_mac	AP MAC	SM	SM	SM
config_version	Configuration version	AP/SM	AP/SM	AP/SM
connected_sms	Connected SM count	AP	AP	AP
cpu	CPU utilization			AP/SM
distance	SM distance (KM)	SM	SM	SM
gain	Antenna gain (dBi)	AP/SM	AP/SM	AP/SM
gps_sync_state	GPS synchronization state	AP/SM	AP/SM	
last_sync	Last synchronization (UTC Unix time milliseconds)	AP/SM	AP/SM	AP/SM
mac	MAC address	AP/SM	AP/SM	AP/SM
managed_ account	Managed account name	AP/SM	AP/SM	AP/SM
mode	Device mode	AP/SM	AP/SM	AP/SM
name	Device name	AP/SM	AP/SM	AP/SM
network	Network	AP/SM	AP/SM	AP/SM
reboots	Reboot count	AP/SM	AP/SM	
status	Status [online, offline, claimed, waiting, onboarding]	AP/SM	AP/SM	AP/SM
status_time	Uptime/downtime interval (seconds)	AP/SM	AP/SM	AP/SM
temperature	Temperature			AP/SM
tower	Tower name	AP	AP	AP
type	Type	AP/SM	AP/SM	AP/SM
vlan	VLAN			AP/SM

Networks

Name	Details	cnVision	ePMP	PMP
default_gateway	Default gateway	AP/SM	AP/SM	AP/SM
ip	IP address	AP/SM	AP/SM	AP/SM
ipv6	IPv6 address	AP/SM	AP/SM	
ip_dns	DNS	AP/SM	AP/SM	AP/SM
ip_dns_secondary	Secondary DNS			AP/SM
ip_wan	WAN IP	AP/SM	AP/SM	
lan_mode_status	LAN mode status [no-data, half, full]	AP/SM	AP/SM	
lan_mtu	MTU size	SM	SM	
lan_speed_status	LAN speed status	AP/SM	AP/SM	
lan_status	LAN status [down, up]	AP/SM	AP/SM	AP/SM
netmask	Network mask	AP/SM	AP/SM	AP/SM

Radios

Name	Details	cnVision	ePMP	PMP
radio.auth_mode	Authentication mode	SM	SM	
radio.auth_type	Authentication type ePMP [open, wpa1, eap- ttls] PMP [disabled, enabled]	AP/SM	AP/SM	AP/SM
radio.channel_width	Channel width ePMP [5 MHz, 10 MHz, 20 MHz, 40 MHz] PMP [...]	AP/SM	AP/SM	AP/SM
radio.color_code	Color code			AP/SM
radio.dfs_status	DFS status ePMP: [not-applicable, channel- availability-check, in-service, radar- signal-detected, alternate-channel-monitoring, not-in- service] PMP: [Status String]	AP/SM	AP/SM	AP/SM

Name	Details	cnVision	ePMP	PMP
radio.dl_err_drop_pkts	Downlink error drop packets	SM	SM	
radio.dl_err_drop_pkts_ percentage	Downlink error drop packets percentage	SM	SM	
radio.frequency	RF frequency	AP/SM	AP/SM	AP/SM
radio.frame_period	Frame period			AP
radio.dl_frame_utilization	Downlink frame utilization			AP
radio.dl_lqi	Downlink Link Quality Indicator			SM
radio.dl_mcs	Downlink MCS	SM	SM	
radio.dl_modulation	Downlink Modulation			SM
radio.dl_pkts	Downlink packet count	AP/SM	AP/SM	AP/SM
radio.dl_pkts_loss	Downlink packet loss			AP/SM
radio.dl_retransmits	Downlink Retransmission	AP/SM	AP/SM	
radio.dl_retransmits_pct	Downlink Retransmission percentage	AP/SM	AP/SM	
radio.dl_rssi	Downlink RSSI	SM	SM	SM
radio.dl_rssi_imbalance	Downlink RSSI imbalance			AP
radio.dl_snr	Downlink SNR (dB)	SM	SM	
radio.dl_snr_h	Downlink SNR (dB) horizontal			SM
radio.dl_snr_v	Downlink SNR (dB) vertical			SM
radio.dl_throughput	Downlink throughput	AP/SM	AP/SM	AP/SM
radio.mac	Wireless MAC	AP/SM	AP/SM	
radio.mode	Radio mode [eptp-master, eptp- slave, tdd, tdd-ptp, ap/sm]	AP/SM	AP/SM	
radio.sessions_dropped	Session drops	AP	AP	AP/SM
radio.software_key_ throughput	Software key – max throughput			SM

Name	Details	cnVision	ePMP	PMP
radio.ssid	SSID	AP/SM	AP/SM	
radio.sync_source	Synchronization source			AP
radio.sync_state	Synchronization state			AP
radio.tdd_ratio	TDD ratio ePMP [75/25, 50/50, 30/70, flexible] PMP [...]	AP	AP	AP
radio.tx_capacity	SM transmit capacity	SM	SM	
radio.tx_power	Radio transmit power	AP/SM	AP/SM	AP/SM
radio.tx_quality	SM transmit quality	SM	SM	
radio.ul_err_drop_pkts	Uplink error drop packets	SM	SM	
radio.ul_err_drop_pkts_ percentage	Uplink error drop packets percentage	SM	SM	
radio.ul_frame_utilization	Uplink frame utilization			AP
radio.ul_mcs	Uplink MCS	AP/SM	AP/SM	
radio.ul_modulation	Uplink Modulation example [2X MIMO-B)]			SM
radio.ul_lqi	Uplink Link Quality Indicator			SM
radio.ul_pkts	Uplink packet count	AP/SM	AP/SM	AP/SM
radio.ul_pkts_loss	Uplink packet loss			AP/SM
radio.ul_retransmits	Uplink Retransmission	SM	SM	
radio.ul_retransmits_pct	Uplink Retransmission percentage	AP/SM	AP/SM	
radio.ul_rssi	Uplink RSSI	SM	SM	SM
radio.ul_snr	Uplink SNR (dB)	SM	SM	
radio.ul_snr_h	Uplink SNR (dB) horizontal			SM
radio.ul_snr_v	Uplink SNR (dB) vertical			SM
radio.ul_throughput	Uplink throughput	AP/SM	AP/SM	AP/SM
radio.wlan_status	WLAN status [down, up]	AP/SM	AP/SM	

PTP 650/670/700

General

Name	Details	Mode
config_version	Configuration version	All
connected_sms	Connected SM count	Master
gain	Antenna gain (dBi)	All
last_sync	Last synchronization (UTC Unix time milliseconds)	All
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
temperature	Temperature	All
tower	Tower name	All
type	Device type	All
vlan	VLAN	All

Networks

Name	Details	Mode
default_gateway	Default gateway	All
ip	IP address	All
ip_dns	DNS	All
ip_dns_secondary	Secondary DNS	All
lan_status	LAN status [down, up]	All
netmask	Network mask	All

Ethernet Ports (Array format)

Name	Details	Mode
ethports[].port	Port name	All
ethports[].rx_frames	Ports receive frames oversize	All
ethports[].rx_util	Ports receive bandwidth utiliization	All
ethports[].speed	Ports speed and duplex	All
ethports[].tx_util	Ports transmit bandwidth utiliization	All

Radios

Name	Details	Mode
radio.byte_error_ratio	Byte Error Ratio	All
radio.channel_width	Channel width ePMP: [5 MHz, 10 MHz, 20 MHz, 40 MHz] PMP: [...]	All
radio.color_code	Color code	All
radio.rx_frequency	Receive frequency	All
radio.tx_frequency	Transmit frequency	All
radio.tx_power	Radio transmit power	All

PTP 820/850

General

Name	Details	Mode
ip	IP address	All
last_sync	Last synchronized	All
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All

Name	Details	Mode
network	Network	All
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
temperature	Temperature	All
tower	Uptime/downtime interval (seconds)	All
type	Device type	All

Radio

Name	Details	Mode
radios[].defective_blocks	Radio defective blocks	All
radios[].id	Radio Id	All
radios[].radio_location	Radio location	All
radios[].rx_bps	Receive bits/second	All
radios[].rx_level	Receive level	All
radios[].rx_frequency	Receive frequency	All
radios[].tx_bps	Transmit bits/second	All
radios[].tx_level	Transmit level	All
radios[].tx_frequency	Transmit frequency	All
radios[].tx_mute_status	Transmit mute status	All
radios[].modem_mse	Modem Mean Square Error (MSE) in dB	All
radios[].modem_xpi	Modem Cross-Polar Isolation (XPI) in dB	All

Interfaces

Name	Details	Mode
interfaces[].admin_state	Admin state	All
interfaces[].auto_negotiation	Auto Negotiation	All
interfaces[].interaface_location	Interface location	All
interfaces[].mac	MAC address	All
interfaces[].media_type	Media type	All
interfaces[].operational_status	Operational Status	All
interfaces[].port_duplex	Interface duplex type	All
interfaces[].speed	Interface speed	All

Wi-Fi

NOTE:

Mode is Enterprise, Home, or All.

General

Name	Details	Mode
config_version	Configuration version	All
cpu	CPU utilization	All
mac	MAC address	All
managed_account	Managed account name	All
memory	Available memory	All
mode	Device mode	All
name	Device name	All
network	Network	All
parent_mac	Parent MAC	All

Name	Details	Mode
site	Site name	All
site_id	Site unique identifier	All
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
type	Device type	All

Networks

Name	Details	Mode
ip	IP address	All
ipv6	IPv6 address	All
ip_dns	DNS	All
ip_dns_secondary	Secondary DNS	All
ip_wan	WAN IP	All
lan_mode_status	LAN mode status [no-data, half, full]	Enterprise
lan_speed_status	LAN speed status	All
lan_status	LAN status [down, up]	Home
netmask	Network mask	All

Radios (Array format)

Name	Details	Mode
radios[].airtime	Airtime	All
radios[].band	Radio band	All
radios[].bssid	Radio mac	Enterprise
radios[].channel	Channel	All
radios[].id	Radio Id	All
radios[].multicast_rate	Multicast rate	Enterprise

Name	Details	Mode
radios[].noise_floor	Noise floor	Enterprise
radios[].num_clients	Number of clients	All
radios[].num_wlans	Number of WLANs	Enterprise
radios[].power	Transmit power	All
radios[].quality	RF Quality description	Enterprise
radios[].radio_state	Radio state	Enterprise
radios[].rx_bps	Receive bits/second	All
radios[].rx_bytes	Receive bytes	All
radios[].tx_bps	Transmit bits/second	All
radios[].tx_bytes	Transmit bytes	All
radios[].unicast_rates	Unicast rates	Enterprise
radios[].utilization	Radio utilization	Enterprise

cnWave 5G Fixed

General

Name	Details	Mode
cpu	CPU utilization	All
last_sync	Last synchronization (UTC Unix time milliseconds)	All
mac	MAC address	All
managed_account	Managed account name	All
ip	IP Address	All
mode	Device mode	All
name	Device name	All
network	Network	All
tower	Tower name	All

Name	Details	Mode
status	Status [online, offline, claimed, waiting, onboarding]	All
status_time	Uptime/downtime interval (seconds)	All
config_version	Current config version	All
type	Device type	All
connected_cpe	Number of CPEs connected to the BTS	BTS
registered_cpe	Number of CPEs registered with the BTS	BTS
cpe_registration_state	CPEs Registration State	CPE
cpe_registration_count	CPEs Registration Count	CPE
cpe_imsi	CPE Device Identity	CPE

Boot

Name	Details	Mode
startup_count	Startup Count for the device	BTS
startup_reason	Startup Reason for the device	BTS

Shutdown (Array format)

Name	Details	Mode
shutdown[].date	Shutdown Date	BTS
shutdown[].detail	Shutdown Detail	BTS
shutdown[].index	Shutdown Index	BTS
shutdown[].reason	Shutdown Reason	BTS

Interface Config

Name	Details	Mode
sfp1_speed	SFP1 Speed	BTS
sfp2_speed	SFP2 Speed	BTS

Interfaces (Array format)

Name	Details	Mode
interfaces[].port_name	Port name	BTS
interfaces[].in_octets	Received octets	BTS
interfaces[].out_octets	Transmitted octets	BTS
interfaces[].in_ucast_pkts	Received unicast packets	BTS
interfaces[].out_ucast_pkts	Transmitted unicast packets	BTS
interfaces[].in_mcast_pkts	Received multicast packets	BTS
interfaces[].out_mcast_pkts	Transmitted multicast packets	BTS
interfaces[].in_bcast_pkts	Received broadcast packets	BTS
interfaces[].out_bcast_pkts	Transmitted broadcast packets	BTS
interfaces[].in_discards	Received discarded packets	BTS
interfaces[].out_discards	Transmitted discarded packets	BTS
interfaces[].in_errors	Received errored packets	BTS
interfaces[].out_errors	Transmitted errored packets	BTS

Radio

Name	Details	Mode
dl_throughput	Received Throughput	BTS
ul_throughput	Transmitted Throughput	BTS
frequency	Frequency	BTS
max_eirp	Maximum EIRP	BTS
polarization	Polarization	All
link_symmetry	Link Symmetry	BTS
bandwidth	Bandwidth	BTS
ul_target_rxPower	Transmitted Target Power	BTS
ul_tx_power_init	Transmitted Initial Power	BTS
ul_tx_power_cont	Transmitted Control Power	BTS

Name	Details	Mode
ul_frame_util	Transmitted Frame Utilization	BTS
dl_frame_util	Received Frame Utilization	BTS
dl_mcs	Downlink MCS	CPE
ul_mcs	Uplink MCS	CPE
alignment_active	Alignment Active Status	CPE
cpe_range	Range of CPE	CPE
current_eirp	Current Effective radiated power	CPE
ul_backoff	Uplink Backoff	CPE
dl_backoff	Downlink Backoff	CPE
ul_sounding_state	Uplink Sounding State	CPE
dl_sounding_state	Downlink Sounding State	CPE
ul_channel_distortion	Uplink Channel Distortion	CPE
dl_channel_distortion	Downlink Channel Distortion	CPE
ul_evm	Uplink EVM	CPE
dl_evm	Downlink EVM	CPE
ul_rx_power	Uplink Received Power	CPE
dl_rx_power	Downlink Received Power	CPE
ul_spatial_freq	Uplink Spatial Frequency	CPE
dl_spatial_freq	Downlink Spatial Frequency	CPE

Wireless and Ethernet interfaces

Name	Details	Mode
in_octets	Received octets	CPE
out_octets	Transmitted octets	CPE
in_ucast_pkts	Received unicast packets	CPE
out_ucast_pkts	Transmitted unicast packets	CPE
in_mcast_pkts	Received multicast packets	CPE

Name	Details	Mode
out_mcast_pkts	Transmitted multicast packets	CPE
in_bcast_pkts	Received broadcast packets	CPE
out_bcast_pkts	Transmitted broadcast packets	CPE
in_discards	Received discarded packets	CPE
out_discards	Transmitted discarded packets	CPE
in_errors	Received errored packets	CPE
out_errors	Transmitted errored packets	CPE

Performance API Response (v2 Format)

Performance API Response v2 Format are shown for following devices:

- 60 GHz cnWave
- cnMatrix
- cnReach
- Fixed Wireless
- PTP 650/670/700
- PTP 820/850
- Wi-Fi
- cnWave 5G Fixed

60 GHz cnWave

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
online_duration	Duration of device connection with server (seconds)	All
site	Site	All

Name	Details	Mode
timestamp	Timestamp	All
type	Device type	All
uptime	Device online time (seconds)	All

Radios (Array format)

Name	Details	Mode
radios[].id	Radio ID	All
radios[].rx_bps	Receive bits per second	All
radios[].tx_bps	Transmit bits per second	All

Ethernet Ports (Array format)

Name	Details	Mode
ethports[].max_rx	Ports maximum receive bytes	All
ethports[].max_tx	Ports maximum transmit bytes	All
ethports[].min_rx	Ports minimum receive bytes	All
ethports[].min_tx	Ports minimum transmit bytes	All
ethports[].port	Port name	All
ethports[].rx	Ports receive bytes	All
ethports[].tx	Ports transmit bytes	All
ethports[].rx_bps	Ports receive bits per second	All
ethports[].tx_bps	Ports receive bits per second	All
ethports[].min_rx_bps	Ports minimum receive bits per second	All
ethports[].min_tx_bps	Ports minimum transmit bits per second	All
ethports[].max_rx_bps	Ports maximum receive bits per second	All
ethports[].max_tx_bps	Ports maximum transmit bits per second	All

General

Name	Details
mac	MAC address
managed_account	Managed account name
mode	Device mode
name	Device name
network	Network
site	Site
timestamp	Timestamp
tower	Tower
type	Device type

Switch

Name	Details
switch.rx.broadcast_pkts	Receive broadcast packets
switch.dl_kbits	Downlink usage (in kbits on hour or minute basis)
switch.dl_throughput	Downlink throughput (Kbps)
switch.ul_kbits	Uplink (in Kbits on hour or minute basis)
switch.rx.multicast_pkts	Receive multicast packets
switch.ul_throughput	Uplink throughput (Kbps)
switch.rx.pkts_err	Receive Packet error
switch.rx.unicast_pkts	Receive unicast packets
switch.tx.broadcast_pkts	Transmit broadcast packets
switch.tx.multicast_pkts	Transmit multicast packets
switch.tx.pkts_err	Transmit packet error
switch.tx.unicast_pkts	Transmit unicast packets

cnReach

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
online_duration	Duration of device connection with server (seconds)	All
sm_count	Connected SM count	All
timestamp	Timestamp	All
tower	Tower	All
type	Device type	All
uptime	Device online time (seconds)	All

Radios (Array format)

Name	Details	Mode
radios[].id	Radio ID	Radios
radios[].neighbors	Radio neighbors	Radios
radios[].noise	Average noise	Radios
radios[].power	Transmit power	Radios
radios[].rssi	RSSI value	Radios
radios[].rx_bytes	Receive bytes	Radios
radios[].throughput	Total throughput	Radios
radios[].tx_bytes	Transmit bytes	Radios

Fixed Wireless (cnVision, ePMP and PMP)

General

Name	Details	cnVision	ePMP	PMP
mac	MAC address	AP/SM	AP/SM	AP/SM
managed_account	Managed account name	AP/SM	AP/SM	AP/SM
mode	Device mode	AP/SM	AP/SM	AP/SM
name	Device name	AP/SM	AP/SM	AP/SM
network	Network	AP/SM	AP/SM	AP/SM
online_duration	Duration of device connection with server (seconds)	AP/SM	AP/SM	AP/SM
sm_count	Connected SM count	AP	AP	AP
sm_drops	Session drops	AP/SM	AP/SM	AP
timestamp	Timestamp	AP/SM	AP/SM	AP/SM
tower	Tower	AP/SM	AP/SM	AP/SM
type	Device type	AP/SM	AP/SM	AP/SM
uptime	Device online time (seconds)	AP/SM	AP/SM	AP/SM

Radios

Name	Details	cnVision	ePMP	PMP
radio.dl_frame_utilization	Downlink frame utilization			AP
radio.dl_kbits	Downlink usage (in Kbits on hour or minute basis)	AP/SM	AP/SM	
radio.dl_mcs	Downlink MCS	SM	SM	

Name	Details	cnVision	ePMP	PMP
radio.dl_modulation	Downlink modulation			SM
radio.dl_pkts	Downlink packet count	AP/SM	AP/SM	
radio.dl_pkts_loss	Downlink packet loss			AP/SM
radio.dl_retransmits_pct	Downlink retransmission percentage	AP/SM	AP/SM	
radio.dl_rssi	Downlink RSSI	SM	SM	SM
radio.dl_rssi_imbalance	Downlink RSSI imbalance			SM
radio.dl_snr	Downlink SNR	SM	SM	
radio.dl_snr_h	Downlink SNR (dB) horizontal			SM
radio.dl_snr_v	Downlink SNR (dB) vertical			SM
radio.dl_throughput	Downlink Throughput (Kbps)	AP/SM	AP/SM	AP/SM
radio.ul_frame_utilization	Uplink frame utilization			AP
radio.ul.kbits	Uplink usage (in Kbits on hour or minute basis)	AP/SM	AP/SM	
radio.ul_mcs	Uplink MCS	SM	SM	
radio.ul_modulation	Uplink modulation			SM
radio.ul_pkts	Uplink packet count	AP/SM	AP/SM	
radio.ul_pkts_loss	Uplink packet loss			AP/SM

Name	Details	cnVision	ePMP	PMP
radio.ul_retransmits_pct	Uplink Retransmission percentage	AP/SM	AP/SM	
radio.ul_rssi	Uplink RSSI	SM	SM	SM
radio.ul_snr	Uplink SNR	SM	SM	
radio.ul_snr_h	Uplink SNR (dB) horizontal			SM
radio.ul_snr_v	Uplink SNR (dB) vertical			SM
radio.ul_throughput	Uplink Throughput (Kbps)	AP/SM	AP/SM	AP/SM

PTP 650/670/700

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
sm_count	Connected SM count	Master
timestamp	Timestamp	All
tower	Tower	All
type	Device type	All

Ethernet Ports (Array format)

Name	Details	Mode
ethports[].max_rx	Ports maximum receive bytes	All
ethports[].max_tx	Ports maximum transmit bytes	All
ethports[].min_rx	Ports minimum receive bytes	All
ethports[].min_tx	Ports minimum transmit bytes	All
ethports[].pkt_error	Ports packet error	All
ethports[].port	Port name	All
ethports[].rx	Ports receive bytes	All
ethports[].tx	Ports transmit bytes	All
ethports[].rx_bps	Ports receive bits per second	All
ethports[].tx_bps	Ports receive bits per second	All
ethports[].min_rx_bps	Ports minimum receive bits per second	All
ethports[].min_tx_bps	Ports minimum transmit bits per second	All
ethports[].max_rx_bps	Ports maximum receive bits per second	All
ethports[].max_tx_bps	Ports maximum transmit bits per second	All

Ethernet

Name	Details	Mode
ethernet.link_loss	Link loss	All
ethernet.pcb_ temperature	PCB temperature	All
ethernet.rx_channel_util	Receive channel utilization	All
ethernet.rx_capacity	Receive capacity	All
ethernet.ssr	Signal strength ratio	All
ethernet.rx_power	Receive power	All
ethernet.sfp_interface.tx	SFP transmit bytes	All

Name	Details	Mode
ethernet.rx_throughput	Receive throughput	All
ethernet.tx_channel_util	Transmit channel utilization	All
ethernet.tx_capacity	Transmit capacity	All
ethernet.tx_power	Transmit power	All
ethernet.tx_throughput	Transmit throughput	All
ethernet.vector_error	Vector error	All

PTP 820/850

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device Mode	All
name	Device name	All
network	Network	All
online_duration	Duration online	All
timestamp	Timestamp	All
tower	Tower	All
type	Device type	All
uptime	Device online time (seconds)	All

Radio

Name	Details	Mode
radios[].id	Radio ID	All
radios[].max_rsl	Radio Maximum Receiver Signal Level	All
radios[].max_tsl	Radio Maximum Transmission Signal Level	All
radios[].min_rsl	Radio Minimum Receiver Signal Level	All

Name	Details	Mode
radios[].min_tsl	Radio Minimum Transmission Signal Level	All
radios[].peak_ throughput	Radio Peak Throughput	All
radios[].radio_location	Radio Location	All
radios[].throughput	Radio Throughput	All
radios[].modem_max_ mse	Modem maximum MSE in dB	All
radios[].modem_min_ mse	Modem minimum MSE in dB	All
radios[].modem_max_ xpi	Modem maximum XPI in dB	All
radios[].modem_min_xpi	Modem minimum XPI in dB	All
radios[].modem_max_ mrmc_profile	Modem maximum MMRC	All
radios[].modem_max_ mrmc_profile	Modem minimum MMRC	All

Radio Groups

Name	Details	Mode
radios_groups[].id	Radio Group ID	All
radios_groups[].peak_ throughput	Radio Group peak throughput	All
radios_groups[].radio_ location	Radio Group location	All
radios_groups [].throughput	Radio Group throughput	All

Wi-Fi

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
online_duration	Duration of device connection with server (seconds)	All
site	Site	All
timestamp	Timestamp	All
type	Device type	All
uptime	Device online time (seconds)	All

Radios (Array format)

Name	Details	Mode
radios[].clients	Number of clients	All
radios[].id	Radio ID	All
radios[].rx_bps	Receive bits/second	All
radios[].throughput	Total throughput	All
radios[].tx_bps	Transmit bits/second	All
radios[].band	Radio band (2.4 GHz/5 GHz)	All

NOTE:

The specification for the equivalent v1 APIs is available in the Appendix.

- Statistics API Response (v1 Format)
- Performance API Response (v1 Format)

cnWave 5G Fixed

General

Name	Details	Mode
mac	MAC address	All
managed_account	Managed account name	All
mode	Device mode	All
name	Device name	All
network	Network	All
online_duration	Duration of device connection with server (seconds)	All
timestamp	Timestamp	All
type	Device type	All
uptime	Device online time (seconds)	All
cpe_registered	Registered CPEs count	BTS
cpe_connected	Connected CPEs count	BTS
cpe_registrationCnt	Number of times the CPE registered with the BTS	CPE

Radio

Name	Details	Mode
ul_throughput	Uplink Throughput	BTS
dl_throughput	Downlink Throughput	BTS
cpe_ul_throughput	Uplink Throughput	CPE
cpe_dl_throughput	Downlink Throughput	CPE
cpe_ul_evm	Uplink EVM	CPE
cpe_dl_evm	Downlink EVM	CPE
cpe_ul_mcs	Uplink MCS	CPE
cpe_dl_mcs	Downlink MCS	CPE
cpe_ul_rxPower	Uplink Rx Power	CPE
cpe_dl_rxPower	Downlink Rx Power	CPE

Client API Response (v2 Format)

Client details API Response v2 Format are shown below:

Name	Details	Wi-Fi
ap_mac	AP MAC	
client_type	Client type(Client | Guest Client)	
download_quota	Download quota (Note: only applicable for Guest Client)	
download_quota_balance	Download quota balance (Note: only applicable for Guest Client)	
ip	IP address of client	
mac	Client MAC	
managed_account	Managed account name	
manufacturer	Manufacturer name	
name	Client name	
radio.band	Band(2.4 GHz/5 GHz)	
radio.rssi	RSSI	
radio.rx_bytes	Received bytes	
radio.snr	SNR	
radio.ssid	SSID	

External Guest Access Login API

Integrates an external captive portal with the Cambium Networks AP while posting directly to cnMaestro. This API provides the support for the external captive portal to make login requests.

POST `/api/v2/ext-portals/login`

Request:

curl -X

```
/api/v2/ext-portals/login" -H "accept: */*" -H "Authorization: Bearer
e88916f5b663c1ea966af835c8a0a19c20d17686" -H "Content-Type: application/json"-d
```

Body

```
"{\"ga_ap_mac\":\"11-22-33-44-55-66\",\"ga_cmac\":\"11-22-33-44-55-65\",\"ga_
Qv\":\"eUROBR86HBgAGDEEVgQAGw4UWRUCACYVMgFPMV5ZWVFfUVdGX1ZFJXxZR1dLBhMUMww\",\"ga_
user\":\"test-user\",\"ga_pass\":\"test-pass\"}"
```

Response:

```
{
"data": {
         "mType": 3,
         "msgId":28,
```

```
        "status":<integer values>,
        "prefixQs":<true/false>,
        "expiry":<integer values>,
        "action":<integer values>,
        "cmac":<client mac>,
        "msg":<Radius Returned Message>,
        "extURL":<external url string>
        }
}
```

The status value description is provided in the table below.

Status	Description
0	Login is successful.
1	Invalid login request, the client is not currently associated to the AP which is being requested for login here.
2	RADIUS reject due to invalid username/password.
3	RADIUS timeout, AP didn't received the RADIUS response.
4	Missing RADIUS server config on the WLAN config of the AP.
5	If LDAP configured on the AP for authentication then LDAP server responded back with reject.
6	LDAP timeout happened on the AP for the request.
7	Missing LDAP configuration on the WLAN configuration of the AP.
8	Logout is successful.
9	Logout failed due to missing session on the AP. Most likely client session is already deleted from this AP.

The response parameter name and details is shown below.

Name	Details
action	0: On success action redirects the user to AP onboard logout page. 1: On success redirects user to an external URL. 2: On success redirects user to its original URL.
cmac	MAC address of the client.
expiry	Displays the session time for the given guest session.

Name	Details
msg	Message is based on RADIUS attribute reply message (18) in the RADIUS Access Accept or Reject message.
prefixQs	True: Add query strings to landing URL on success. False: Remove query strings from landing URL on success. `prefixQs` and `action` values are driven based on WLAN configuration.

60 GHz cnWave RESTful API

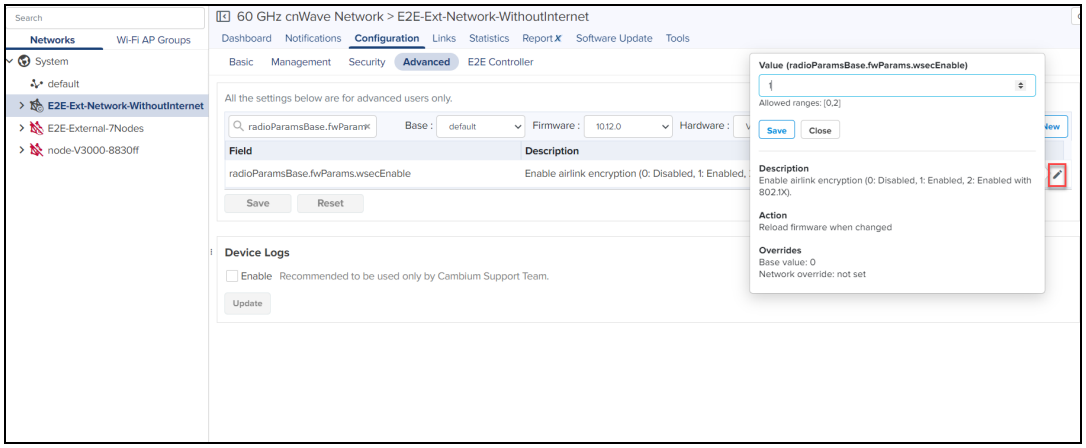
cnMaestro supports configuration overrides for 60 GHz cnWave E2E Network, E2E Controller, and Node(s) using the RESTful API.

E2E Network

To determine the configuration parameters available in an E2E Network, navigate to **E2E Network** > **Configuration** > **Advanced**. Search for the desired **Field**, and review its **Description**, allowed **Values**, and **Override status**. Use the RESTful API to override single or multiple fields.

GET `/api/v2/cnwave60/networks/{network_id}/configuration`

PUT `/api/v2/cnwave60/networks/{network_id}/configuration`



Field names are separated by dots. Each substring between the dots will be converted to objects and the last substring will be the key and value.

Example

In case of field name `radioParamsBase.fwParams.wsecEnable`, payload will be:

```
{
  "radioParamsBase": {
    "fwParams": {
       "wsecEnable": 1
    }
  }
}
```

⚠	**WARNING:** Partial update is not allowed. Always send full configuration that needs to be pushed to E2E Network.

Optimization

To determine the optimization parameters available in an E2E Network, navigate to **E2E Network** > **Configuration** > **Advanced**.

GET `/api/v2/cnwave60/networks/{network_id}/optimization/{optimization_type}`

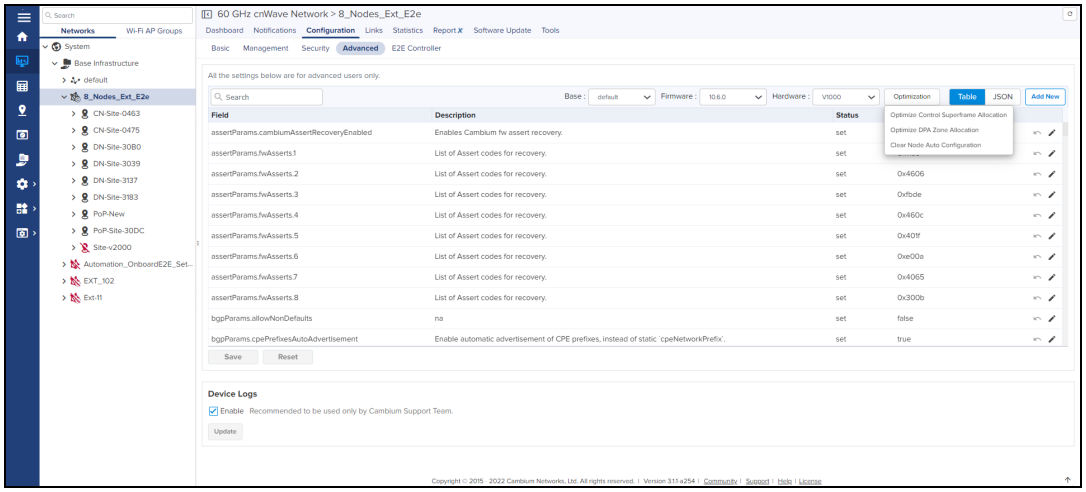
PUT `/api/v2/cnwave60/networks/{network_id}/optimization/{optimization_type}`

Available values :

`controlSuperframeAllocation,`

`dpaZoneAllocation`

`clearNodeAutoConfig`



Example

```
{
  "clearUserConfig": true,
  "nodes": [
    "string"
  ],
  "configPaths": "string"
}
```

Device (Node) Configuration

To update Device configuration, navigate to **Node** > **Configuration** > **Advanced**. Search for the **Field**, and review its **Description**, allowed **Values**, **and Overrides status**. Use the RESTful API to override those fields.

GET `/api/v2/cnwave60/networks/{mac}/configuration`

PUT `/api/v2/cnwave60/networks/{mac}/configuration`

Field names are separated by dots. Each substring between the dots will be converted to objects and the last substring will be the key and value.

Example

In case of field name `linkParamsBase.fwParams.minTxPower`, object to send in the API payload will be:

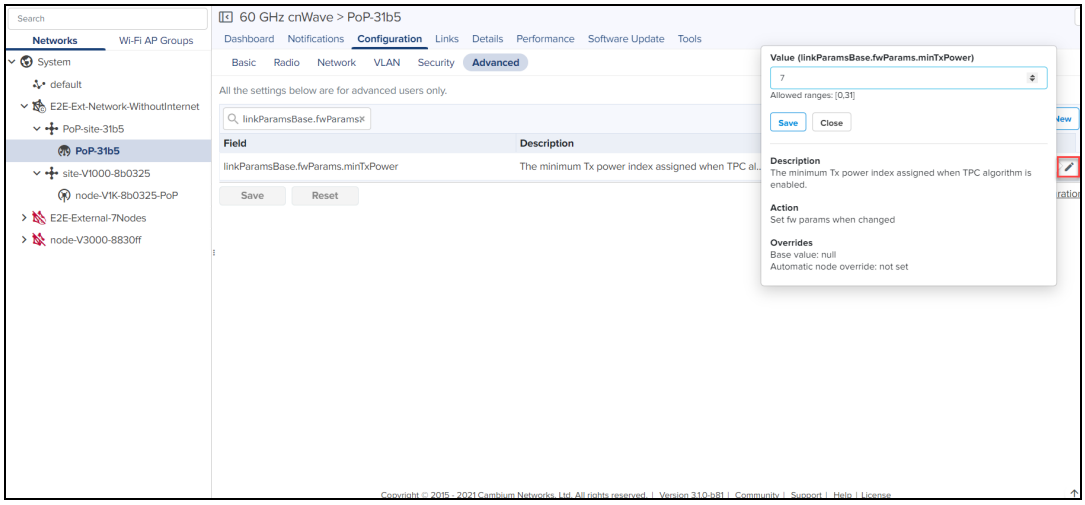
```
{
    "linkParamsBase": {
        "fwParams": {
            "minTxPower": 6
            "maxTxPower": 8
         }
      }
```

}

The below two APIs are introduced in Release 3.1.0 to update multiple device configurations overrides.

GET `/api/v2/cnwave60/networks/{network_id}/devices/overrides`

PUT `/api/v2/cnwave60/networks/{network_id}/devices/overrides`



	**WARNING:** Partial update is not allowed. Always send full configuration that needs to be pushed to 60 GHz cnWave Devices.

The example payload for PUT request is seen from cnMaestro UI.

Example

```
{
  "device1_name": {
    "radioParamsBase": {
     "fwParams": {
       "txPower": 6
     }
    }
   },
   "device2_name": {
     "popParams": {
      "POP_IFACE": "nic2"
     }
    }
  }
```

	**NOTE:** You can download the full config of the node by clicking on the **Show Full Configuration** as well and then get the JSON key and pass in RESTful API.

E2E Controller

To update E2E Controller configuration, navigate to **E2E Network** > **Configuration** > **E2E Controller**. Search for the desired **Field**, and review its **Description**, allowed **Values**, and **Override status**. Use the RESTful API to override those fields.

GET `/api/v2/cnwave60/networks/{network_id}/controller/configuration`

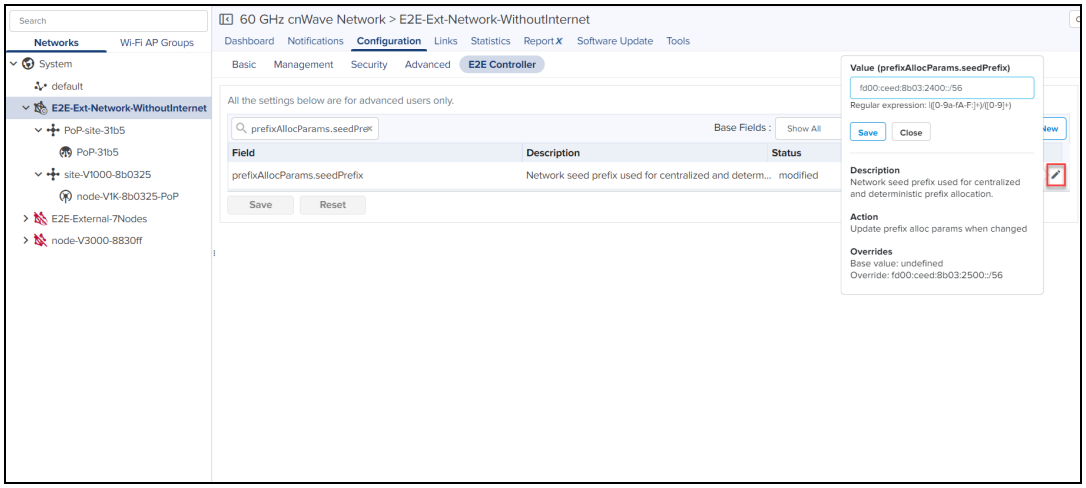
PUT `/api/v2/cnwave60/networks/{network_id}/controller/configuration`

Field names are separated by dots. Each substring between the dots will be converted to objects and the last substring will be the key and value.

Example

In case of field name `prefixAllocParams.seedPrefix`, payload will be:

```
{
    "prefixAllocParams": {
     "seedPrefix": "fd00:ceed:1992:1400::/56"
    }
}
```



WARNING:

Partial update is not allowed. Always send full configuration that needs to be pushed to the E2E Controller.

Guest Access

This section describes how to configure Guest Access using cnMaestro. This feature allows the clients to connect to the internet through Free Tier, Vouchers, or Paid Access types.

The Guest Access feature creates a separate network for guests by providing Internet access to guest wireless devices such as mobiles, tabs, and laptops.

NOTE:

The Guest Access feature is supported only on Enterprise Wi-Fi devices and ePMP 1000 Hotspot.

Configuration

- Create the Guest Access Portal in cnMaestro
- Map the device to cnMaestro

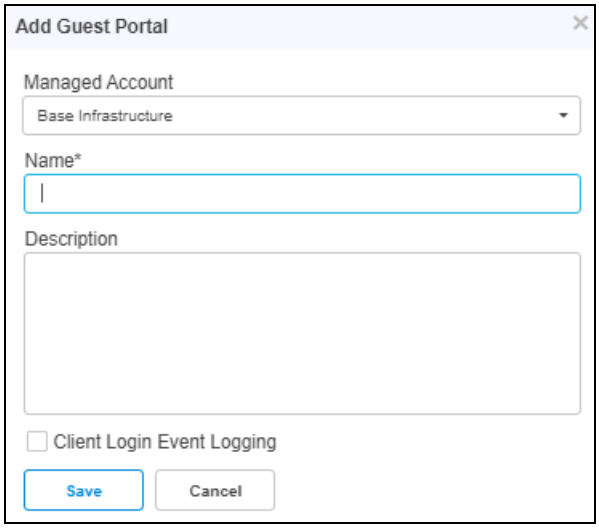
Creating the Guest Access Portal in cnMaestro

1. Basic Details
2. Access Portal
3. Design Page
4. Sessions
5. Guests

Procedure for Creating Guest Access

1. Navigate to **Network Services > Guest Access Portal**.

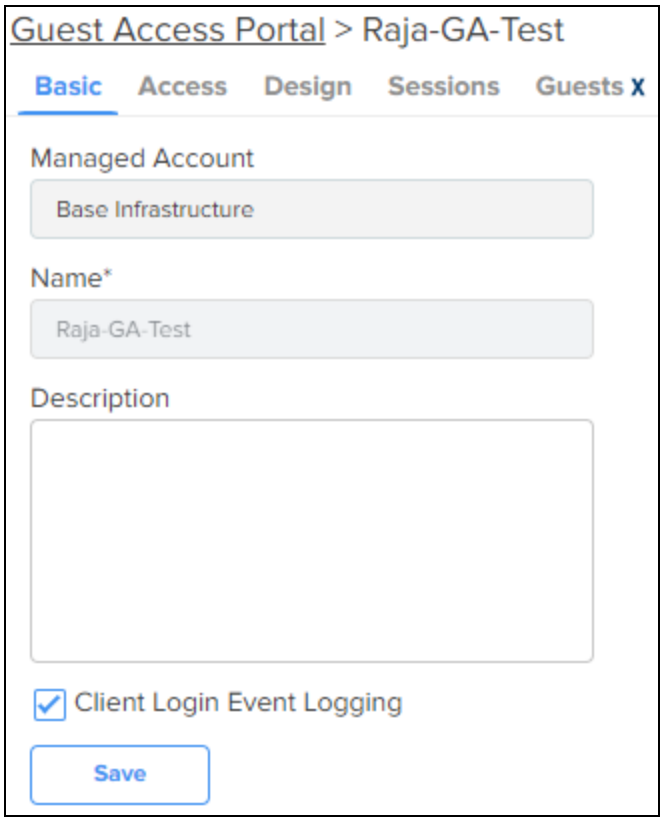
2. Click **Add Portal**. A maximum of four portals can be created per account.
3. Enter a name and brief description for the portal.



4. Click **Save**..

Basic Details

The **Basic** details page contains the **Managed Account** Type, **Name**, and **Description**.



	NOTE: A name once created for the Portal cannot be changed.

Access Portal

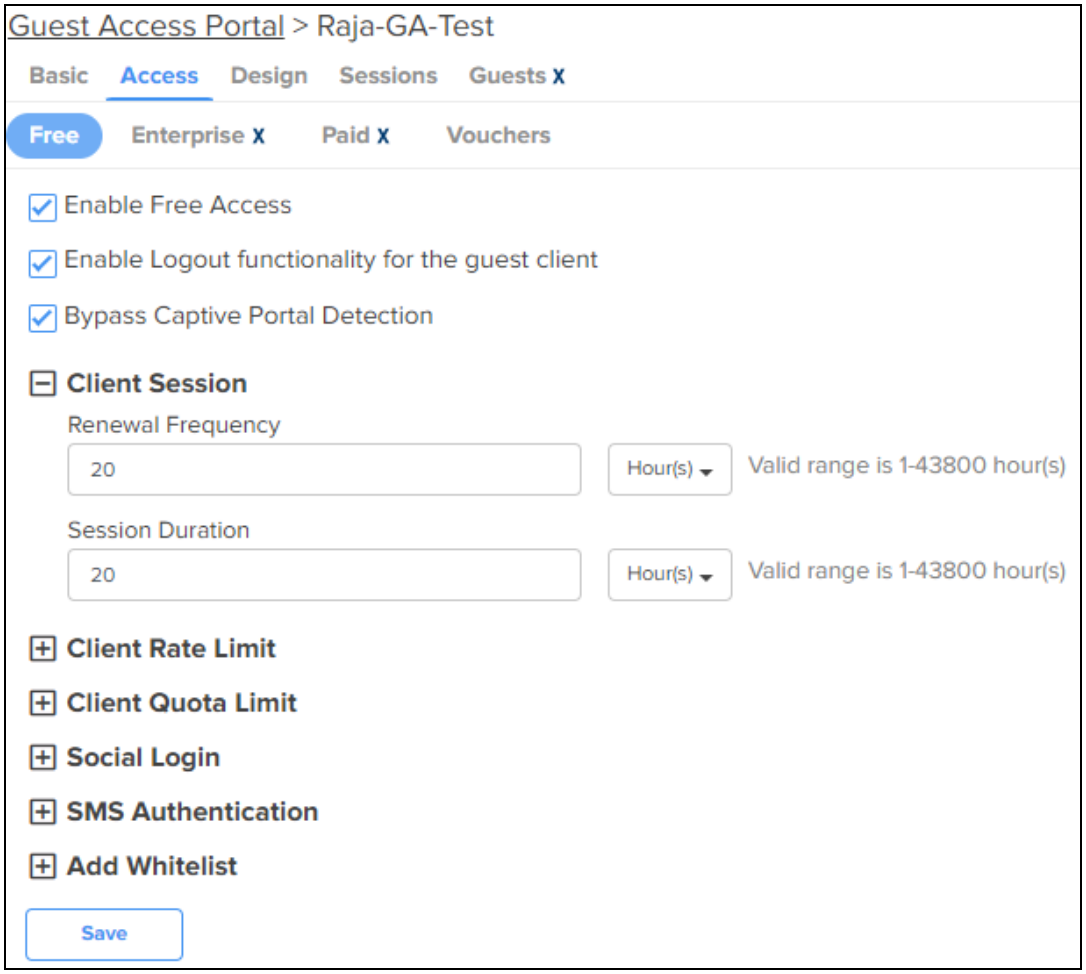
The Access Portal tab has four different access types:

- Free
- Enterprise X access through one of the following options:
  - Microsoft Azure
  - Sponsored Guest
  - Self Registration
  - Google
- Paid X
- Vouchers

The parameters under each access method can be configured only after the corresponding access method is enabled.

	NOTE: Microsoft Azure and Google-based access are not supported on devices running release 4.x..

Free Access Type Configuration



Free Access type contains configurable parameters such as:

- Session validity
- Renewable frequency
- Client rate limits
- Social login

You can select authentication using Google, Facebook, Twitter and Office 365, or all. You will need to enter the App ID of your social login App. If you enable Facebook login you will also need to enter your Facebook App secret.

Table 114: Free Access Type Parameters

Parameter	Description
Add Whitelist	Options for configuring the IP address or the domain name.
Client Rate Limit	Options for configuring downlink and uplink parameters in kbps to limit the data transfer rate to or from the client. If a client rate limit parameter is blank, no limits are applied.
Client Quota Limit	The data quota limit feature has been added for RADIUS-based as well as controller-based guest portals. For controller-based, it is either directional or total data quota limit. Once the client logs inas a guest, the data quota limit is enforced and the values are sent to the access point to which the client is connected. The access point keeps track of the data limits and also sends client statistics to the controller every thirty minutes. In case of multiple devices allowed for a given policy, the data quota limits enforcement has some limitations and works with the latency of thirty minutes during which the cumulative data quota limits of the devices can be exceeded beyond the configured data quota limits. The similar behavior is supported through RADIUS attributes for RADIUS-based onboard guest access clients. RADIUS_VENDOR_ID_CAMBIUM 9 (17713) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_UP (151) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_DOWN (152) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_UP_GIGWORDS (153) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_DOWN_GIGWORDS (154) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_TOTAL (155) RADIUS_VENDOR_ATTR_CAMBIUM_WIFI_QUOTA_TOTAL_GIGWORDS (156) The gigwords attributes are used for supporting data quota limits above 4 GB when required.
Renewable Frequency	Once the session duration for the client expires, the client needs to wait for the period specified by renewal frequency before logging in again.
Session Duration	The duration for which the client is provided access.
SMS Authentication	SMS OTP supports Twilio, SMS Country, and SMS Gupshup SMS gateway providers. Any one of the gateway providers can be used to support the SMS OTP to be delivered to the cell phone of the end user. Once OTP is received the client can enter the OTP to get Internet access.
Social Login	Consists of the following options: • Domain URL: The redirected URL used by the client when trying to access the Internet. • Google: Consists of ID and Secret options to configure, which admin can create from https://console.cloud.google.com/ • Facebook: Consists of ID and Secret options to configure, which admin can create from https://developers.facebook.com/apps/ • Twitter: Consists of consumer key, consumer secret key, and callback URL. • Office 365: Consists of Id and Replyback URL.

NOTE:

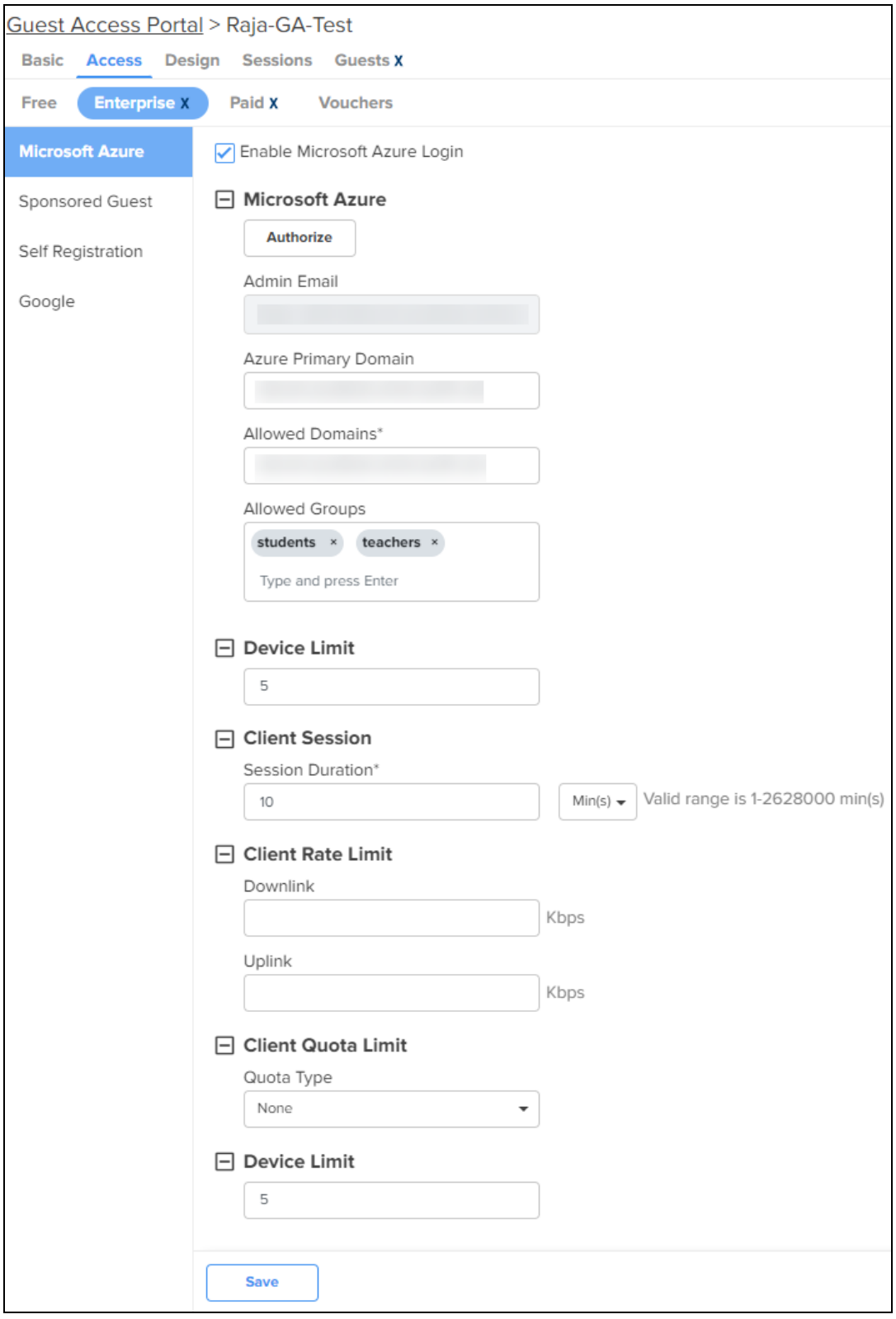
- Renewal frequency should be greater than session expiration.
- Client will get Social login options only when enabled in Access Control page in Portal.
- If Social login is enabled, it is mandatory in free access method for client to login through Google/Facebook/Twitter/Office 365.

Enterprise Wi-Fi Access^{X} using Microsoft Azure Login, Sponsored Guest, Self Registration, or Google

	**Note:** • Microsoft Azure and Google-based access are supported only on Enterprise Wi-Fi 6 APs running firmware version 6.5.1 and later. • Microsoft Azure is supported on cnMaestro 4.1.0 and later versions. • Google-based access is supported on cnMaestro 5.0.0 and later versions.

Microsoft Azure

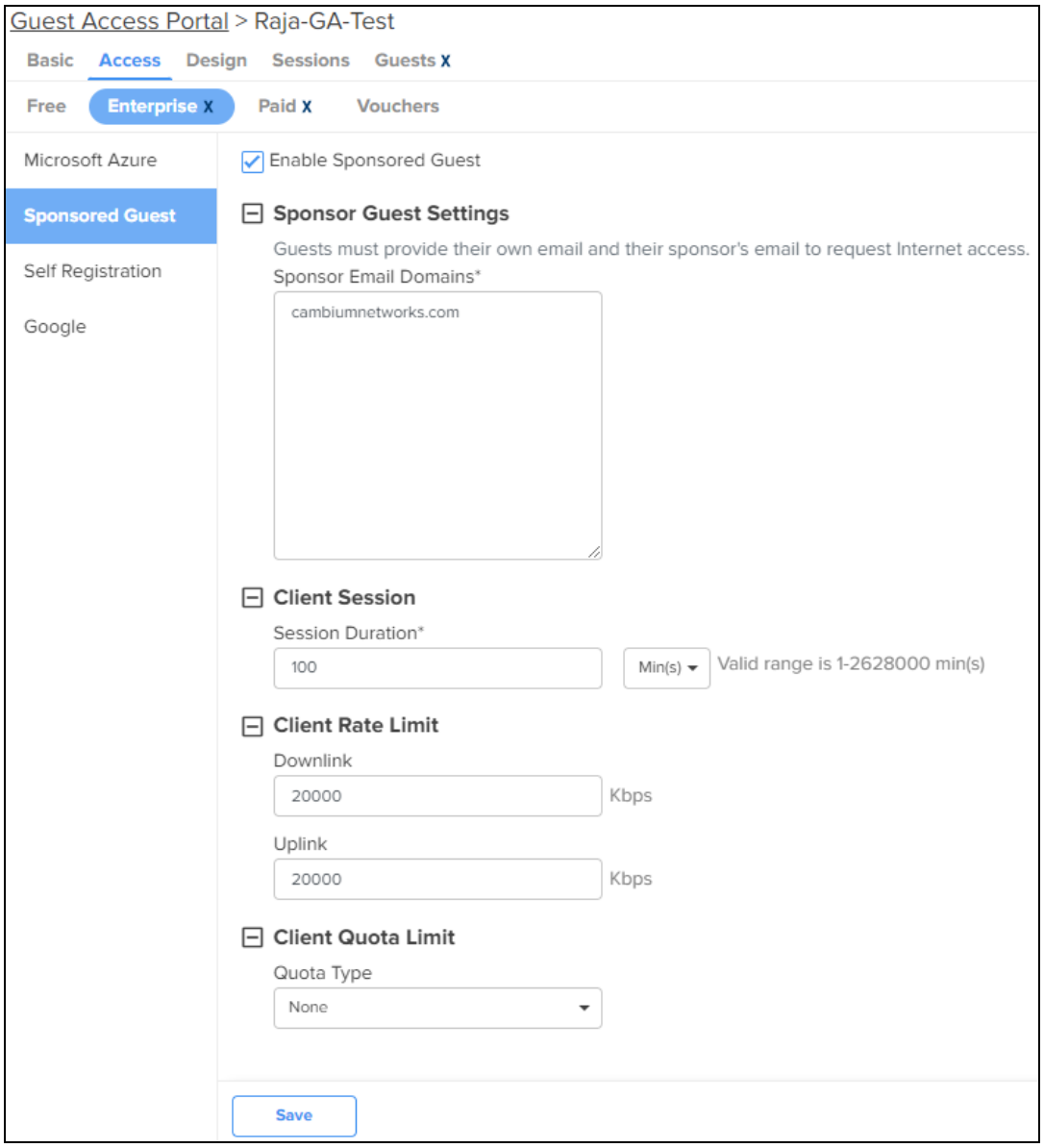
Enterprise Microsoft Azure access page enables Microsoft Azure users to log in to access the Enterprise Wi-Fi. To set up users to authenticate from Microsoft Azure, navigate to **Network Services > Guest Access Portal > Access > Enterprise^{X} > Microsoft Azure**, complete the following parameters and click **Save**:



Sponsored Guest

In this type of access, guests must provide their own email address and their sponsor's email address to request Internet access.

To allow sponsored guests to access the Wi-Fi, navigate to **Network Services > Guest Access Portal > Access > Enterprise^{X} > Sponsored Guest** complete the following parameters, and click **Save**:



Self Registration

Self registration enables guests to register themselves when connecting to the Wi-Fi network for the first time. The Wi-Fi administrator can configure the self registration process to require a sponsor approval or not. The sponsor approval can also be configured to be manual or automatic confirmation.

To configure self registration, navigate to **Network Services > Guest Access Portal > Access > Enterprise^{X} > Self Registration** and configure the following parameters.

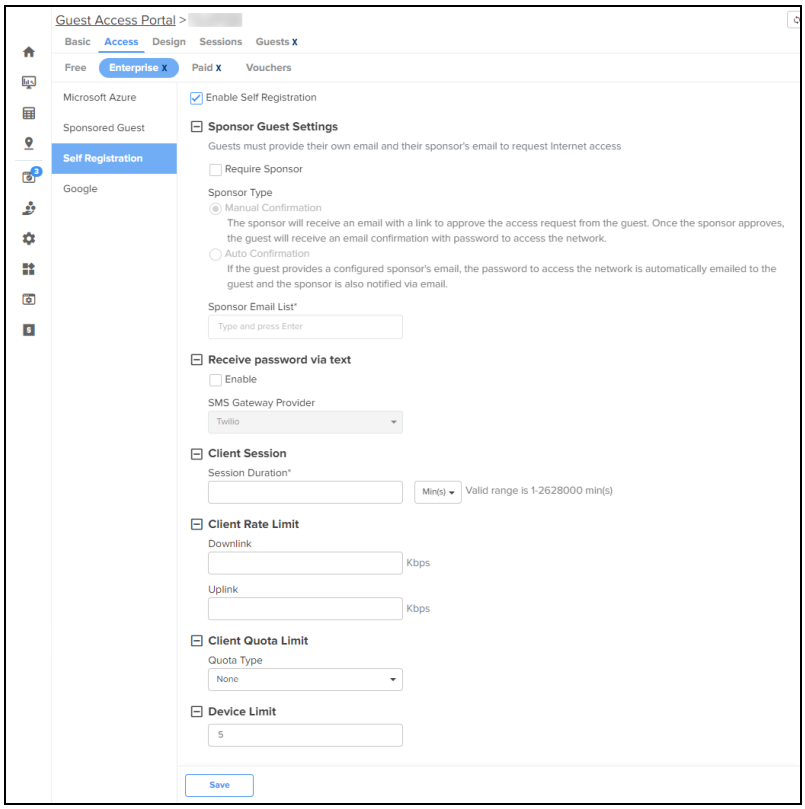


Table 115: Self Registration Parameters

Parameter	Description
Enable Self Registration	Select the check box to enable self registration feature and configure the following parameters.
Sponsor Guest Settings The guests must enter a sponsor email address when registering to connect to the wireless network. The administrator can choose to configure whether the sponsor must manually approve each request or the approval is automatic.	
Require Sponsor	Select the check box if you want the self registration to be approved by a sponsor. The guests must enter the sponsor email address when registering for access to the SSID.
Sponsor Type	Specifies whether the sponsor approval for guest internet access must be automatic or manual. The following options are available: • **Manual Confirmation**—The sponsor receives an email for approving the guest's access request. After approval, the guest receives an email confirmation along with the password to connect to the wireless network. • **Automatic Confirmation**—If the guest provides a configured sponsor's email address, the password to access the network is automatically emailed to the guest and the sponsor is also notified via email.
Sponsor Email List	Configure the list of sponsor email addresses for approving access requests.
Receive password via text By default, the guests receive the password to their email address. However, if you want the guests to receive the password to their mobile devices as well, configure the following parameters.	
Enable	Select the check box to send the password to the guest's mobile device.

Table 115: Self Registration Parameters

Parameter	Description
SMS Gateway Provider	Select the SMS gateway to be used to send the OTP to the guest's mobile device. The following gateways are supported (each of the gateways have their own respective parameters that must be configured): • Fast SMS • Generic SMS API • SMS Country • SMS Gupshup • SMSAPI • Twilio • Victory Link SMS Each of the above gateways must be configured with their respective parameters.
Client-related parameters	
Client Session—**Session Duration**	Specifies the maximum duration (in minutes) that the guest can browse the internet in a single session. Supported range: 1-2628000 minutes
Client Rate Limit	Specifies the download and upload speed limit (in Kbps) for the guests. Configure the speed limit in the **Downlink** and **Uplink** fields.
Client Quota Limit	
Quota Type	Specifies the type of quota for configuring the data usage limit. The following options are supported: • None—No limit is configured for data usage. Guests can access unlimited data in the configured session duration. • Directional—Configure limits separately for downlink and uplink directions. The **Downlink** and **Uplink** fields are enabled. • Total—Configure the limit for both directions totally. The **Total** field is enabled.
Downlink	Specifies the downlink data usage limit (in either MB or GB, selected from the drop-down list). This field is available only when you select **Directional** in the **Quota Type** field.
Uplink	Specifies the uplink data usage limit (in either MB or GB, selected from the drop-down list). This field is available only when you select **Directional** in the **Quota Type** field.
Total	Specifies total data usage limit for both the directions (in either MB or GB, selected from the drop-down list). This field is available only when you select **Total** in the **Quota Type** field.
Device Limit	Specifies the number of devices that the guest can connect to the wireless network. Default: 5.

Google-based access

Google-based access enables users with a Google account to connect to the wireless network by synchronizing the active directory. When enabled, if a guest who is part of the supported group tries to connect to the Wi-Fi network, the AP provides access to the guest.

	Note: To configure Google-based access, you must have a Google Workspace account.

To configure Google-based access, navigate to **Network Services > Guest Access Portal > Access > Enterprise**X **> Google** and configure the following parameters.

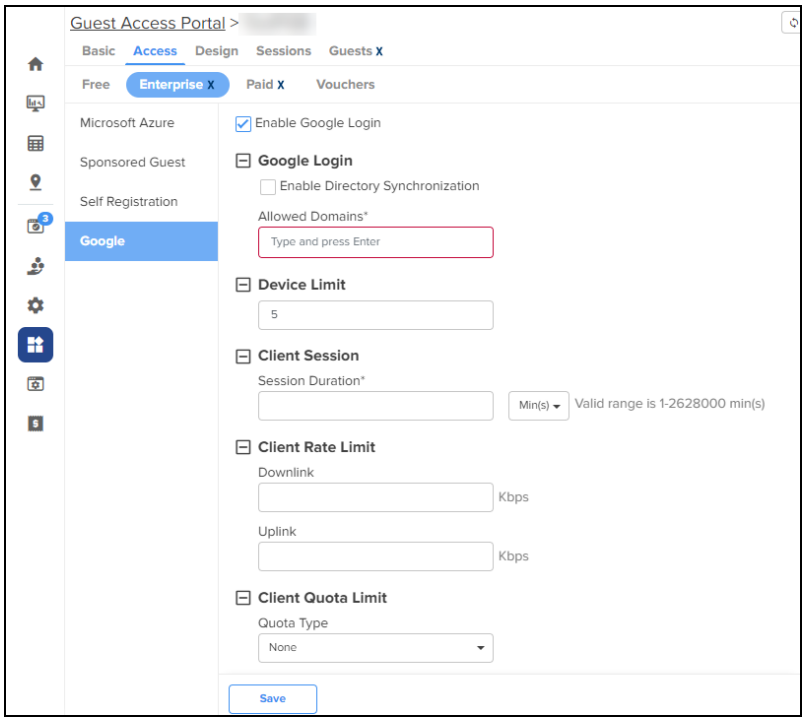


Table 116: Google Parameters

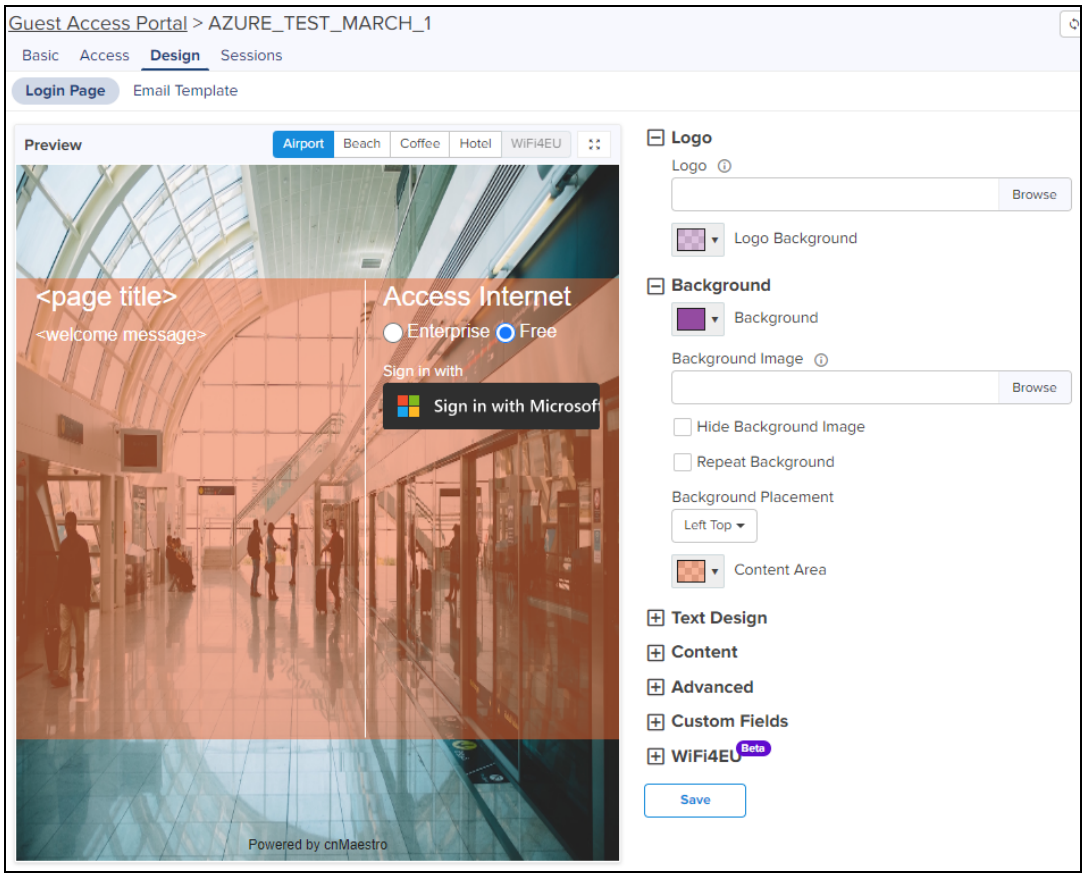
Parameter	Description
Enable Google Login	Select the check box to enable Google-based Wi-Fi access and configure the following parameters.
Device Limit	Specifies the number of devices that the guest can connect to the wireless network. Default: 5.
Google Login	
Enable Directory Synchronization	Select the check box to enable synchronization of Google Apps Domain Directory. This functions requires authorization. Click **Follow these steps** for information on configuring your Google Apps Domain Directory.
Allowed Domains	List of domains to be allowed for Google-based access. Enter the domain name in the text box.
Client-related parameters	

Table 116: Google Parameters

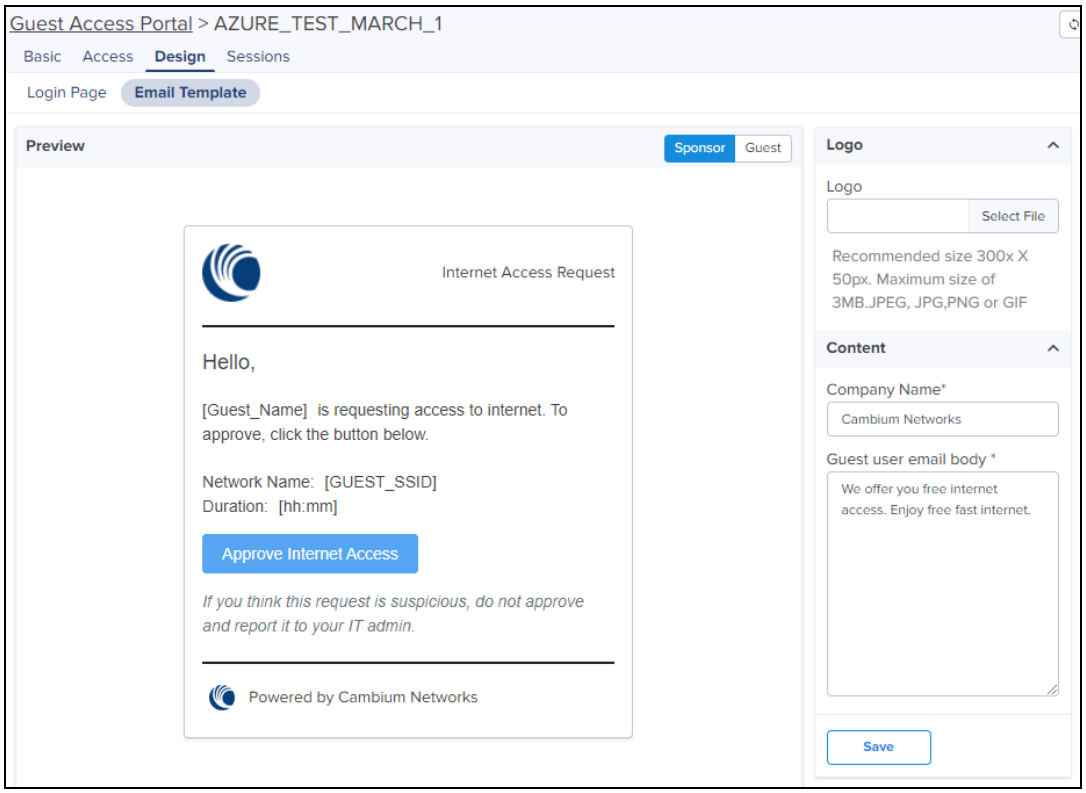
Parameter	Description
Client Session—Session Duration	Specifies the maximum duration (in minutes) that the guest can access internet in a single session. Supported range: 1-2628000 minutes
Client Rate Limit	Specifies the download and upload speed limit (in Kbps) for the guests. Configure the speed limit in the **Downlink** and **Uplink** fields.
Client Quota Limit	
Quota Type	Specifies the type of quota for configuring the data usage limit. The following options are supported: None—No limit is configured for data usage. Guests can access unlimited data in the configured session duration. Directional—Configure limits separately for downlink and uplink directions. The **Downlink** and **Uplink** fields are enabled. Total—Configure the limit for both directions totally. The **Total** field is enabled.
Downlink	Specifies the downlink data usage limit (in either MB or GB, selected from the drop-down list). This field is available only when you select **Directional** in the **Quota Type** field.
Uplink	Specifies the uplink data usage limit (in either MB or GB, selected from the drop-down list). This field is available only when you select **Directional** in the **Quota Type** field.
Total	Specifies total data usage limit for both the directions (in either MB or GB, selected from the drop-down list). This field is available only when you select **Total** in the **Quota Type** field.

Designing the Guest Access Login Page and Email Templates

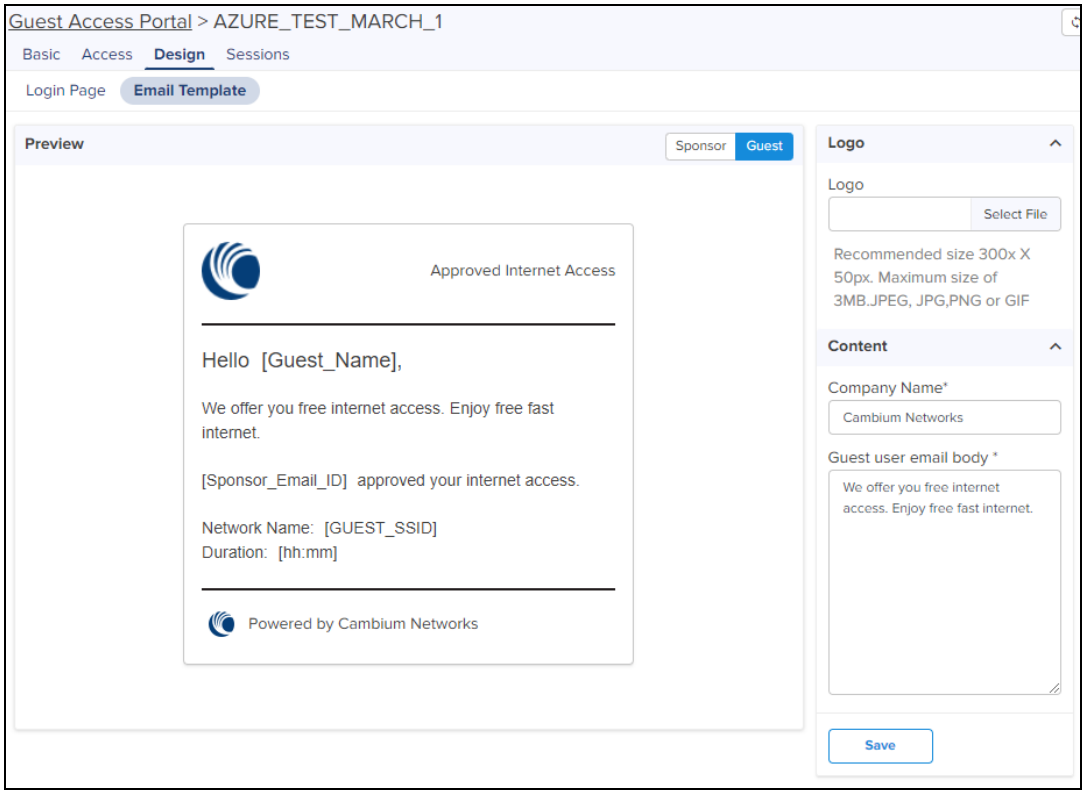
To design the guest login page for users to see when requesting access, navigate to **Network Services > Guest Access Portal > Design > Login Page**, complete the following parameters, and click **Save:**



To design the email template that should be used to send approval request to the sponsor (in Sponsored Guest and Self Registration access types), navigate to **Network Services > Guest Access Portal > Design > Email Template > Sponsor**, complete the following parameters, and click **Save:**



To design the email template that should be used to send approved access details to the guest, navigate to **Network Services > Guest Access Portal > Design > Email Template > Guest**, complete the following parameters, and click **Save:**

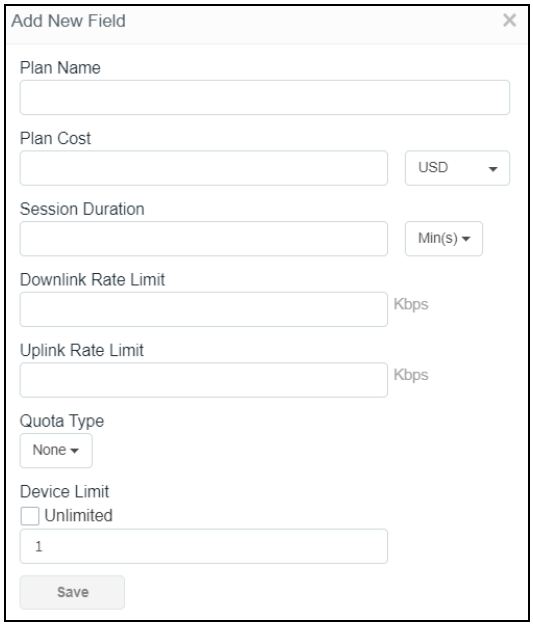


Paid Access[X]

Paypal has been added as a payment gateway service where end users can purchase Internet connectivity using a credit card or their existing PayPal accounts. For purchasing Internet plans, clients are directed to PayPal portal where they purchase the plan and then they are automatically redirected to guest access portal where the purchased voucher is displayed. The user should ensure to save this Voucher information if s/he plans to use it on multiple devices.

Table 117: Paid Access Type Parameters

Parameter	Description
General	**Plan Name:** The name of the plan.
	Session Duration: The duration for which the client is allowed to access the network.
	Client Rate Limit: The uplink and the downlink values in kbps to limit the data transfer rate to or from the client. If a client rate limit parameter is blank, no limit s are applied.
	Device Limit: The device limit allow that number of devices to be connected or select the unlimited to connect any number of devices.



Voucher Access Type Configuration

Important Points to Remember

- Vouchers can only be generated after enabling Vouchers and creating at least one Voucher plan.
- A maximum of 50,000 Vouchers per portal can be created on cnMaestro.

Note:

User is allowed to add only 1000 vouchers at a time. In order to create 50,000 vouchers user needs to add 50 times.

- A maximum of 1,000 Vouchers per portal can be created on cnMaestro Cloud (https://cloud.cambiumnetworks.com/).
- Total number of generated Vouchers = Vouchers Unclaimed + Vouchers Claimed + Vouchers Expired.
- The admin can export all/valid/current page Voucher codes as PDF/CSV document.

Voucher contains options to add new plans and Vouchers. Based on user requirements, the plans can be created with different validity and rate limits.

1. **Create a plan**
   - Navigate to **Network Services > Access Control Portal** page and select **Access Control** tab.
   - Enable **Vouchers.**
   - Click **Add New Plan** button. The window with general and design parameters for the plan is displayed.

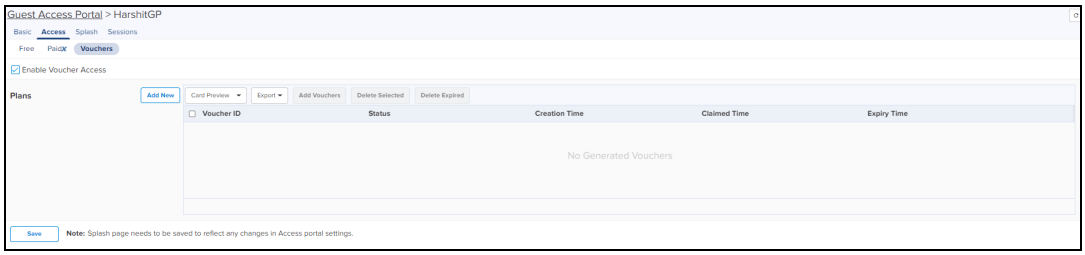
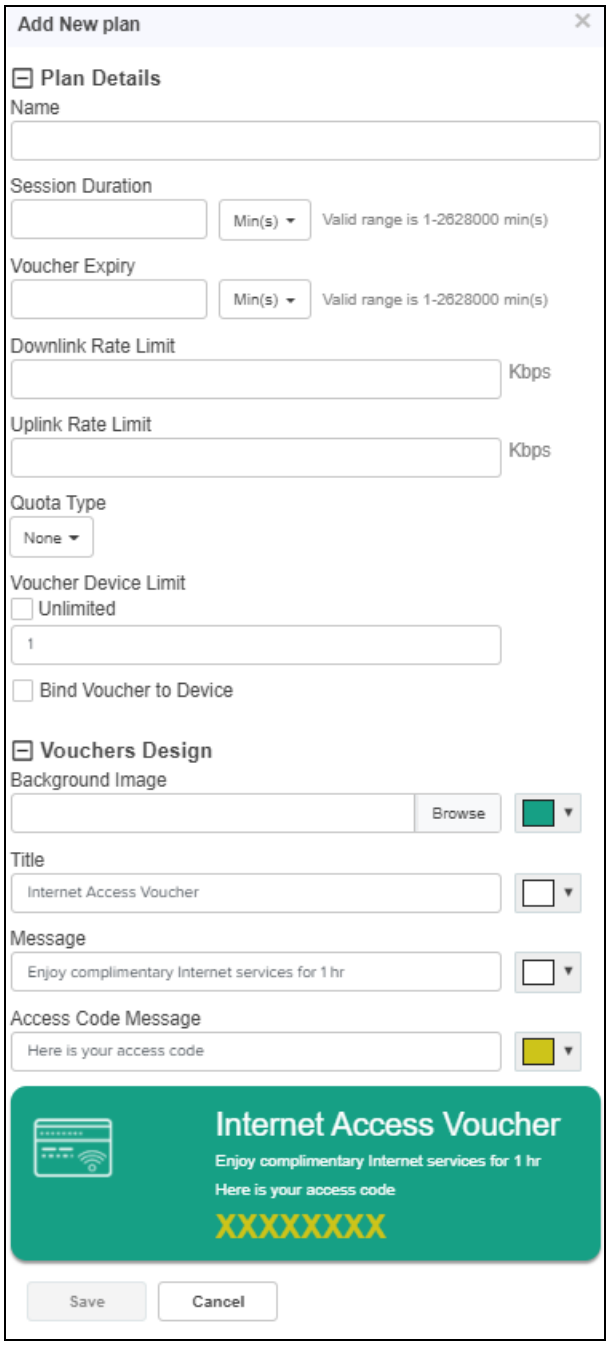


Table 118: Voucher Access Type Parameters

Parameter	Description
Design	• **Color:** There are options to modify colors for the title, message, code, and background. • **Background Image:** You can browse and select a background image for this page. • **Title:** The title of the voucher plan. • **Message:** Detailed information about the plan. • **Access Code Message**: 8 digit access code will be provided to use the voucher. With all the above parameters, administrators can create their own design for the card with text, color, and message to be displayed on card.
General	• **Name**: The name of the plan. • **Session Duration:** The duration for which the client is allowed network access. • **Voucher Expiry**: The expiry time for the generated Vouchers. Once this time lapses, the Vouchers cannot be used. • **Client Rate Limit**: The uplink and the downlink values in kbps to limit the data transfer rate to or from the client. If a client rate limit parameter is blank, no limits are applied. • **Voucher Device Limit**: Limit the devices to use the voucher.



2. Once a plan is configured, Vouchers can be generated for it. Each Voucher is a unique, randomized alphanumeric code.

Figure 399 Select a plan

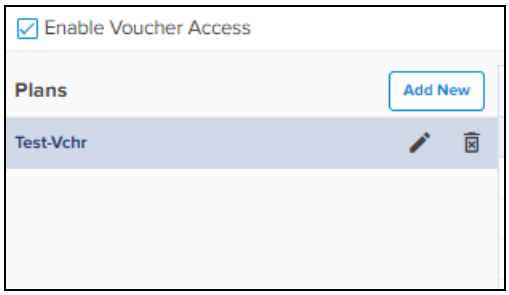
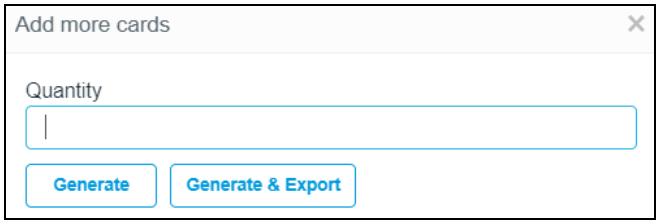


Figure 400 Add Vouchers



3. Once the plan is created and the Vouchers are generated, the following page is displayed.

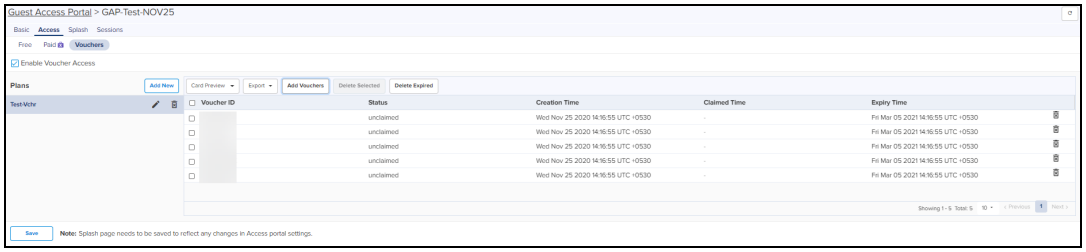


Figure 401 Sample Voucher Code

	NOTE: The modified values in the Access Portal page is reflected on the design page only when the design page is saved after making the changes.

Design Page

The Design page refers to the page to which a wireless client is redirected when it connects to the guest portal. Administrators can create their own Design page by modifying the default logo, background, and text to be displayed in the Design page with different colors and fonts.

- If **Free** is selected in **Access Portal**, the client only sees free access related parameters.
- If **Voucher** is selected in **Access Portal**, the client only sees Voucher related parameters with a text box to enter the **Voucher code**.
- If both **Free** and **Voucher** are selected, then the client sees both Free and Voucher related parameters.

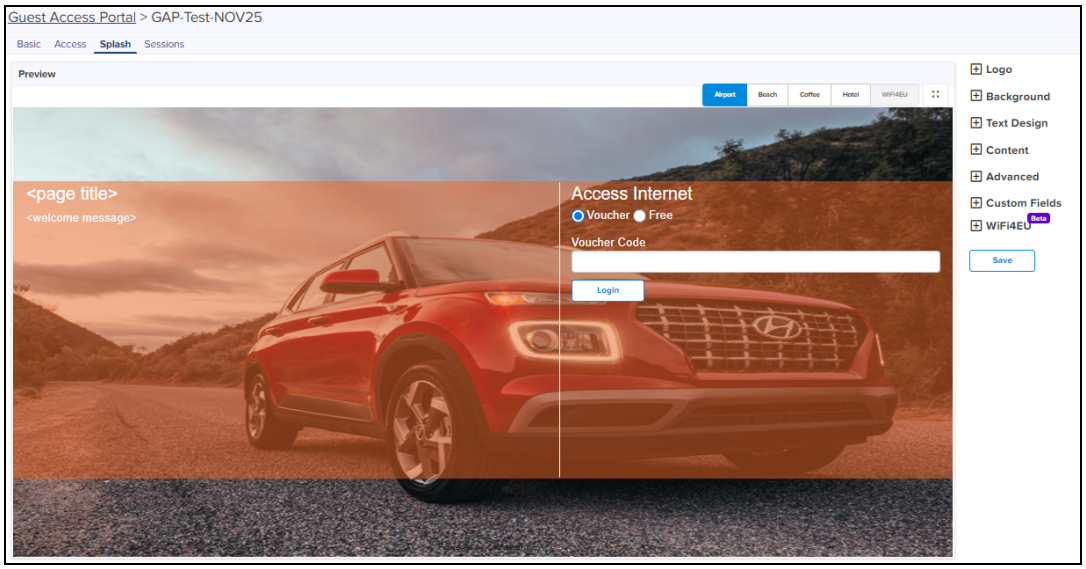


Table 119: Design Page Parameters

Parameter	Description
Accept Terms Message	Text to appear as the accept terms message.
Advanced	Expand **Advanced** option. Browse and select the advanced fields.
Background	Browse and select the image that needs to be displayed as the background. • Recommended image resolution—1024 pixels × 800 pixels • Maximum supported image file size—5 MB • Supported file formats—JPEG, JPG, PNG, and GIF
Background Placement	Choose the option from the drop-down for placing the background image in the **Design** page.
Custom Fields	Expand **Custom Field** option. The user can customize the fields in the **Design** page by choosing the **Custom Field** option in the **Guest Access Portal** page and clicking **Add New** button.
Enter Voucher Code Message	Enter the text to appear in **Voucher Code Message**.
Free Label	Enter the text that should appear on the **Free Label**.
Login Button	Enter the text that should appear on the window to submit.
Login Failure Message	Message to appear when any error occurs during login.
Login Success Message	Message to appear after successful login.
Login Title	Title of the login section.

Table 119: Design Page Parameters

Parameter	Description
Logo	Browse and select the logo that needs to be displayed on the **Design** page. • Recommended image resolution—300 pixels × 50 pixels • Maximum supported image file size—3 MB • Supported file formats—JPEG, JPG, PNG, and GIF
Message	Text to appear as the welcome text. You can choose the font style and size for the welcome text.
On Success Redirect to URL	Enter the URL to be redirected to the page like Google, Twitter, and Facebook, etc.
Opacity	The transparency of background image.
Page Title	Text to appear as the title of the page. You can choose the font style and size for the title.
Please wait Message	Text to appear in the waiting screen.
Repeat Background	Enable the check box if you want the background image to be repeated.
Select Plans Label	Enter the text to appear in the label to select plan.
Server Error Message	Text to appear if there is an error while contacting server.
Terms and Conditions Title	Text to appear as the title for the terms and the conditions.
Terms and Conditions	Text to appear as the terms and conditions.
Terms Agree Button	Text to appear in the terms agree button.
Terms Cancel Button	Text to appear in the terms cancel button.
Text Design	Choose the appropriate colors for the background, logo in the background, content area, and for the text.
Voucher Code	Enter the text to appear in Voucher Code, Voucher Label, Enter Voucher Code Message, and Voucher Code Error Message.
Voucher Code Error Message	Enter the text to appear in Voucher Code Error Message.

Table 119: Design Page Parameters

Parameter	Description
Voucher Label	Enter the text to appear in Voucher Label.
Failure	Enter the text to appear in Google Authentication Failure Message, Twitter Authentication Failure Message, and Facebook Authentication Failure Message.
WIFI4EU	WiFi4EU provides free, high-quality Internet access only across the European Union.

WIFI4EU

WiFi4EU provides the free, high-quality Internet access across the European Union. Administrator can enable the WiFi4EU check-box to provide access to the free internet.

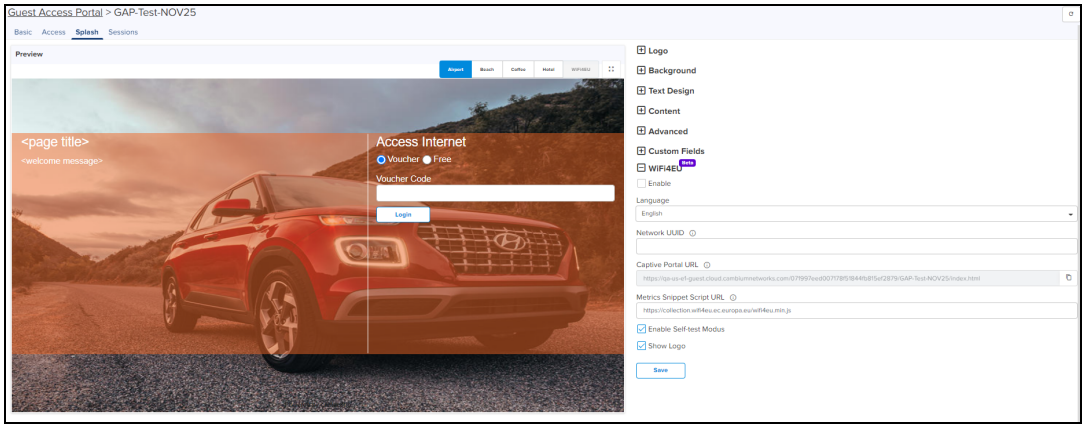


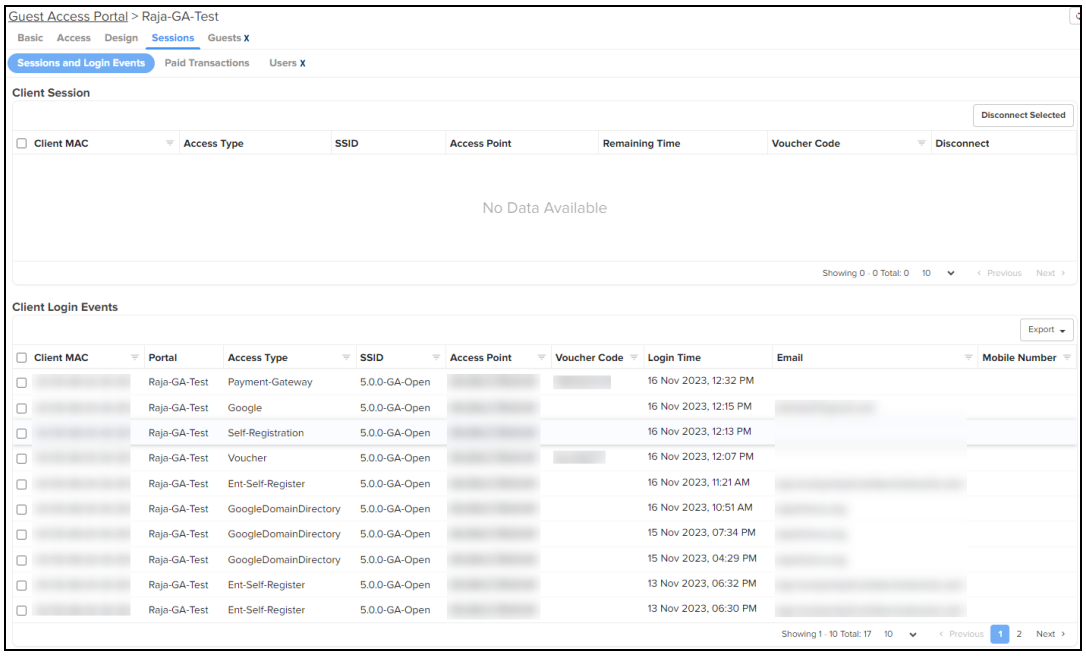
Table 120: WiFi4EU Parameters

Parameter	Description
General	• **Network UUID**: Universally Unique Identifier (UUID) that the EC attribute is generated when the network installation is created in the Installation. • **Language:** Allows to select the preferred language. • **Enable Self Test Mode**: Allows the browsers background script verification. • **Show Logo:** Displays the WiFi4EU logo provided by the European union.

Sessions

Sessions tab contains Client MAC address, Access Point MAC address, Access Type as Free (Google or Facebook) or Voucher, WLAN-SSID of client connected AP, Remaining time and Disconnect option.

Administrator can check how many clients are connected, Access Type (Free/Voucher) of the client, and can disconnect the clients.



Client Login Events table creates events of client login sessions. It maintains the login events for 7 days. This table has Client MAC address, Portal Name, SSID, Access point MAC, Voucher code (if client connected with Voucher), Access type (Google/Facebook/Voucher).

Admin can export the client login events as PDF / CSV.

Table 121: Sessions Parameters

Parameter	Description
Access Point	MAC address of the Access Point.
Access Type	Access type as Free or Voucher.
Client MAC	MAC address of the client.
Disconnect	Displays if the client is disconnected from the network.
Remaining Time	The time left for the client to access the Internet. It depends upon the session duration configured in the Access Portal.
Voucher	Displays the valid applied voucher.
WLAN	SSID of the network.

NOTE:

For **Free** Access method, the client MAC address is displayed even after the free session duration expires. Delete the MAC address of the client after the Renewable Frequency completes.

Users table displays details of users accessing the network using Enterprise Google-based access.

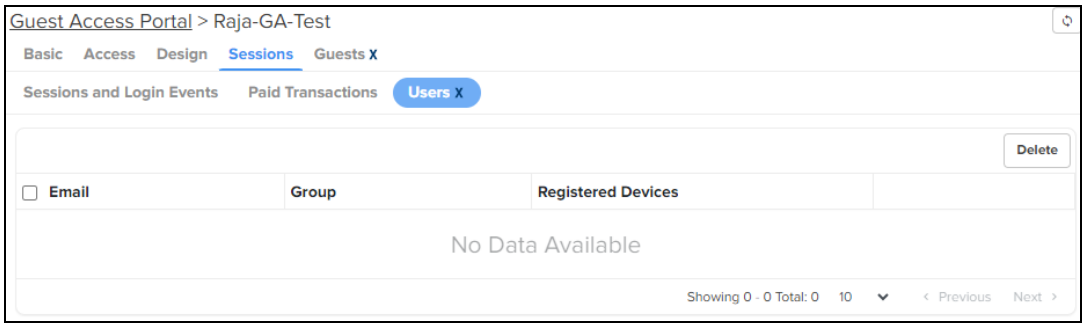


Table 122: Users Table Parameters

Parameter	Description
Email	Email address of the registered user.
Group	Name of the group to which the user belongs.
Registered Devices	MAC address of the registered devices.

Guests[X]

The Guests page allows you to view details of self registered guests connecting to the wireless network. However, to view this page, you must first enable and configure self registration under **Network Services > Guest Access Portal > Access Type > Enterprise[X] > Self Registration**.

You can also add new guest details on this page. These users can directly access the wireless network after entering the required details in the access portal.

To add a new user, complete the following steps:

1. Click **Add New** on the **Guests** page.

   The **Add New User** window is displayed.

2. Configure the name and email address of the guest in the **Name** and **Email** fields.

   Add a description, if required, in the **Notes** field.

3. Click **Add**.

   The details of the Enterprise self registered guests that are connected to the Wi-Fi network are displayed in the table

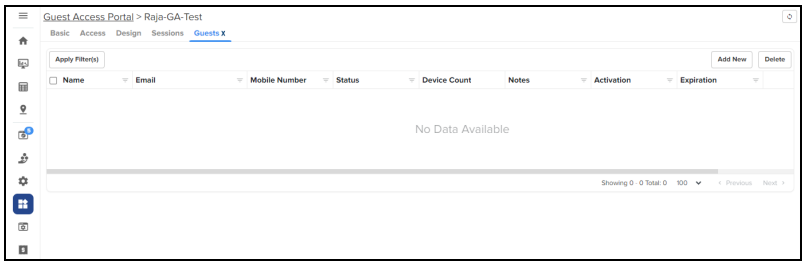


Table 123: Guests Table Details

Parameter	Description
Name	Name of the guest that was entered at registration.
Email	Email address of the guest.
Status	Displays the whether the guest is connected or offline.
Device Count	Displays the number of devices that the guest has connected to the network.
Notes	Displays the comments or description provided when adding the guest.
Activation	Displays the date and time when the guest first connected to the network.
Expiration	Displays the date and time when the guest disconnected from the network. For currently connected guests, this field displays the date and time of session expiration.

Mapping the device to Guest Access Portal in cnMaestro

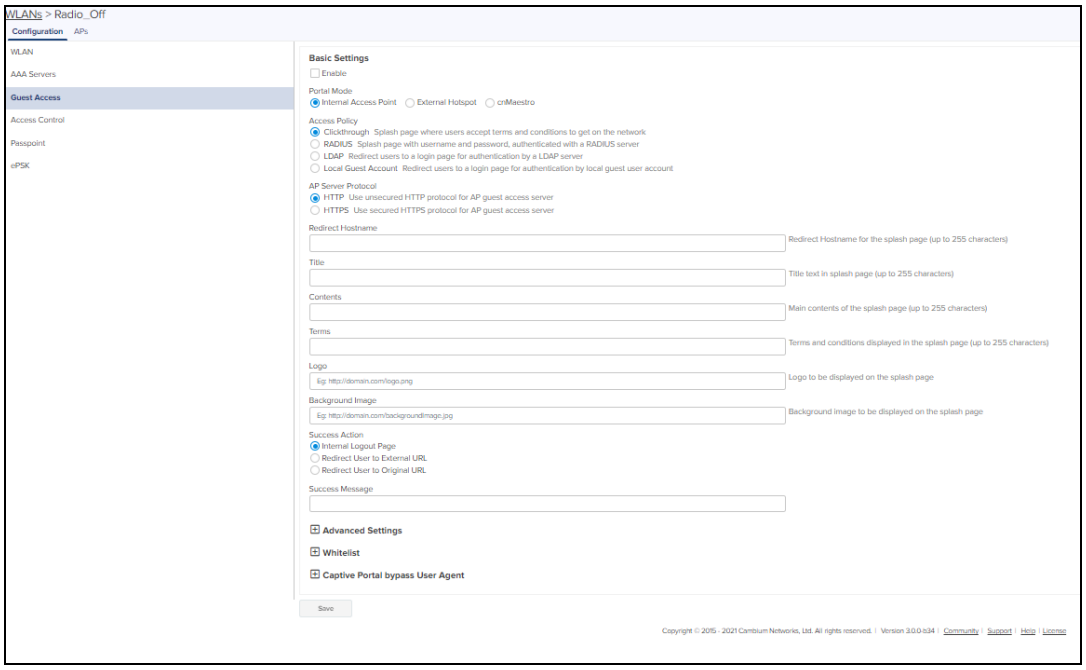
The administrator needs to configure the name of the Guest Access Portal in the device which redirects the device to cnMaestro for client connectivity.

	NOTE: The client gets the fully configured **Design** page for login only if the Access Point is onboarded to the server.

Configuration at device level

To configure the Guest Access at device level, perform the following:

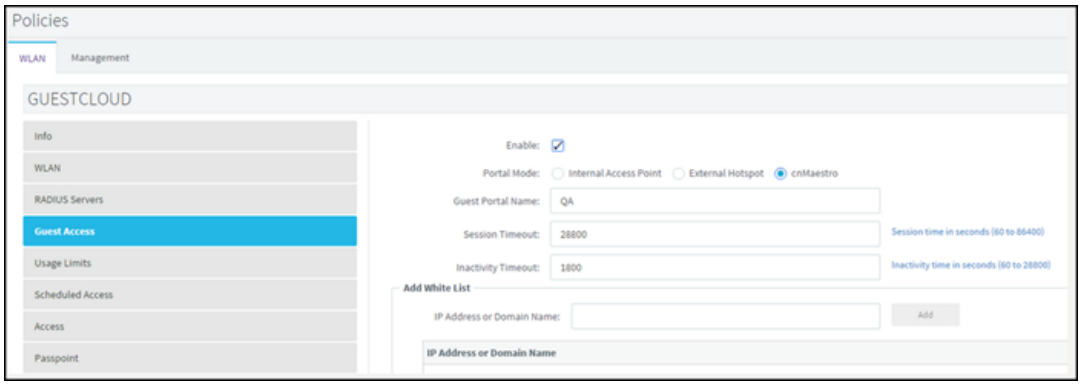
1. Login to the device.
2. Navigate to **Configuration** > **WLAN** > **Guest Access.**

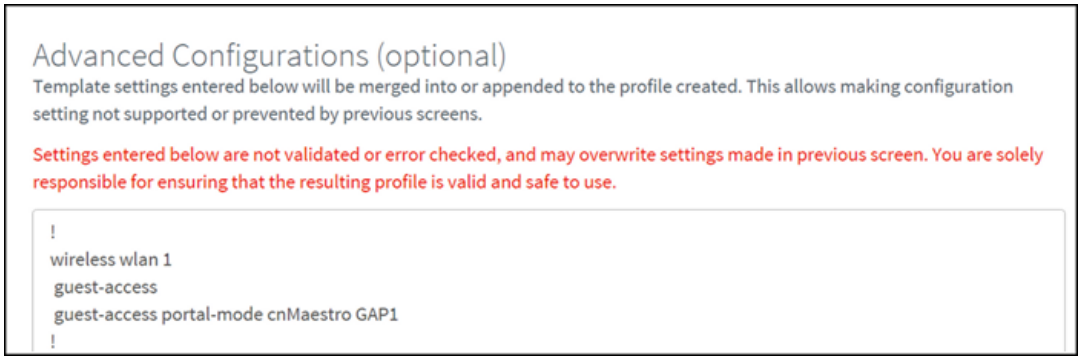


3. Enable the **Guest Access** check box.
4. Choose the **Portal Mode** radio as **cnMaestro**.
5. In the **Guest Portal Name** text box, select the name of the portal that was created in cnMaestro and enter the respective parameters.

Configuration at cnMaestro side

The administrator can push the configuration from cnMaestro through policy or advanced configuration.

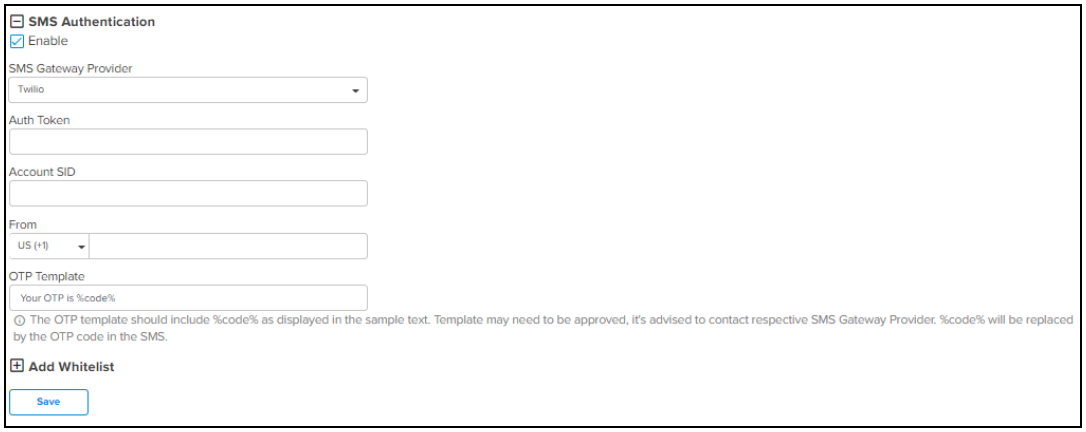




Access Types

The following table describes the parameters described in cofiguring SMS authentication parameters:

Parameter	Description	SMS Gateway Provider				
		Fast SMS	SMS Country	SMS Gupshup	Twilio	Victory Link SMS
Enable	It indicates to enable the SMS Authentication feature.	✓	✓	✓	✓	✓
Username	Indicates the username of the vendor.	✓	✓	✓	X	✓
Sender ID	It is the name or number which flashes on the recipients mobile phone when they receive SMS. This is Optional not mandatory.	✓	✓	✓	X	✓
API Key	It's a token which is provided by vendors.	✓	X	X	X	X
Account Type	It shows type of accounts such as International, OTP, Promotional and Transaction.	✓	X	X	X	X
OTP Template	The template with which SMS has to be sent.	✓	✓	✓	✓	✓
Password	It indicates the password.	X	✓	✓	X	✓
Country Code	It enables to select country code based on deployments.	X	✓	✓	X	X
Auth Token	It acts as a password.	X	X	X	✓	X
Account SID	It acts as a username.	X	X	X	✓	X
From	It enables to select the country code.	X	X	X	✓	X
Language	It indicates the Language.	X	X	X	X	✓



To configure SMS Authentication on cnMaestro, perform the following:

1. Enable SMS Authentication feature.
2. In SMS Gateway provider, select your required gateway from the drop-down.
3. Enter the **User Name**.
4. Enter the **Sender ID**. This field is optional. This allows user to send SMS through the ID which he chooses.
5. Enter **API Key**.
6. Select your **Account Type** from the drop-down.
7. Enter the **OTP Template**. The OTP template should include "%code%. %code% replaces the OTP code in the SMS.

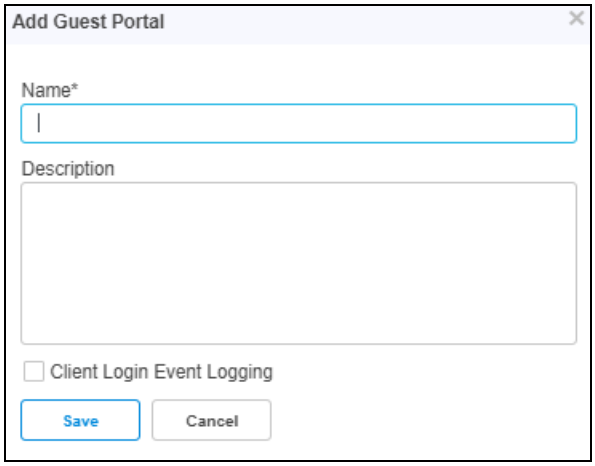
Guest Access using Social Login

Configuration

To achieve cnMaestro Guest Access using Social Logins like Google, Twitter, Facebook, and Office 365, perform the following steps:

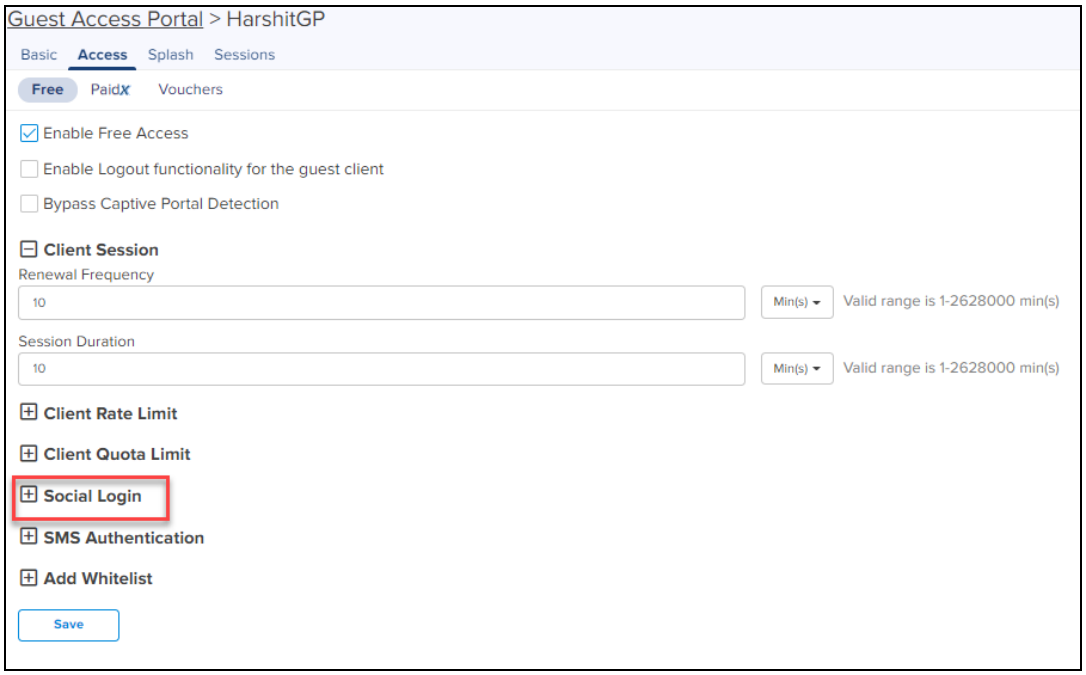
To create Guest Access profile on cnMaestro, do the following:

1. Login to cnMaestro and navigate to **Network Services > Guest Access Portal** > **Add Portal.**
2. Enter Portal Name, Description, enable logging for client login events.
3. Click **Save.**

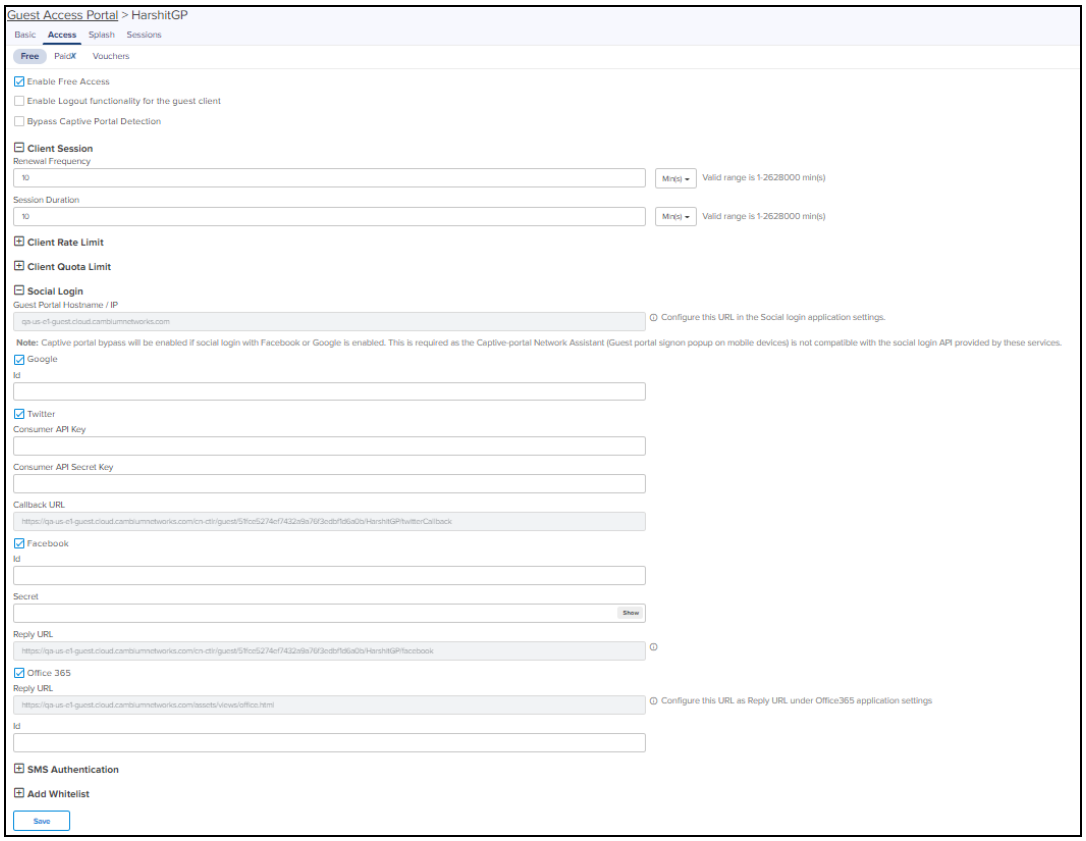


4. Click **Edit Guest Portal Details.**

5. Navigate to **Access** tab and expand **Social Login**.



6. Select Google, Twitter, Facebook, Office 365 based on your requirement.



API Key Generation

Perform the following steps to create APIs for cnMaestro to integrate with Google, Twitter, Facebook, and Office 365:

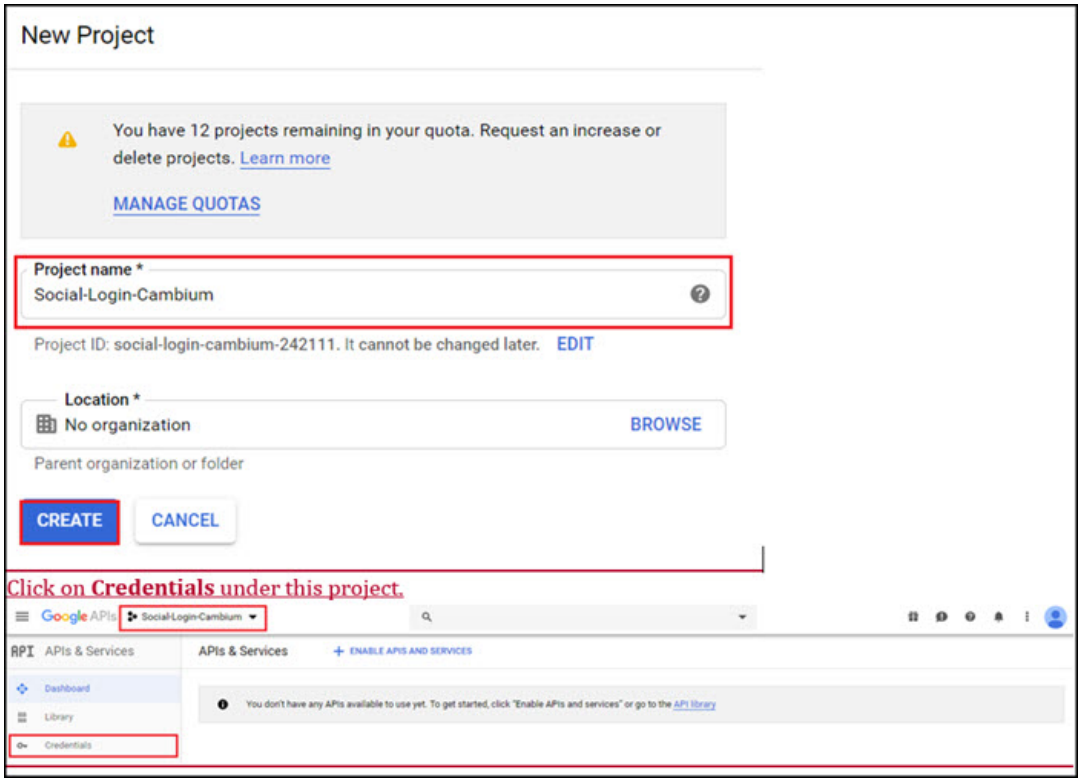
- Google
- Twitter

- Facebook
- Office 365

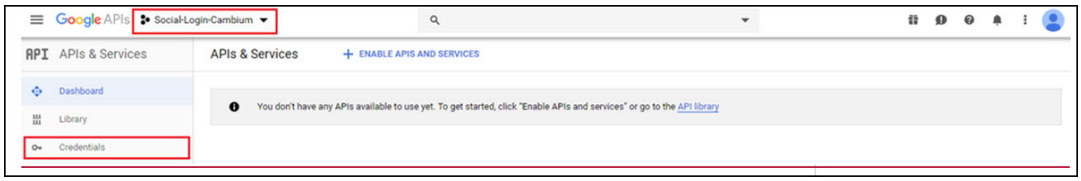
Google

1. Login to Google Account and navigate to https://console.cloud.google.com/.
2. Click **Select a Project** and create a **New Project.**

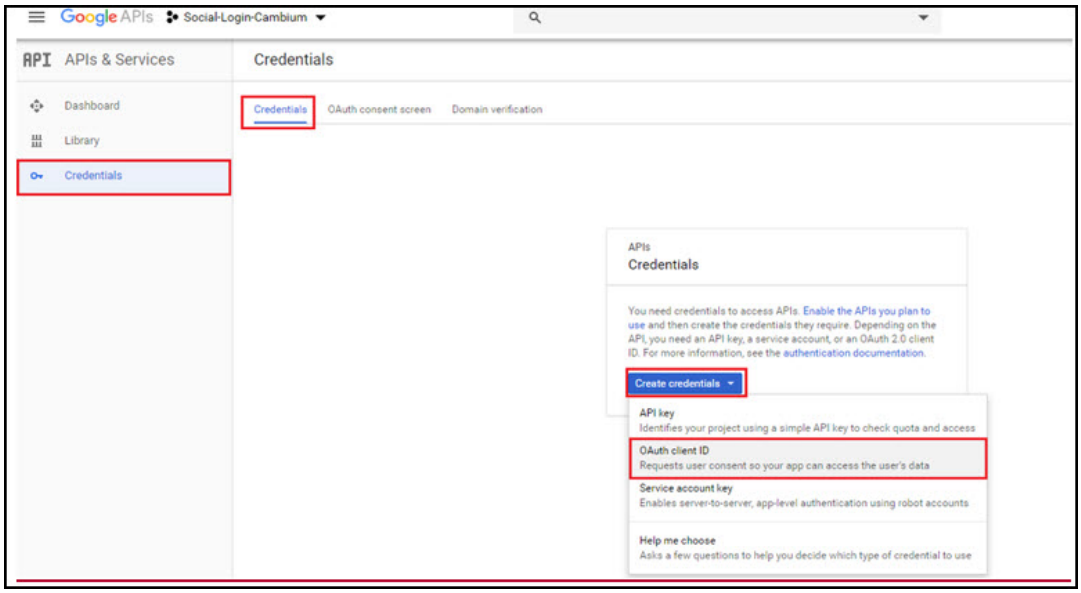
3. Give a name to the Project and click **CREATE**..



4. Click **Credentials** under this project.

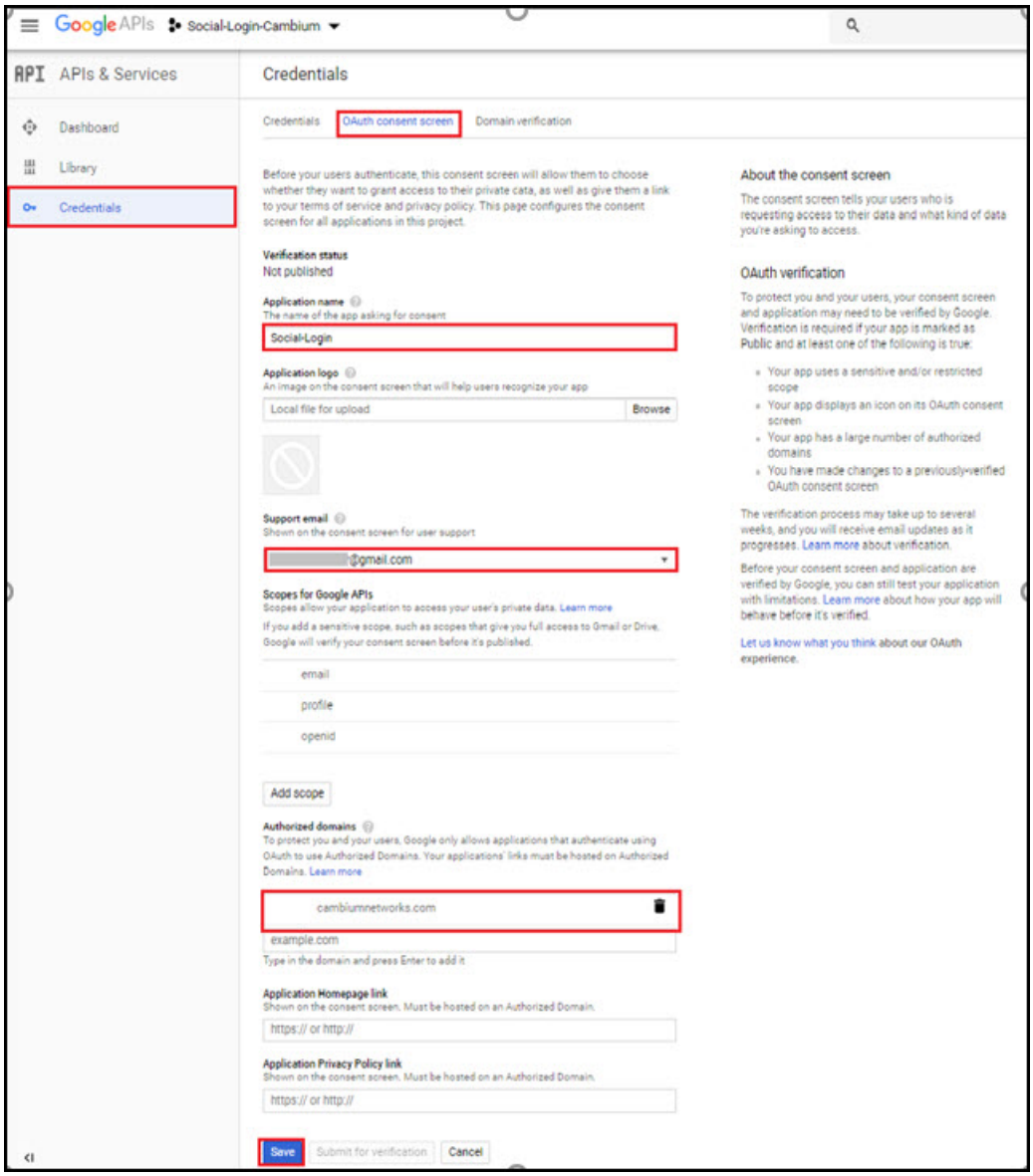


5. Under **Credentials** tab, create OAuth Client ID.

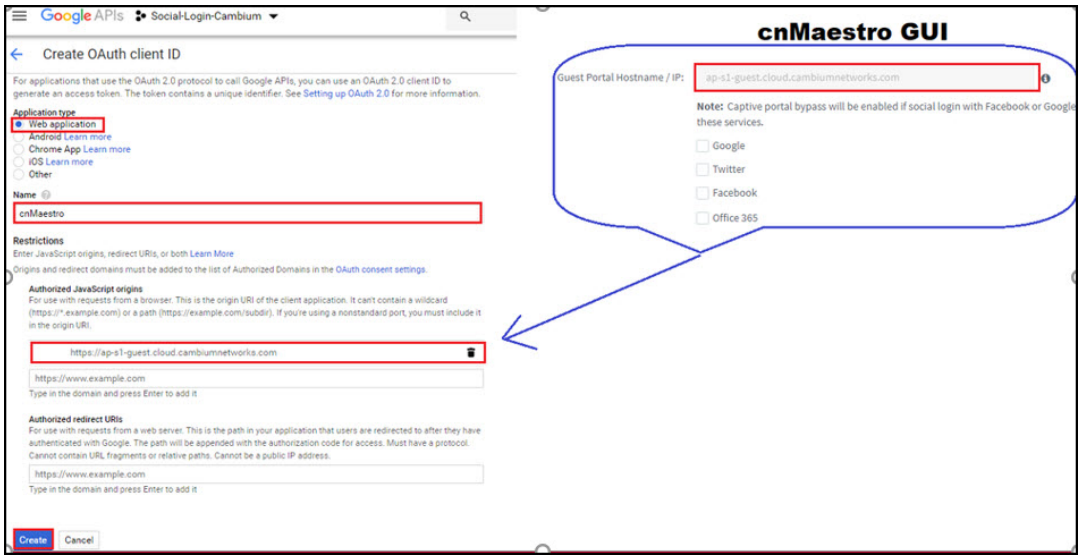


6. Click **Configure Consent Screen**

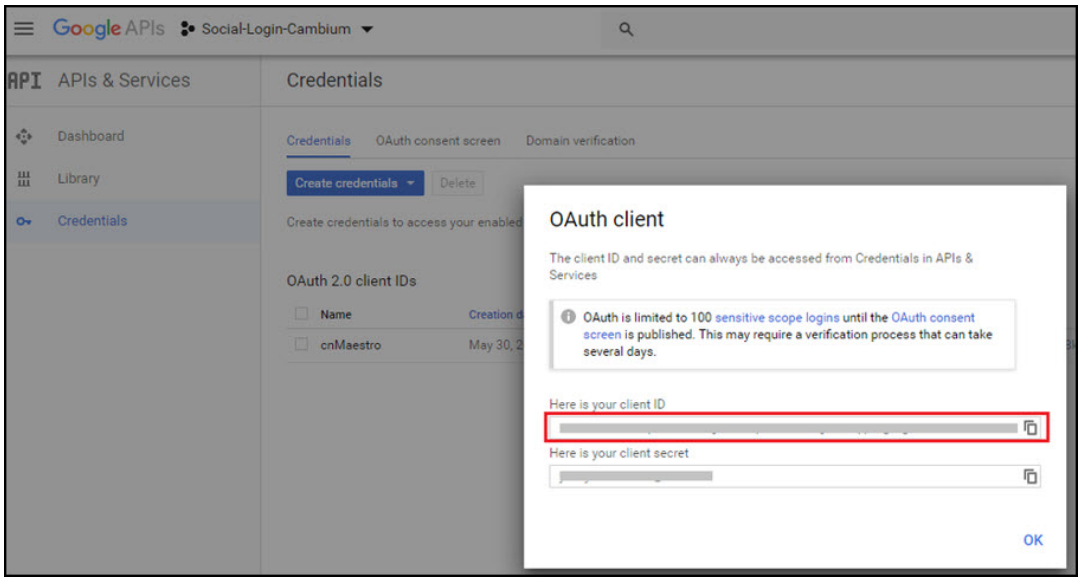
7. Assign a name to the application, map to an email address, add cambiumbnetworks.com to the authorized domain and click **Save**.



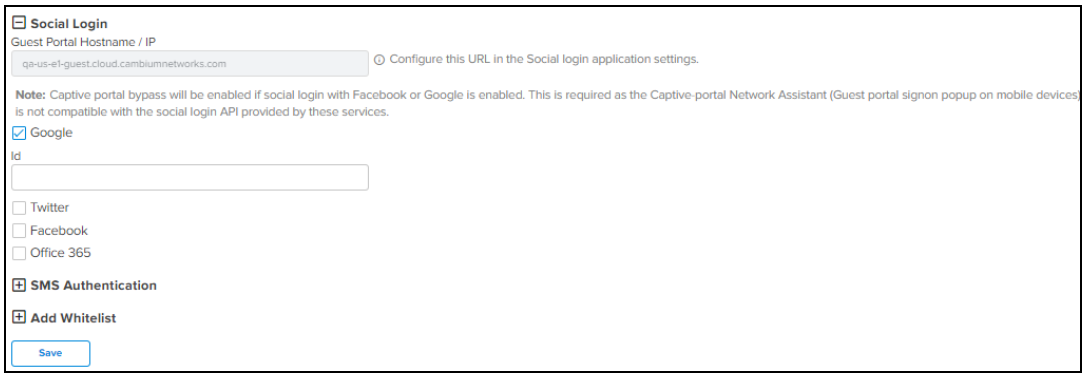
8. Once clicked **Save** for above page it redirects to creation of OAuth Client ID.
9. Select **Application type** as **Web Application**, give a Name, add Guest Portal Hostname URL/IP which you will get from cnMaestro UI and click **Create**.



10. Clicking Create on above page it redirects to the screen showing Client ID and Client Secret.

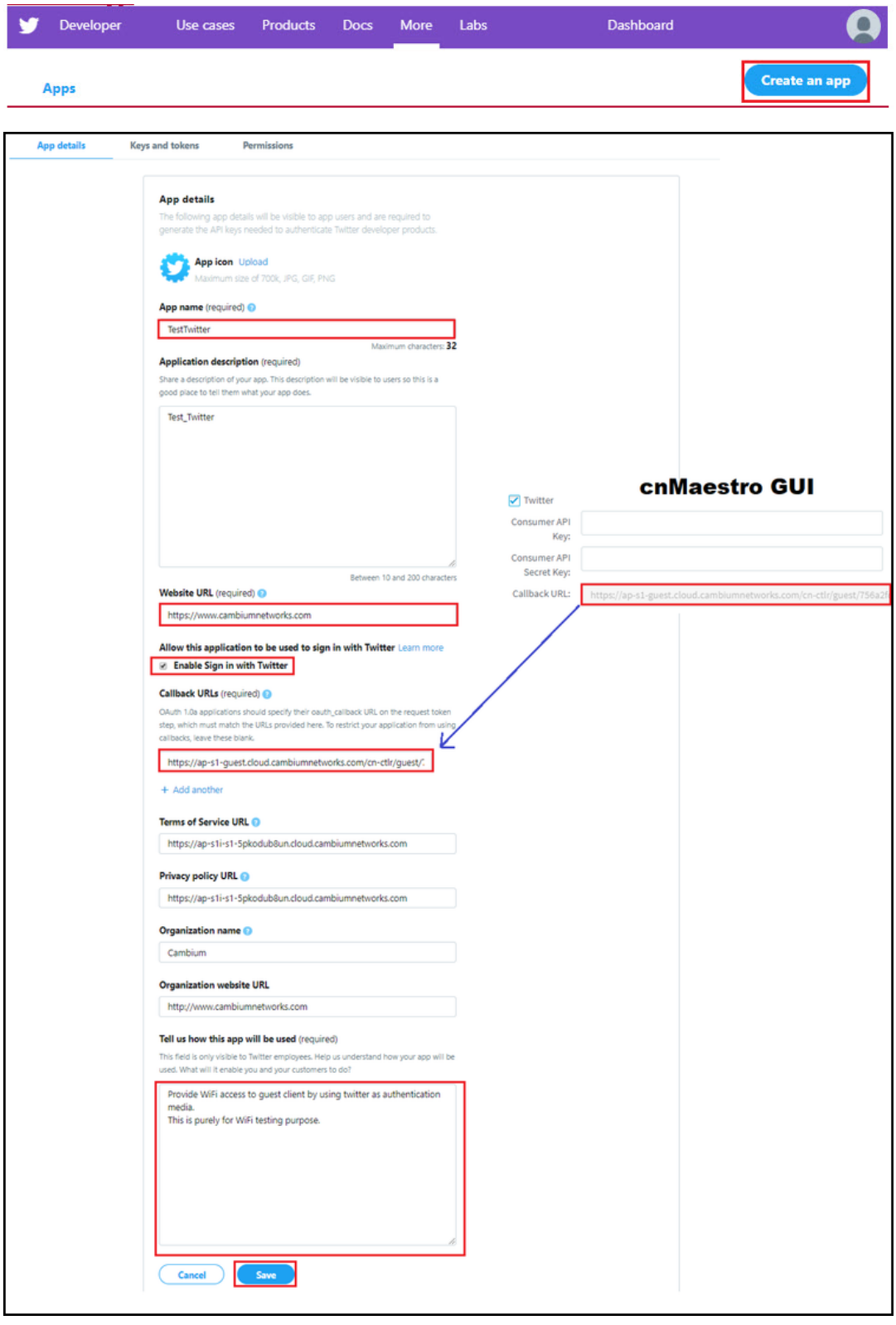


11. Copy the Client ID and paste it to the cnMaestro enabling Google under Social Logins and click **Save**.

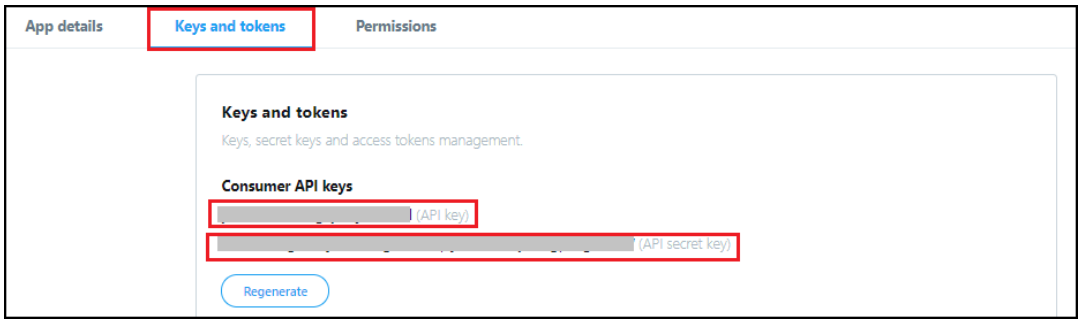


Twitter

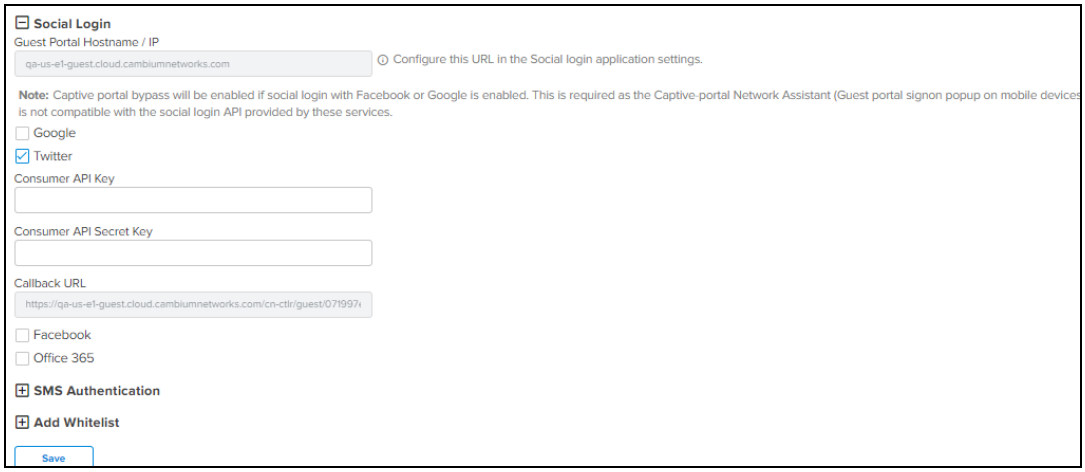
1. Login to Twitter Account and access **https://developer.twitter.com/en/apps** and click **Create an app**.



2. Click **Keys** and **Tokens** and copy **Consumer API Key** and **Consumer API Secret Key**..

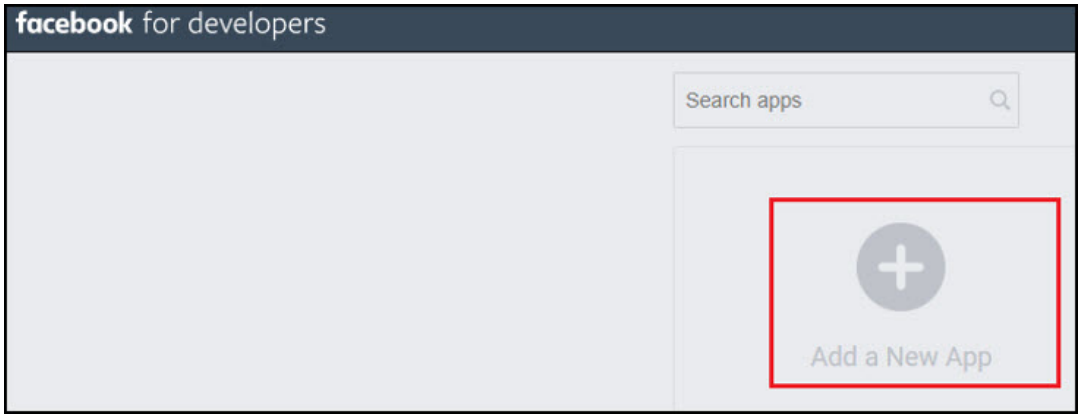


3. Paste them to cnMaestro GUI for Twitter social login.

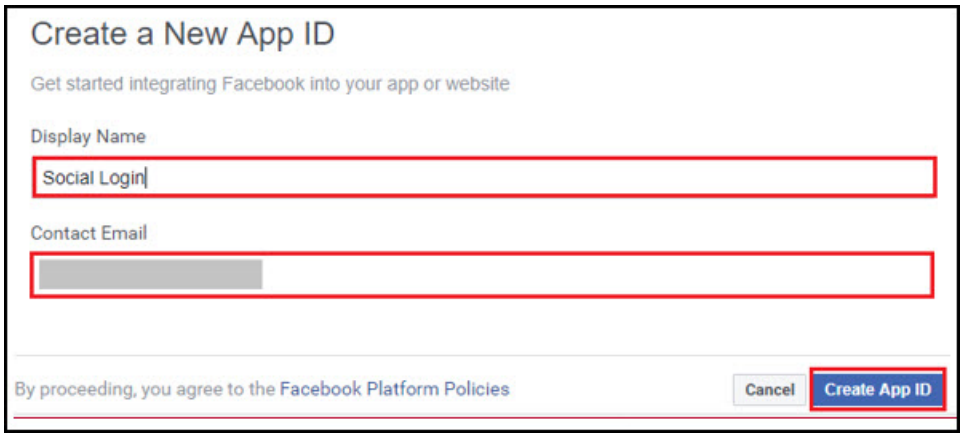


Facebook

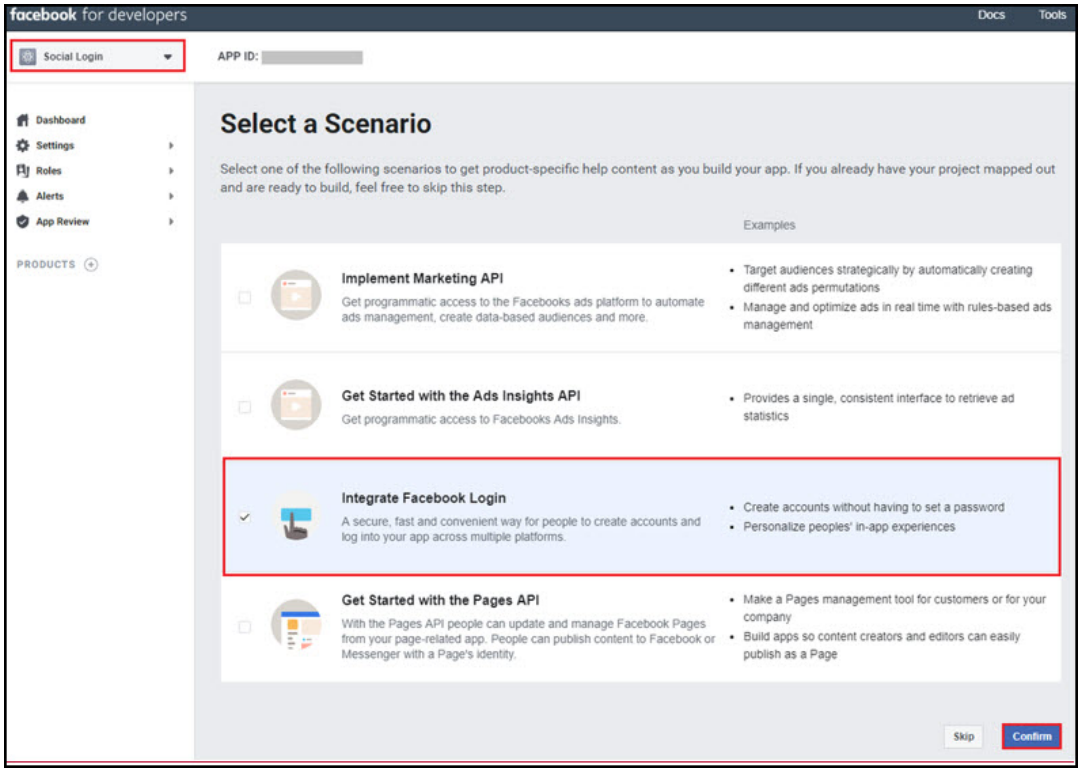
1. Login to Facebook Account and access **https://developers.facebook.com/apps/** and click **Add a New app**.



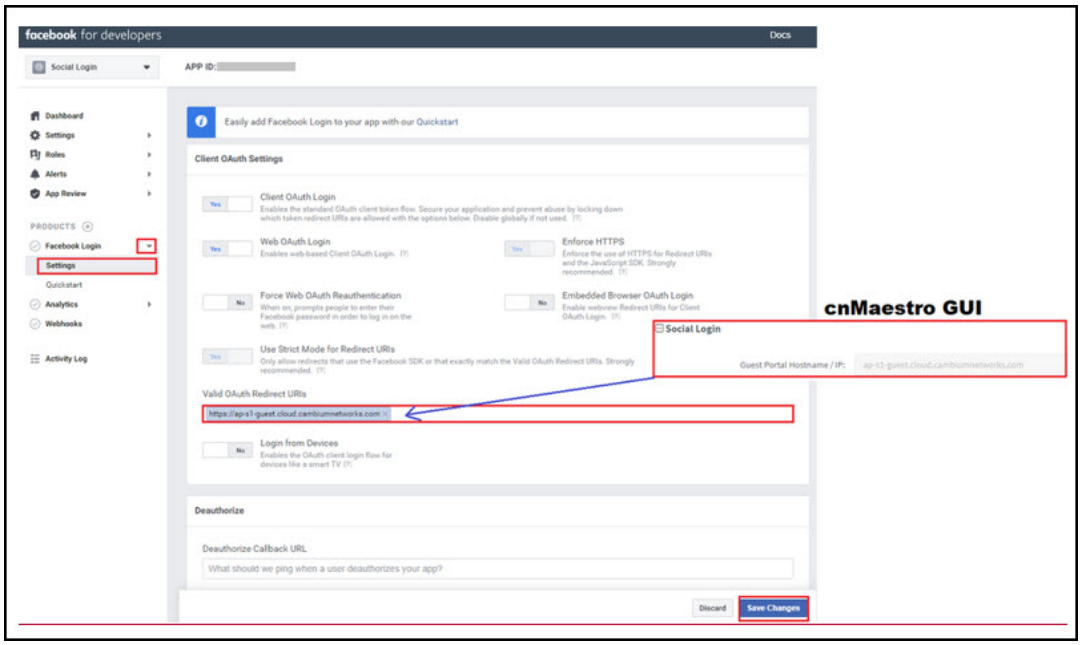
2. Enter App **Display Name**, **Contact Email**, and click on **Create App ID**.



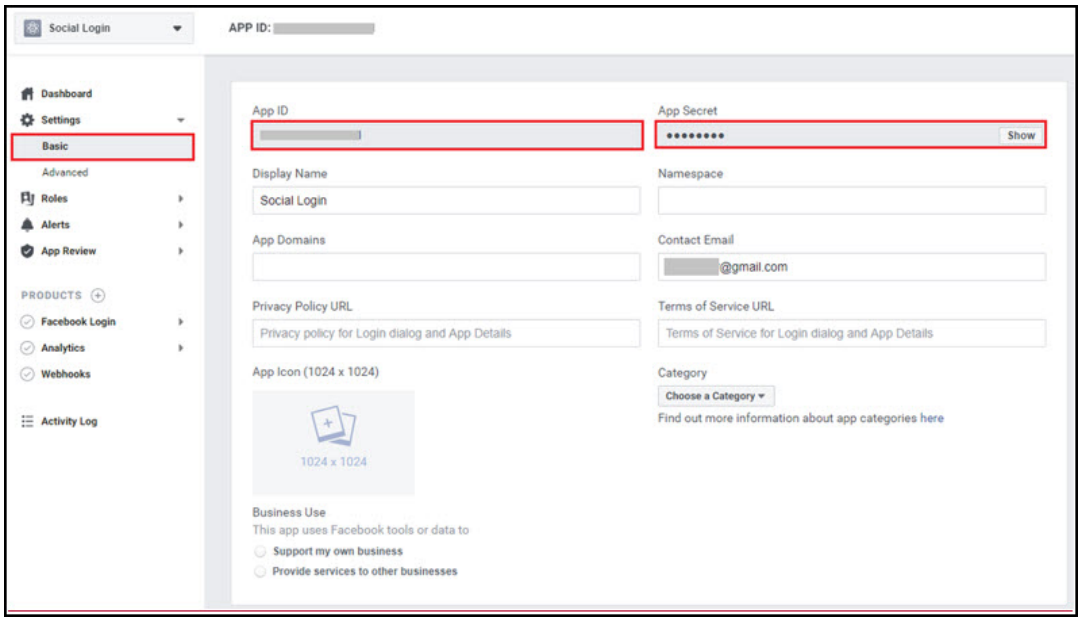
3. Select a Scenario as Integrate Facebook Login and click **Confirm.**

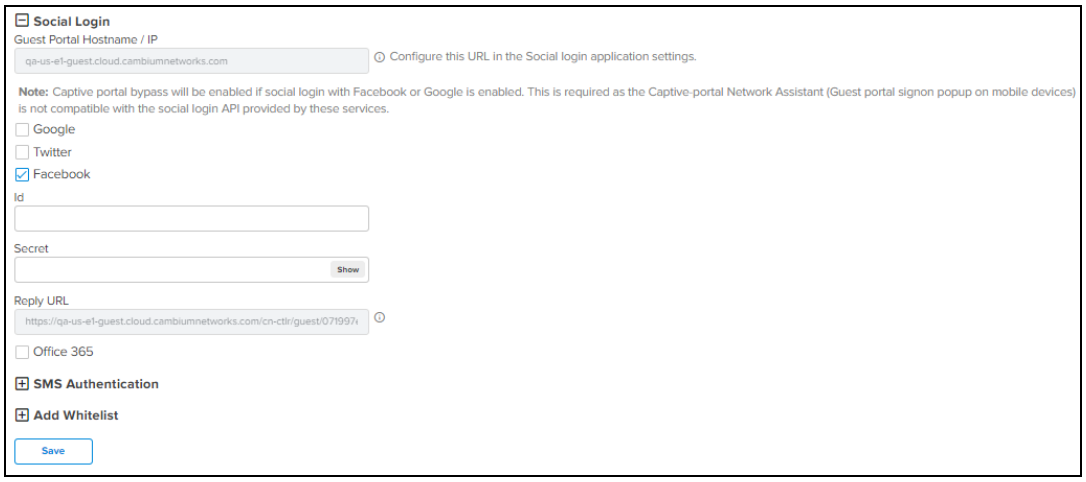


4. Navigate to **Settings** tab under Facebook Login and add Guest Portal Hostname from cnMaestro to Valid OAuth Redirect URLs section and click **Save Changes**.



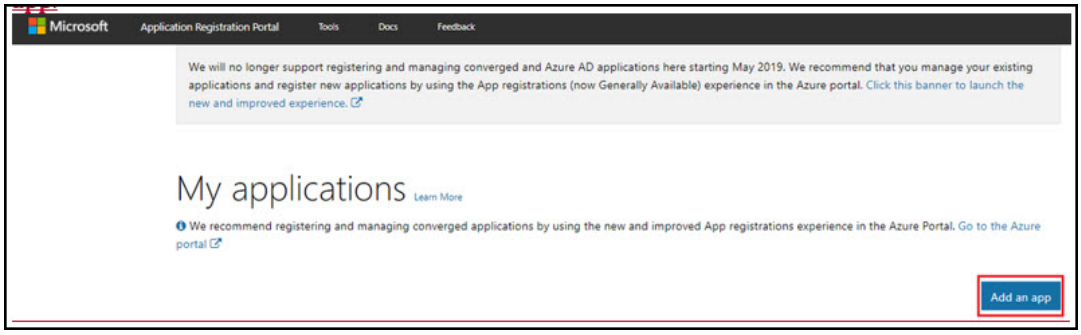
5. Navigate to **Settings** > **Basic** and copy **App ID** and **App Secret**.

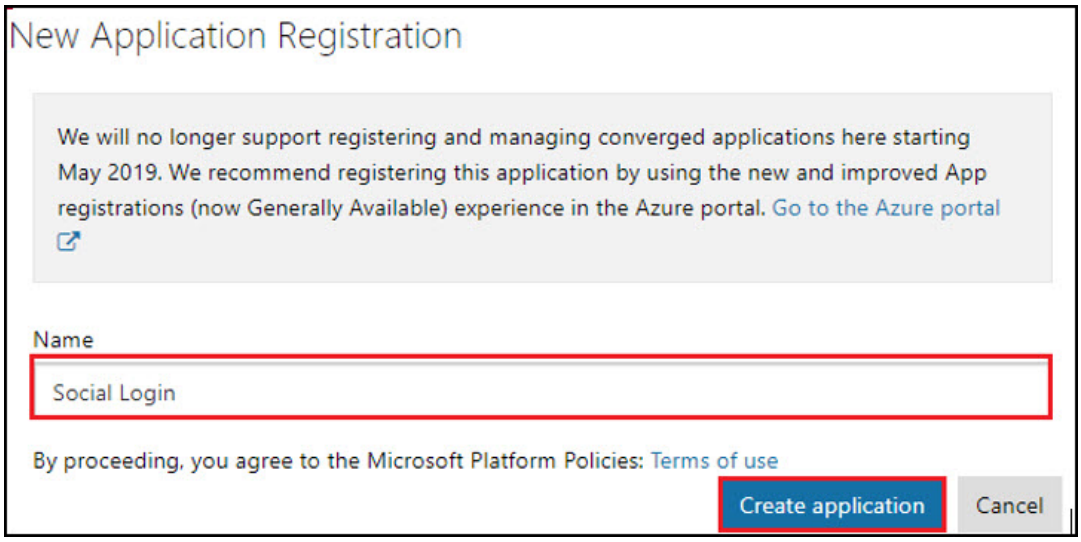




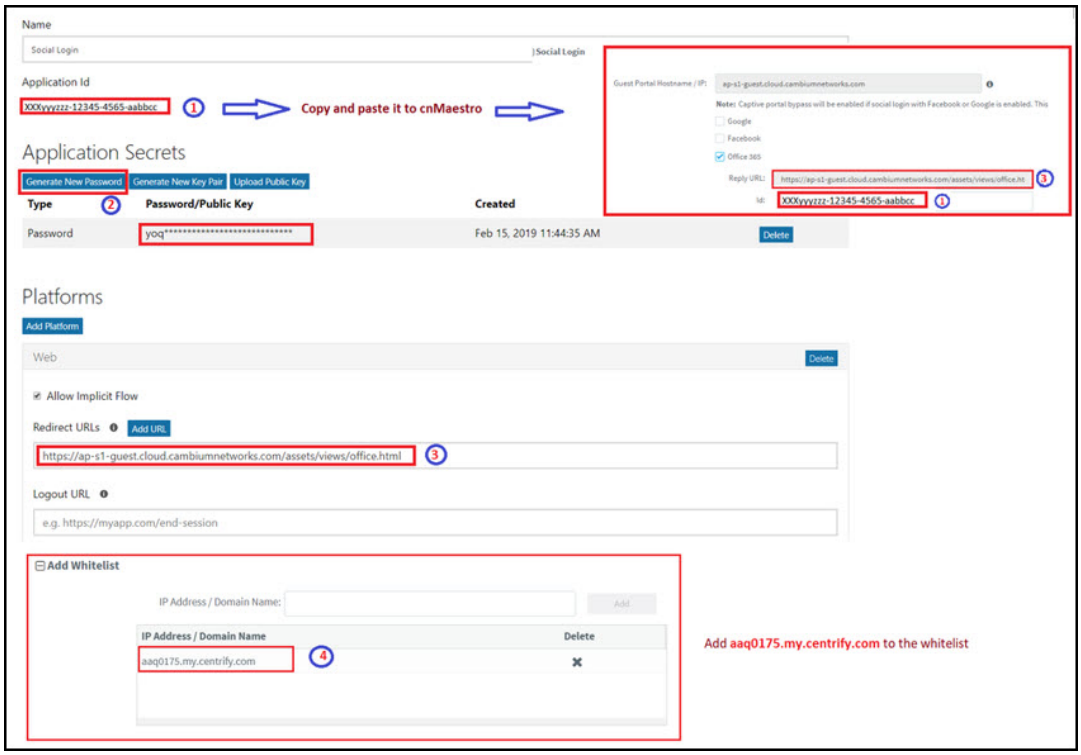
Office 365

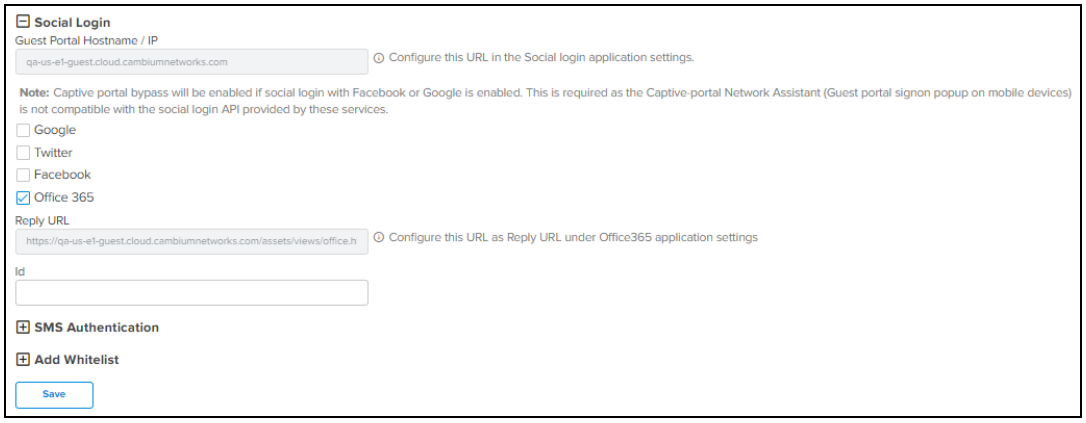
1. Login to Office 365 Account and access https://apps.dev.microsoft.com/ and click **Add an app**.





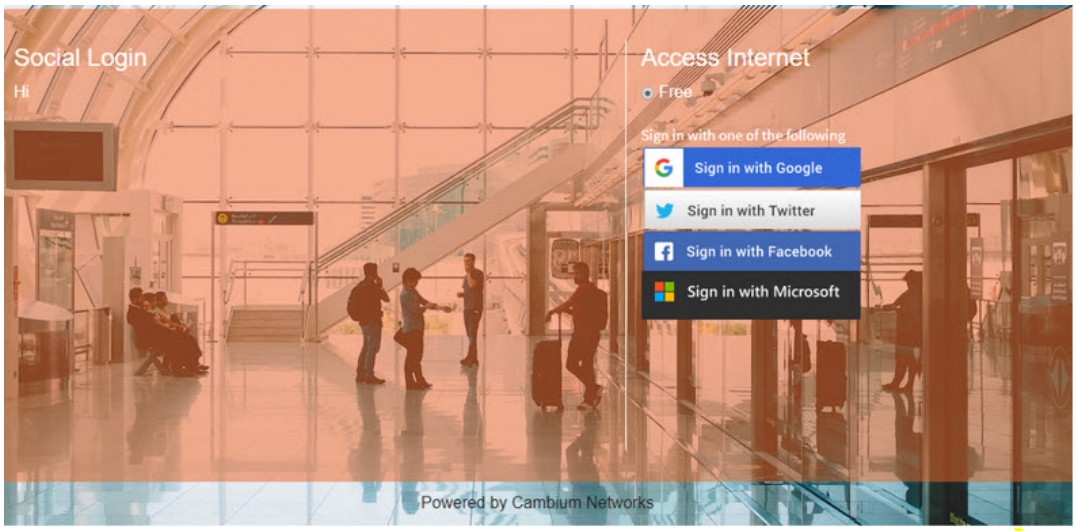
2. Upon Adding your App name and clicking Create application, it redirectes to App page.
3. Copy Application ID and paste it to cnMaestro Guest Access page under Office 365.
4. Click **Generate New Password**.
5. Copy Reply URL from cnMaestro and paste it under Redirect URLs.
6. Add my.centrify.com to the Whitelist on the cnMaestro.





Sample Template

Sample of client login page is displayed below:



Guest Access Portal Logout

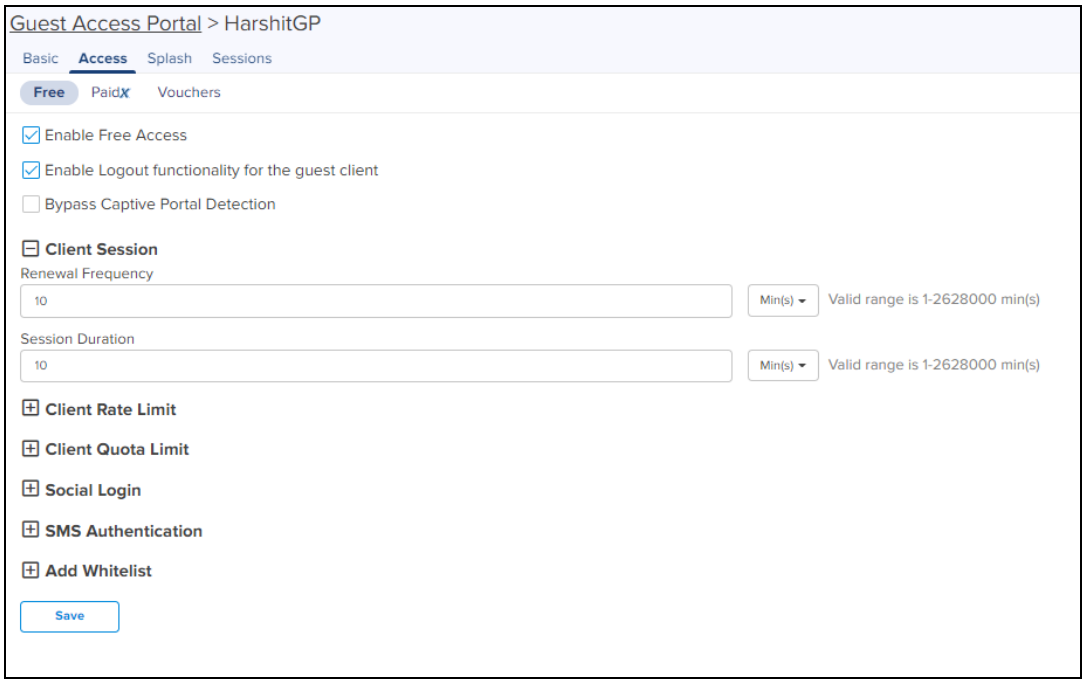
To logout from cnMaestro Guest Access Portal perform as follows:

1. Navigate to **Services > Guest Access Portal** page and select the respective **Guest Portal Name**.

2. Select **Access** tab.

3. Select **Enable Logout functionality for the guest client** check box.

4. Click **Save**.



The users can access and use the Guest Access Portal at any time within the specified **Renewal Frequency** and **Session Duration** provided.

SMS Authentication

The gateway provider sends a text SMS containing the OTP to the end user's phone number. Once OTP is received the client can enter the OTP and get Internet access.

Twilio, SMS Country, and SMS Gupshup are the SMS gateway providers that support the SMS OTP. Also there is a generic SMS gateway option, which provides flexibility to configure any preferred SMS gateway by cnMaestro users. Configuring SMS Gateway through this generic SMS gateway does require a little more involvement to review the integration specifications of the given SMS gateway. Please follow the guidelines as mentioned on the Generic SMS Gateway configuration section.

Generic SMS Gateway configuration

SMS Service providers expose a SMS API which typically works over HTTP GET or HTTP POST requests. Most of the SMS Gateways use username and password in the API requests to validate a given SMS send a request and some use special authorization token in the HTTP Headers.

Apart from that many API have specific tokens that need to be passed into the request along with the authentication part. To start off one has to first go through the SMS API document of the given SMS provider and understand all components do that need to be provided in the HTTP request and then build the corresponding cnMaestro configuration.

In general, all SMS API documents show example curl commands which can be used to create an SMS request with the server. Curl examples demonstrate the required components in the request and help to find the right configuration for the cnMaestro Guest Portal Generic SMS API.

The cnMaestro Generic SMS API configuration is split into multiple components which makes it easy to configure the static and the dynamic parts of the SMS API request. It also provides a way to handle the SMS API response and validate the API success or failure case. To handle the reply type, refer the **Advanced** options.

SMS Gateway provider name

Provide the SMS Gateway name which is used for reference purposes. This is not part of API request so please provide a meaningful name to identify this SMS Gateway service provider.

HTTP Request type

Based on the SMS gateway provider and the API document information, identify the SMS API. The SMS API uses HTTP GET or HTTP POST requests for communication with the SMS gateway server.

Example HTTP GET API request

https://smsapiserver.com/service/sms/send?user=xxx&password=yyyyy&message="Your OTP is ABCD"&mobileNumber=123456789&dnd=yes&sid=SenderID&v=1.1&messagType=N

Curl command to do HTTP GET request

```
Curl -v https://smsapiserver.com/service/sms/send?user=xxx&password=yyyyy&message='Your OTP is ABCD'&mobileNumber=123456789&dnd=yes&sid=SenderID&v=1.1&messagType=N
```

Example HTTP POST request

HTTP POST URL

https://smsapiserver.com/service/sms/send

HTTP POST Form Content

user=xxx&password=yyyyy&message="Your OTP for Internet Access is QW123"&mobileNumber=123456789&dnd=yes&sid=SenderID&v=1.1&messagType=N

Curl command to do HTTP POST request

```
curl -v “https://smsapiserver.com/service/sms/send” -H "Content-Type: application/x-www-
form-urlencoded" -X POST \
--data-urlencode 'user=xxx' \
--data-urlencode 'passwd=yyyyy' \
--data-urlencode 'mobilenumber=1234567789' \
--data-urlencode 'message=Your OTP for Internet access is QW123' \
--data-urlencode 'sid=Sid' \
--data-urlencode 'v=1.1' \
--data-urlencode 'mtype=N' \
--data-urlencode 'dnd=yes' \
--data-urlencode 'DR=Y'
```

If the SMS Gateway is using an authorization token, then below example curl request shows how the **Authorization** field is added into a HTTP header.

```
curl -v -H "Authorization: Bearer nZYIoU7QoUxfD03ct1CC2YvInqI7DmUAH6RYz01K1" \
"https://smsapiserver.com/service/sms/send?\
from=Test&\
to=123456789&\
message=’Your OTP for Internet access is QW123’&\
format=json"
```

All the SMS API have components as follows:

- Static components which are part of the request.
- Two dynamic components which are part of the mobile number, to which the SMS needs to be sent and the message which contains the OTP.

Static components

API URL

Based on the above curl request example the URL configures as https://smsapiserver.com/service/sms/send where the request needs to be sent.

API URL information

From the example curl request please find the static components of the URL. Based on our above example this configures as user=xxx&password=yyyyy&dnd=yes&sid=SenderID&v=1.1&messagType=N.

Remove the message and mobile number query strings from that URL and configure the rest. This is what a static component is for a given SMS API so identify what all options are required for the SMS API request and add it in the format: key1=value1&key2=value2....

HTTP request header key

Based on the above example, If the SMS Gateway Provider API uses some HTTP header field like authorization token, etc. The corresponding HTTP header field name will be configured as **Authorization**.

HTTP request header key value

Based on the above example, the SMS gateway API configuration settings expose some authorization token or auth token and the provided HTTP header key value will be configured as Bearer nZYIoU7QoUxfD03ct1CC2YvInqI7DmUAH6RYz01K1 in this configuration.

Dynamic components

Message parameter name

From the example curl request or the SMS gateway provider the parameter name used for the message key component where the OTP is added. It could be something like message|text|msg or whatever custom parameter name is used for sending the message component.

For example curl request, we have used “message” and this is what configures based on the example curl request.

Mobile number parameter name

From the example curl request or the SMS gateway provider the parameter name used for the mobile number key component where the OTP has to be sent. It could be something like To|mobile|mobile number or whatever custom parameter name is used for sending the mobile number component.

In our example curl request, we have used mobile number and this is what configures based on the example curl request.

Advanced options

If you care for adding functionality for parsing the SMS API response on the cnMaestro and find if the request was successful or if the server returned an error. Then one can use this advanced configuration to let cnMaestro parse the SMS API reply.

The usual HTTP response code is anyway handled by default and this advanced config parses the reply content is configured. This should be configured by advanced users only and in case if there is any failure seen in SMS functionality then disable this and report the issue to Cambium Networks support.

Reply type

The SMS gateway API sends back a response to let the client know about the request results, this result could be in text format or in json/xml format. So based on the SMS API document select the reply type here as **TEXT**.

Success

Configure the text to match the success case as follows:

- Typically, servers may respond with a text message in reply like success or sent, then configure the exact message which should be matched in the response.
- If a server response is like success, sent message to xxxxx, then configure just success which matches in the reply.

Error

Configure the text which matches the failure case as follows:

- Typically, servers may respond with a text message in reply like **Error** or **Failure**, then configure the exact message which should be matched in the response.
- If a server response is like **ERROR**, failed to send SMS to xxxxx, out of credit, then configure just **ERROR** which matches in the reply to mark it as an error.

Reply Type JSON

JSON reply success key name

Please look for the SMS gateway provider API document in detail and find the JSON examples for the reply and identify the key which contains the successful response status value.

cnMaestro guest portal generic SMS supports nested JSON too and one has to configure the complete path for the given result key which contains the SMS message sent status. Example JSON replies are given below to be configured for this configuration:

Example 1

```
{
  "messages": {
  "to": "123456789",
  "status": {
```

```
  "id": 0,
  "groupId": 0,
  "groupName": "ACCEPTED",
  "result": [
 {
  "status": "MESSAGE_ACCEPTED"
 }
],
  "description": "Message accepted"
 },
  "smsCount": 1,
  "messageId": "2250be2d4219-3af1-78856-aabe-1362af1edfd2"
 }
}
```


Success key name to be configured based on the above example messages.status.result[0].status.

Example 2


```
{
  "count": 1,
  "list": [
 {
  "id": "1460978572913968440",
  "points": 0.16,
  "number": "48500500500",
  "date_sent": 1460978579,
  "submitted_number": "48500500500",
  "status": "QUEUE"
  }
 ]
}
```


Success key name to be configured based on the above example list [0]. Status.

Example 3


```
{
 "status": "Sent"
}
```


Success key name to be configured based on the above example is status.

JSON reply success key value

The success status can be single or multiple values based on the SMS Gateway provider and SMS gateway can respond back with a status as a message successfully sent or successfully queued, which is also a success case that the queued message sents out shortly.

Based on our examples the status or the result field can be mapped to multiple values like as follows:

- Sent
- Queued
- Success
- Message Accepted

So in this configuration one can add multiple such values that should be matched for the success case for the value as received for the JSON reply success key name field.

JSON reply failure key name

Look for the SMS Gateway Provider API document in detail and find the JSON examples for the reply and identify the key which contains the Error/Failure response status value.

cnMaestro guest portal generic SMS supports nested JSON too and one has to configure the complete path for the given result key which contains the SMS message sent failure field. Example JSON replies are given below to be configured for this configuration:

Example

```
{
  "invalid_numbers": [
{
  "number": "456456456",
  "submitted_number": "456456456",
  "message": "Invalid phone number"
  }
],
  "error": 13,
  "message": "No correct phone numbers"
}
```

JSON reply failure key name to be configured based on the above example is error.

JSON reply key value

The error/failure status can be single or multiple values based on the SMS Gateway provider and SMS gateway can respond back with a status as a message sent error or multiple error codes for the corresponding error.

Based on our examples the error can be mapped to multiple values like 13|12|-1 etc. So in this configuration, one can add multiple such values which should be matched for the failure case for the value as received for the JSON reply failure key name field. reply type **XML**.

Reply type XML

XML reply success element

Look for the SMS gateway provider API document in detail and find the XML examples for the reply and identify the elements which contain the successful response status value.

cnMaestro guest portal generic SMS supports nested XML too and one has to configure the complete path for the given result element which contains the SMS message sent status. Example XML replies are given below to be configured for this configuration:

Example 1

```
<items>
<item id="0001" type="result">
<status>Success</status>
</item>
</items>
```

Success Element Name to be configured based on the above example is items/item/status.

Example 2

```
<?xml version="1.0" encoding="utf-8"?>
<int xmlns="http://tempuri.org/">-11</int>
```

Success Element Name to be configured based on the above example.

XML reply success element value

The success status can be single or multiple values based on the SMS Gateway provider and SMS gateway can respond back with a status as a message successfully sent or successfully queued, which is also a success case that the queued message sents out shortly.

Based on our examples the status or the result field can be mapped to multiple values like as follows:

- Sent

- Queued
- Success
- Message Accepted

So in this configuration one can add multiple such values that should be matched for the success case for the value as received for the XML Reply Success Element field.

SMS message sent failure field. Example XML replies are given below to be configured for this configuration:

Example 1

```
<items>
<item id="0001" type="result">
<error>-12</status>
</item>
</items>
```

XML Reply Failure Key Name to be configured based on the above example is items/item/error.

Example 2

```
<items>
<item id="0001" type="result">
<status>Error</status>
</item>
</items>
```

XML Reply Failure Key Name to be configured based on the above example is items/item/status.

Example 3

```
<?xml version="1.0" encoding="utf-8"?>
<int xmlns="http://tempuri.org/">-11</int>
```

XML Reply Failure Key Name to be configured based on the above example is int.

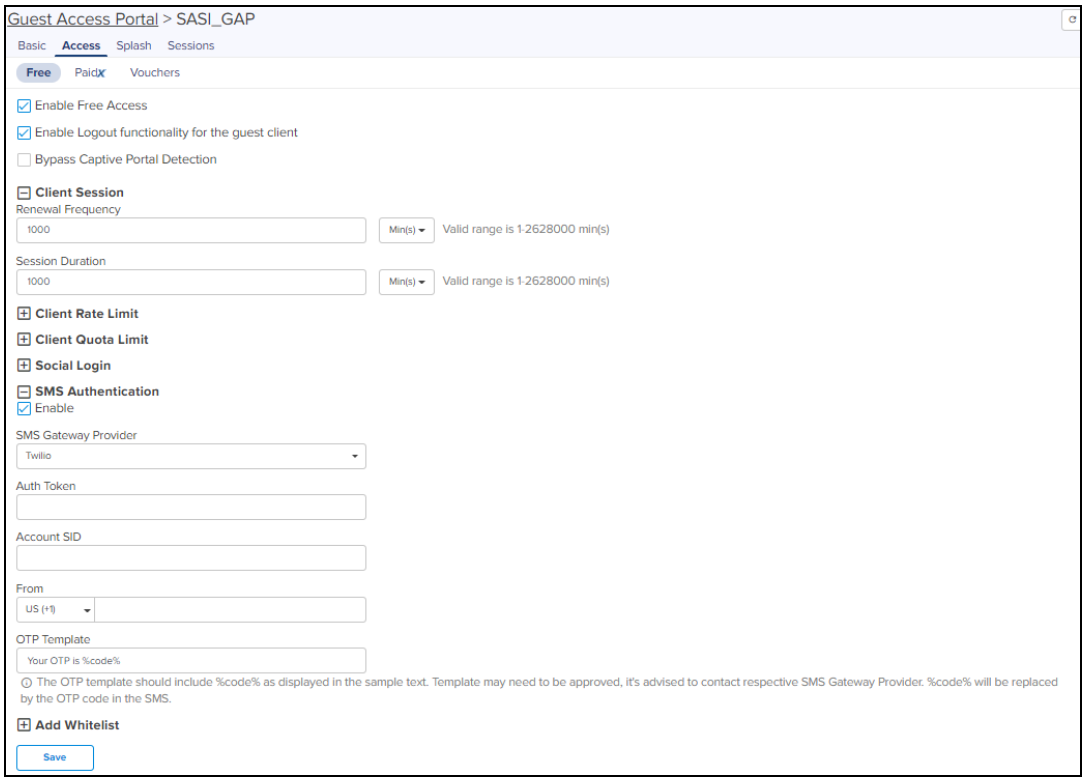
XML reply failure element value

The error/failure status can be single or multiple values based on the SMS Gateway provider and SMS gateway can respond back with a status as a message sent error or multiple error codes for the corresponding error.

Based on our examples the error can be mapped to multiple values like 13|12|-1 etc so in this configuration, one can add multiple such values which should be matched for the failure case for the value as received for the XML reply failure element field.

Sample configuration in the cnMaestro

Figure 402 : Guest Access Portal



RADIUS Proxy X

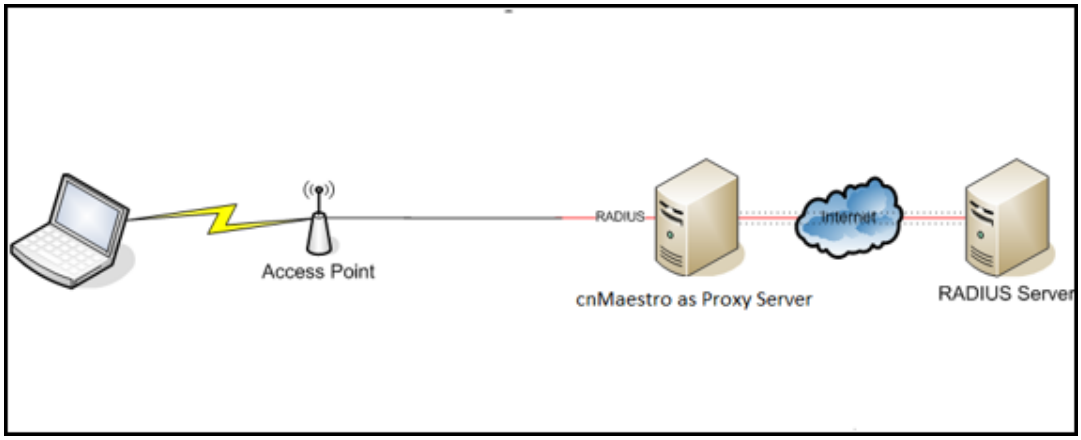
	• **RADIUS Proxy** is not supported in cnMaestro Cloud. • It is available only as a cnMaestro X feature.

Overview

cnMaestro can act as a proxy server to authenticate **RADIUS** requests for cnPilot Wi-Fi devices. In this scenario, cnMaestro acts as a Network Access Server (NAS) for the RADIUS server.

The Access Point sends RADIUS packets to cnMaestro , and cnMaestro sends them to the RADIUS server. cnMaestro can act as a proxy for either authentication or accounting messages, as show in Figure 403.

Figure 403 RADIUS Proxy on cnMaestro On-Premises



Minimum version requirements are as follows:

- Minimum cnPilot AP release required: 3.3.

RADIUS Proxy Configuration

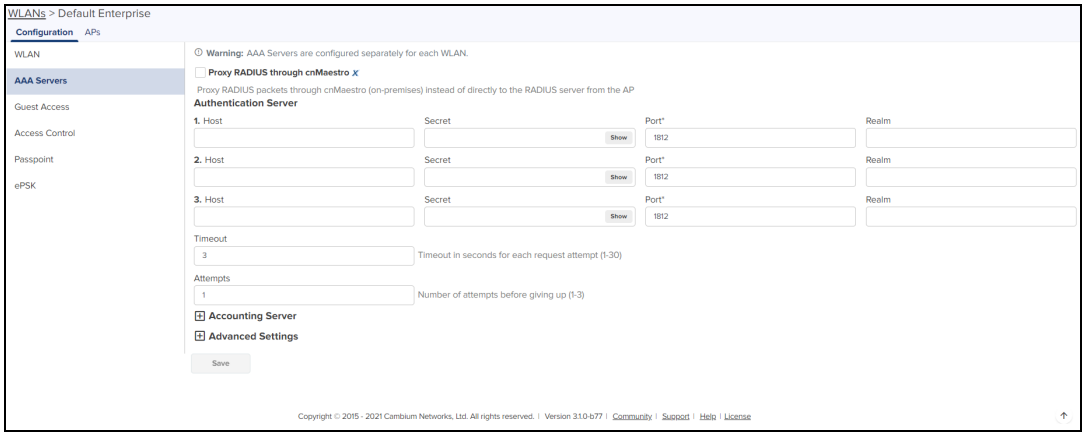
To configure RADIUS Proxy on cnMaestro , perform the following:

1. Navigate to **Shared Settings > AP Groups and WLANs** page.
2. Select **Enterprise WLAN** to edit, and then select **AAA Servers.**
3. Under AAA servers, select **Proxy RADIUS through cnMaestro** check box.
4. Configure **Authentication Server** details.
5. Configure **Accounting Server** details.
6. Configure **NAS-Identifier**.

	Include **NAS-Identifier** attribute to use the RADIUS request packets and default the system name.

7. Push the configuration from cnMaestro to AP.

Figure 404 RADIUS Proxy Configuration

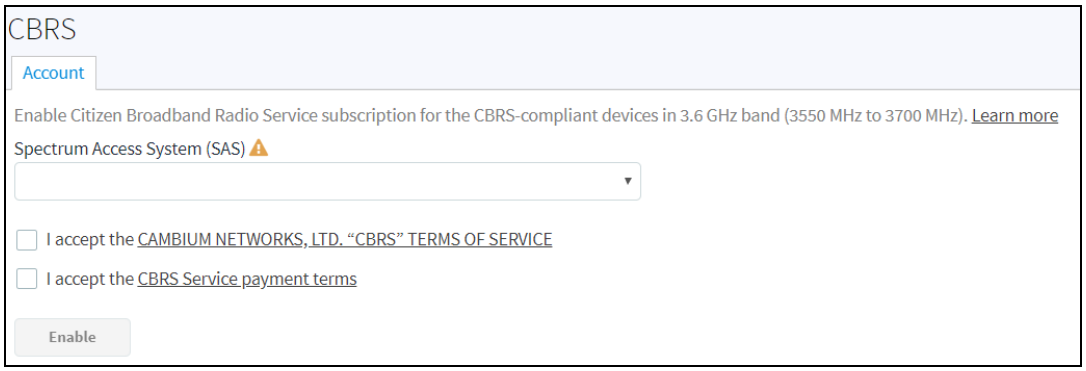


Citizens Broadband Radio Service (CBRS)

This chapter details cnMaestro support for the Citizens Broadband Radio Service subscription which is required to manage CBRS-compliant devices in the 3.6 GHz band (3550 MHz to 3700 MHz).

Enabling CBRS in Cloud

1. Login to a cnMaestro Cloud NMS account or Cloud Anchor account (if hosting on-premises).
2. Navigate to **Services > CBRS** page.
3. Select preferred **Spectrum Access System (SAS)** vendor.



4. Click **I accept the CAMBIUM NETWORKS, LTD. "CBRS" TERMS OF SERVICES** and **I accept the CBRS Service payment terms** to activate **Enable** button.
5. Click **Enable.**
6. In the **Billing Information** window pop-up enter the following:

   Business Contact

   - First Name
   - Last Name
   - Email
   - Phone
   - Street Address
   - Zip Code
   - Country
   - State

   Technical Contact

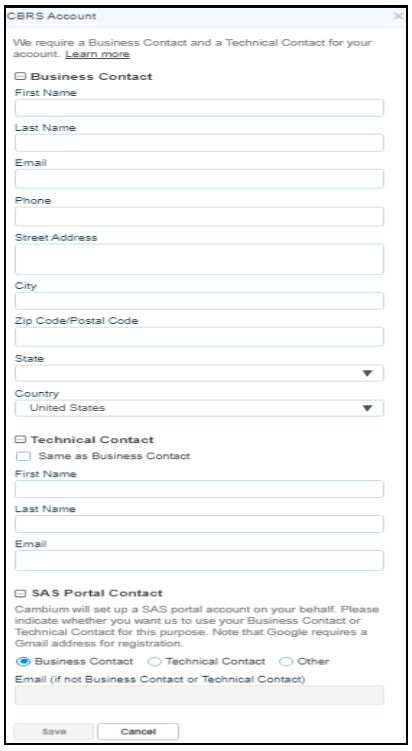
   Enable **Same as Business Contact** or enter a separate Technical Contact.

   - First Name
   - Last Name
   - Email

   SAS Portal Contact

   Cambium Networks creates the SAS portal account on behalf of the operator.

   - Click **Save.**



7. The **Account** page displays:
    - Token
    - Status
    - Total Devices
    - SAS
    - Contact Details
    - Payment Details

a. **Token:**

Token used for authenticated communication with SAS through Cambium Domain Proxy. It gets generated automatically once CBRS is enabled for the Cloud account.

b. **Status:**

- Displays the account status.

Pending Status	Success Status
Status ✔ Account Created ✖ Payment Method Verification Pending ✖ SAS-ID Allocation Pending ● Effective Jul 07 2020 16:54:10 (< 1m) Total Devices ⓘ Usage History 0 APs, 0 SMs	Status ✔ Account Created ✔ Payment Method Verified ✔ SAS-ID Allocated ✔ Account Enabled ● Effective Mar 19 2020 15:02:02 (110d 2h 0m) Total Devices ⓘ Usage History 3 APs, 68 SMs

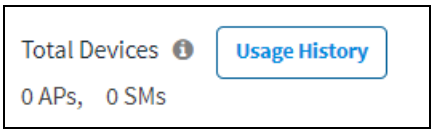
1. **Account Creation**: Displays as **Account Created** once the account is enabled. Refer to **Step f** for entering contact information and enabling account.
2. **Payment Method**: Displays as **Verified** once the Payment Details are approved. Refer to **Step g** Payment Details.

3. **SAS ID**: Once the payment details are verified, the SAS ID is allocated automatically.

	NOTE It may take 1 day to get the SAS ID.

4. **Effective:**
    - **Grey**: indicates the **Pending Status**.
    - **Green**: indicates **Success Status**.
    - **Red**: indicates the account has been **Deactivated**.

c. **Total Devices:** Displays the count of **Total Devices** registered with the SAS using the **Token ID**. **Usage History** provides the list of devices registered with **Month** and **Year**.



	NOTE Initially the device counts will be 0 APs and 0 SMs.

d. **SAS:** Displays the SAS vendor preferred by the operator.

	NOTE Contact Cambium support to disable CBRS operation or to change SAS Vendor.

e. **SAS:** An operator needs to select which SAS vendor they prefer.

f. **Contact Details:**

For new CBRS account migrations, this information would have already been entered in Citizens Broadband Radio Service (CBRS). Review and update if necessary, else refer to Payment Details.

Cambium Networks selectively communicates with both the **Business Contact** and the **Technical Contact** with changes of interest: such as SAS administrator updates, CBRS initiative changes from the CBRS Alliance and WInnForum, and announcements of new Cambium Network CBRS features and options.

Business Contact

Cambium Networks communicates with the **Business Contact** for all commercial aspects of the CBRS Service such as invoicing, payment, change in terms, change in pricing, and other details. This page requires:

- **First Name**
- **Last Name**
- **Email**
- **Phone**
- **Street Address**

- City
- Zip code/Postal Code
- State
- Country

Technical Contact

Cambium Networks communicate with the **Technical Contact**: such as software updates, release notes, learning guides, technical issues, etc.

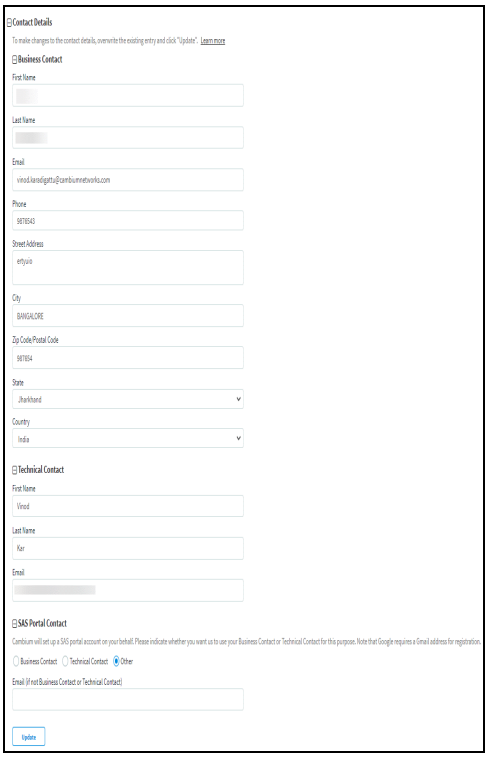
- First Name
- Last Name
- Email

SAS Portal Contact

Cambium Networks sets up the SAS portal account on behalf of the operator. Please select whether to use the **Business Contact, Technical Contact,** or **Other.**

	NOTE: Google requires a Gmail address for registration.

- Click **Update.**

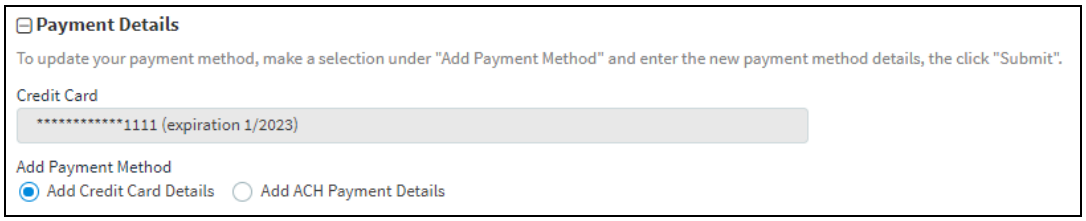


	NOTE: Clicking update the **Account Page** will overwrite the current entries.

g. **Payment Details**

Select one of the payment methods below:

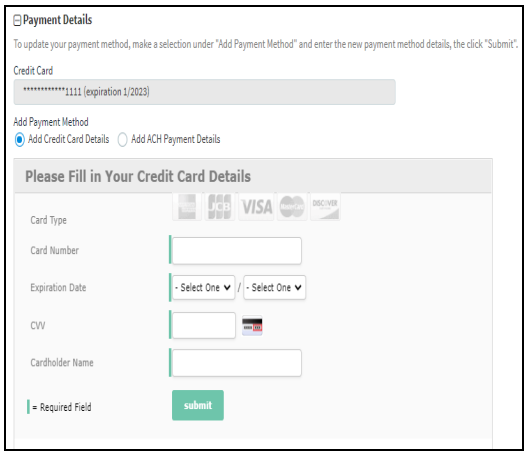
- Add Credit Card Details
- Add ACH Payment Method



Add Credit Card Detail

Enter the following and click **Submit**:

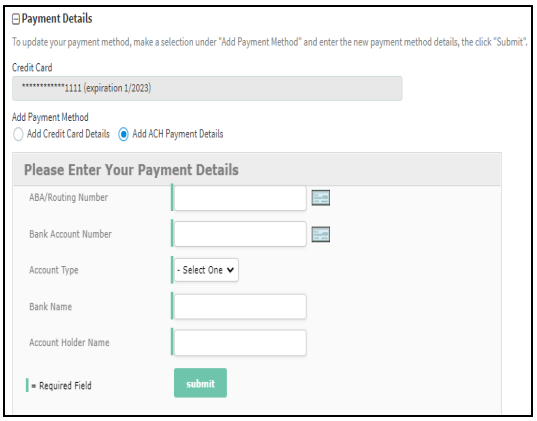
- 16 digit Credit **Card Number**.
- **Expiration Date** and **Year** on the card.
- **CVV** and **Cardholder Name**.



Add ACH Payment Method

Enter the following and click **Submit**:

- **ABA/Routing Number**.
- **Bank Account Number**.
  - Select one of the following for **Account Type:**
    - Checking
    - Saving
    - Business Checking
  - **Bank Name** and **Account Holder Name**.



Management Tool

The Management Tool allows one to register CBRS devices to the SAS provider before physically connecting CBRS-complaint devices to the network. The following Cambium CBRS-compliant devices operate in 3.6 GHz band frequency, ranging from 3550 to 3700 MHz:

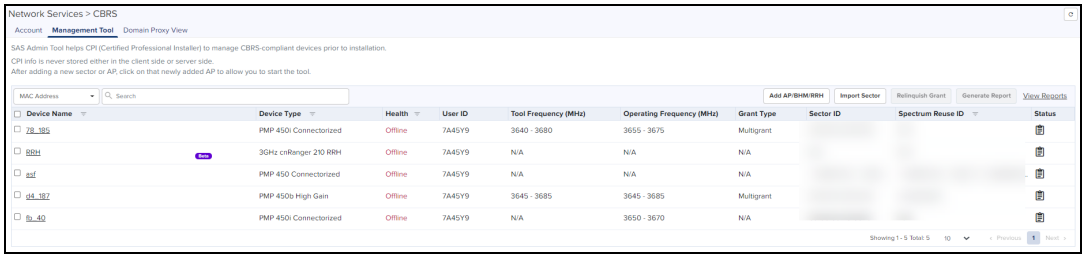
NOTE

The CBRS Multi-Grant feature is first supported in cnMaestro 3.0.2 and PMP 20.2.

- PMP 450b 3 GHz
- PMP 450m AP 3 GHz
- PMP 450i AP and SM 3 GHz
- PMP 450 AP and SM 3.6 GHz
- PTP 450i BHM and BSHS 3 GHz
- PTP 450 BHM and BHS 3.6 GHz
- LTE 3 GHz cnRanger 201 SM
- LTE 3 GHz cnRanger 210 RRH

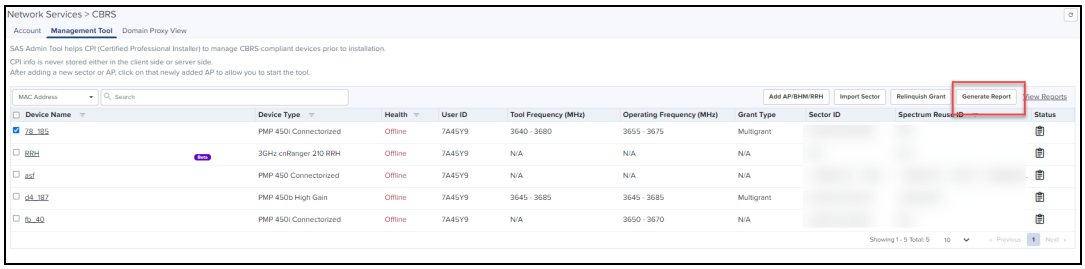
The CBRS procedure can be performed by an authorized CPI (Certified Professional Installer). CPIs are required to enter necessary credentials to update the CBRS parameters.

A CBRS sector view is shown below:



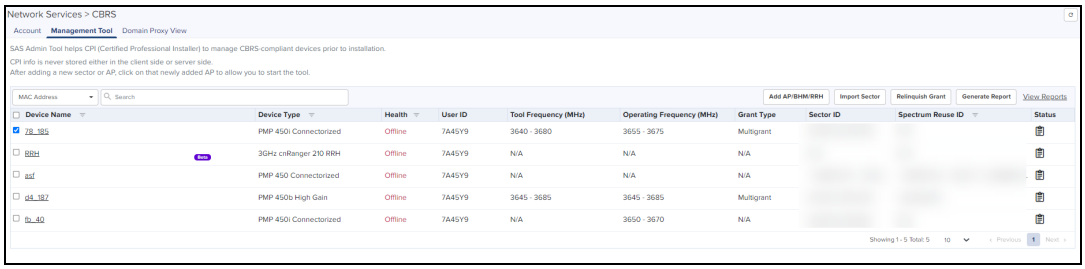
Generate Report

The Generate Report button allows one to download multiple device reports in a **.CSV** format.



Relinquish Grant

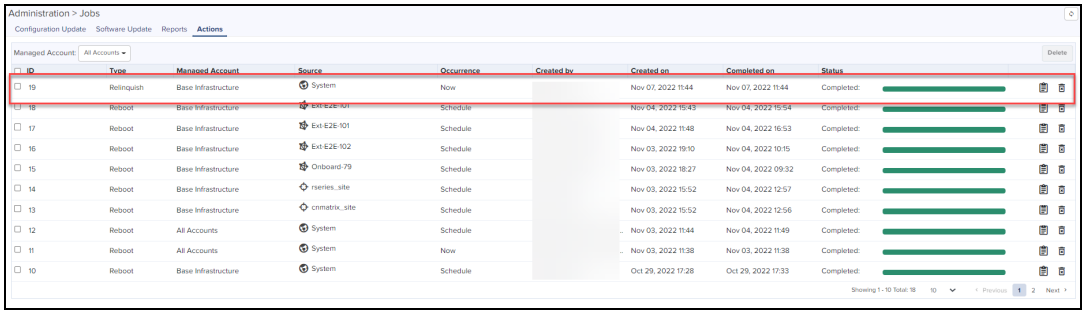
The Relinquish Grant button relinquishes all grants of selected sector and places devices in the Registered state. The device will start the Multi-Grant procedure if the Multi-Grant feature is enabled on the device.



NOTE

- Relinquish Grant can be performed only for the Config_Synced devices running in Single Grant.
- PMP devices should be upgraded to release 20.2, which supports the Multi-Grant feature.

Relinquish grant creates a job in **Action** page, when relinquish of sector is initiated from **Management Tool** page.



Creating a Management Tool Sector

A sector can be created by two ways:

- Add AP/BHM/RRH: Add all parameters manually of an AP/BHM/RRH.
- Import Sector: Upload a file with details from all sector devices.

Add AP/BHM

1. Navigate to **Services > CBRS > Management Tools** and click **Add AP/BHM/RRH**.
2. Enter all parameters under the following categories when the user selects the **Mode** as **AP/BHM**:

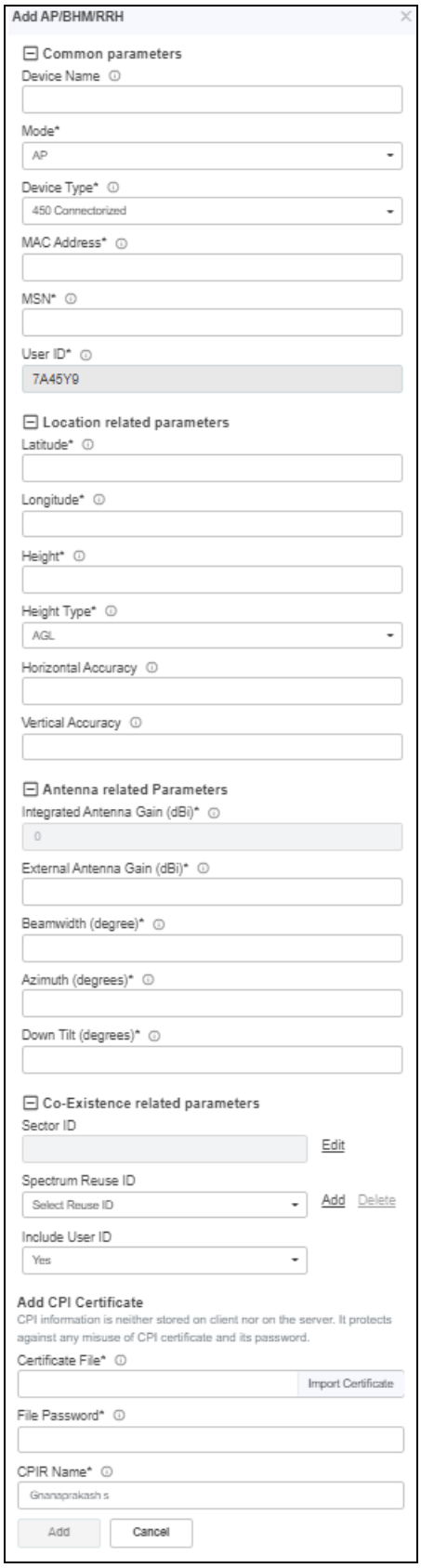
- **Common Parameters**: Device Name, Mode, Device Type, MAC Address, and MSN.
- **Location Related Parameters:** Latitude, Longitude, Height, and Height Type, Horizontal Accuracy, and Vertical Accuracy.
- **Antenna Related Parameters**: External Antenna Gain, Beamwidth, Azimuth, and Down Tilt.

- **Co-Existence Related Parameters:** Sector ID, Spectrum Reuse ID, and Include User ID.

NOTE

- **Include User ID** is applicable only for PMP devices, when SAS is **Federated Wireless.**
- Select **Yes** or **No** to Include user ID.

- **Add CPI Certificate**: Certificate File, File Password, CPIR Name.



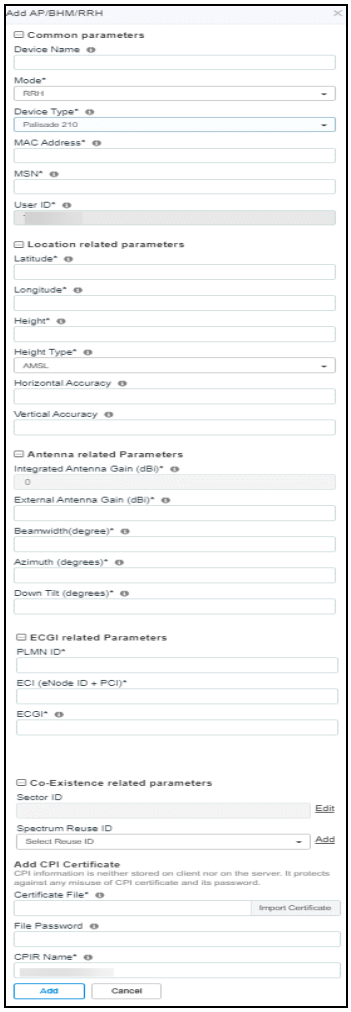
- Click **Add** to add a sector.

Add RRH

1. Navigate to **Services > CBRS > Management Tools** and click **Add AP/BHM/RRH.**

2. Enter all parameters under the following categories when the user selects the **Mode** as **RRH**:

- **Common Parameters**: Device Name, Mode, Device Type, MAC Address, and MSN.
- **Location Related Parameters:** Latitude, Longitude, Height and Height Type, Horizontal Accuracy, and Vertical Accuracy.
- **Antenna Related Parameters**: External Antenna Gain, Beamwidth, Azimuth, and Down Tilt.
- **ECGI Related Parameters**: PLMN ID, ECI (eNode ID + PCI), and ECGI.
- **Co-Existence Related Parameters:** Sector ID and Spectrum Reuse ID.
- **Add CPI Certificate**: Certificate File, File Password, CPIR Name.



3. Click **Add** to add a sector.

	NOTE: Refer to CBRS Device Parameters for additional details.

Import Management Tool Sector

To import a sector:

1. Navigate to **Services** > **CBRS** > **Management Tool** and click **Import Sector** button.

2. Click **Download Template** if user does not have an Import Sector template. Users can download two different template formats:
   - PMP: Excel or ODS
   - LTE: Excel or ODS
3. Click **Import Excel** to select **Import Sector** template file. File must be Microsoft Excel format (.xlsx) or OpenDocument Spreadsheet (ods) format.
4. Enter CPI credentials:
   a. Upload CPI Certificate File by clicking **Import Certificate**.
   b. Enter CPI File Password.
   c. Enter CPI Registered Name.
5. Enter the **Sector ID.**
6. Select **Spectrum Reuse ID** from the drop-down.
7. Select **Include User ID**.

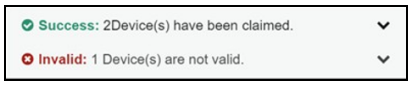
- Selecting **Yes** to **Include User ID** prefixes the **User ID** to the **Sector ID** and **Spectrum Reuse ID** in the registration message of the SAS.

NOTE

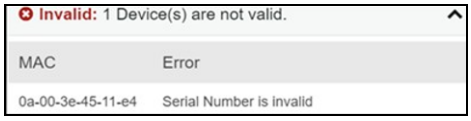
- **Include User ID** is applicable only for PMP devices, when SAS is selected as **Federated Wireless.**
- See the CBRS Consolidated Procedures Guide and the Cambium PMP Release 20.3 training slides for more details on when to select **Yes** or **No.**

8. Click **Import.**

Import status is displayed as **Success, Info**, and **Invalid**.



9. Details of **Success**, **Info,** and **Invalid** section can be seen by clicking arrow ( ).

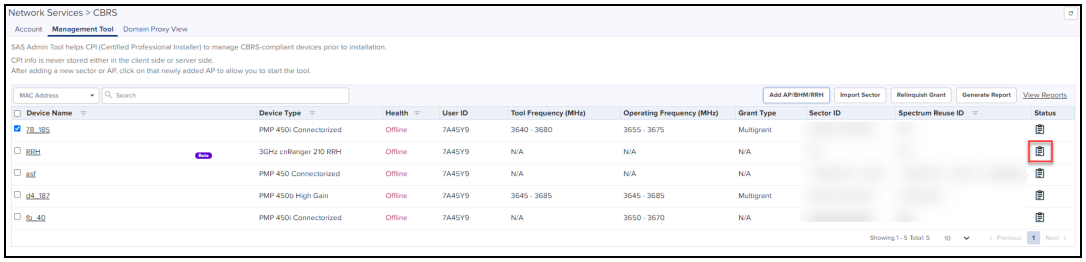


10. If the device is already claimed, it can be onboarded by clicking the onboard link.

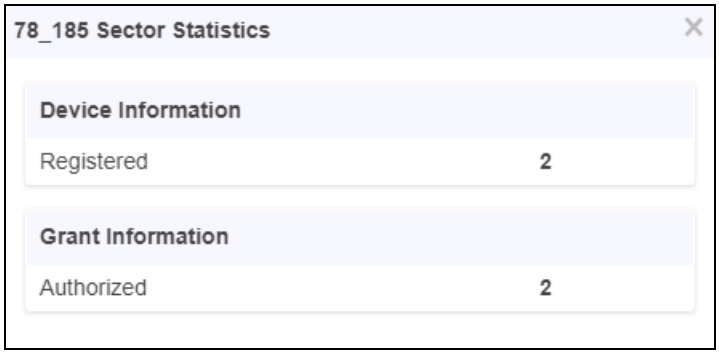
Management Tool Sector Statistics

To view Sector Statistics:

1. Navigate to **Services > CBRS > Management Tool.**
2. Click **View Sector Statistics** under **Status**.



3. **Sector Statistics** window pops up.



NOTE:

Refer to the Live Status Update for additional details.

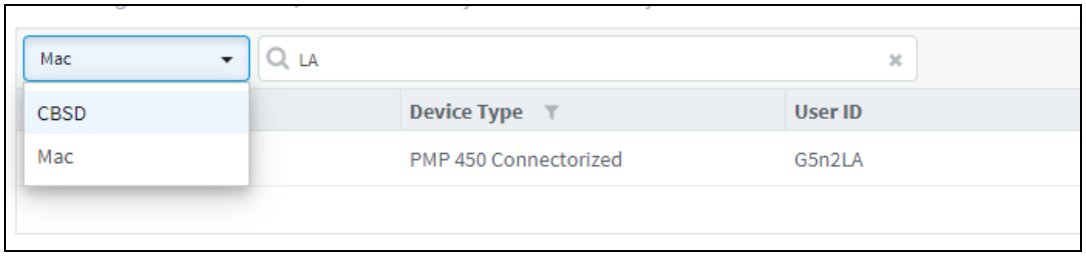
Search Management Tool Sector

To search for a sector:

1. Navigate to **Services > CBRS > Management Tool.**
2. Select **CBSD** or **MAC.**

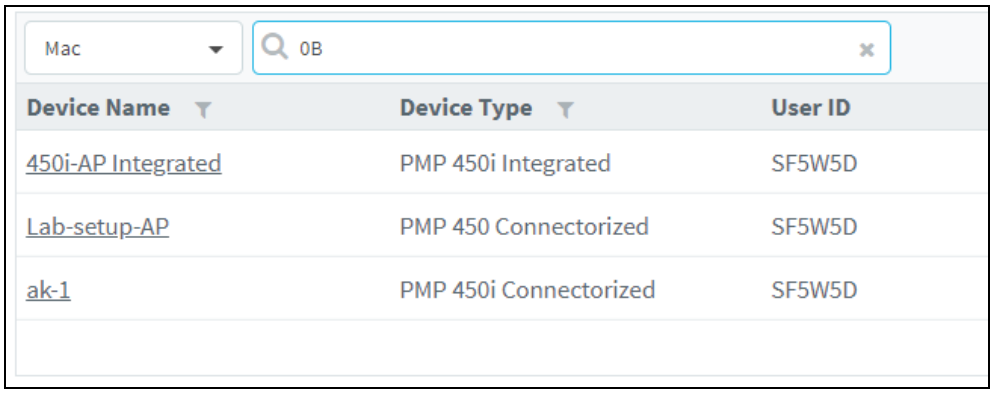
- For **CBSD**: Search by CBSD ID.
- For **MAC**: Search by MAC Address.

3. Enter text in search box to display filtered records.



NOTE:

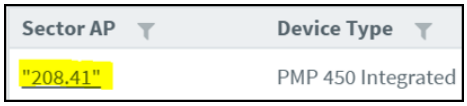
- If an AP device is entered into Search, it displays both AP devices and the related SM devices.
- If an SM devices is entered into Search, it displays only SM devices.



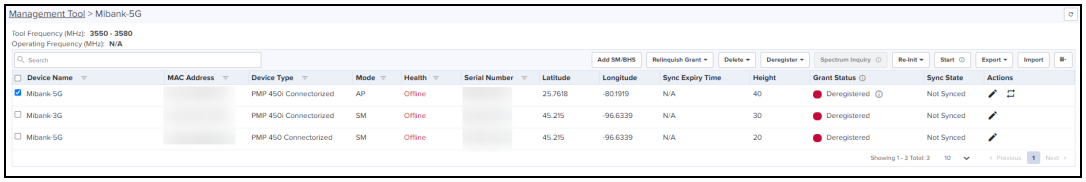
4. Filter AP or sectors can be cleared by clicking or **Clear** button.

Sector View

1. Click a sector from the Sector AP column to get the list of devices.



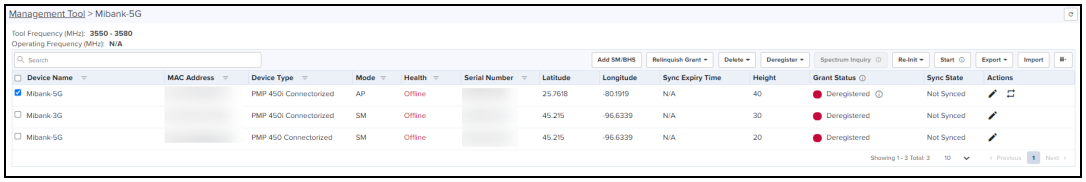
2. All devices of the sector are displayed.



Sector Details View

- The Sector Details view displays the following fields by default:

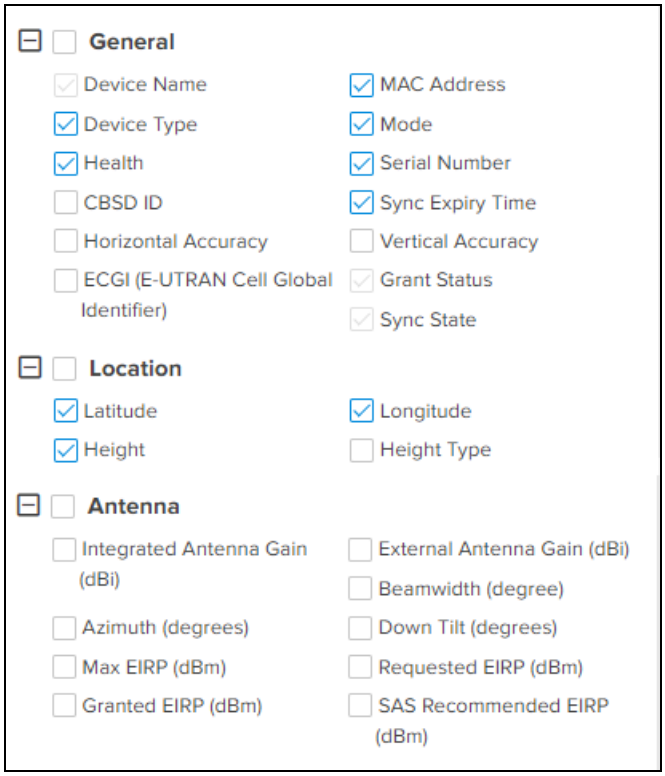
- Device Name, Device Type, Mode, Health, MSN, Latitude, Longitude, Sync Expiry Time, Height, Registered, Sync State, Actions.



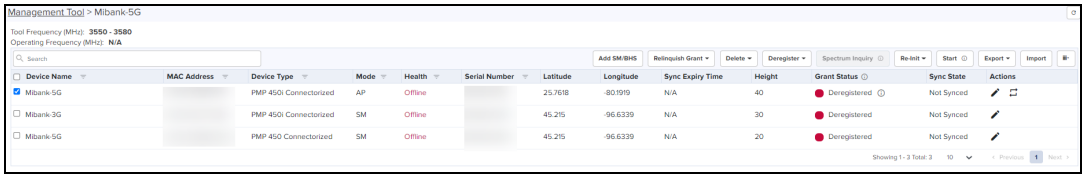
NOTE:

If the device is **Config_Synced**, the CBSD state of the device will be updated from the device in real-time.

- SM can be added in the sector by manually entering all parameters using **Add SM** button or uploading a file containing all SM details using **Import SMs** button.
- Action column can edit or delete any device in the sector. **Edit** and **Delete** buttons are available depending upon the device state. Refer to Edit device and Delete device for more details.
- To include additional fields to be displayed in the **Sector Details** view, select required fields in the column selector( ).



- User can use following button to control the CBRS procedure:



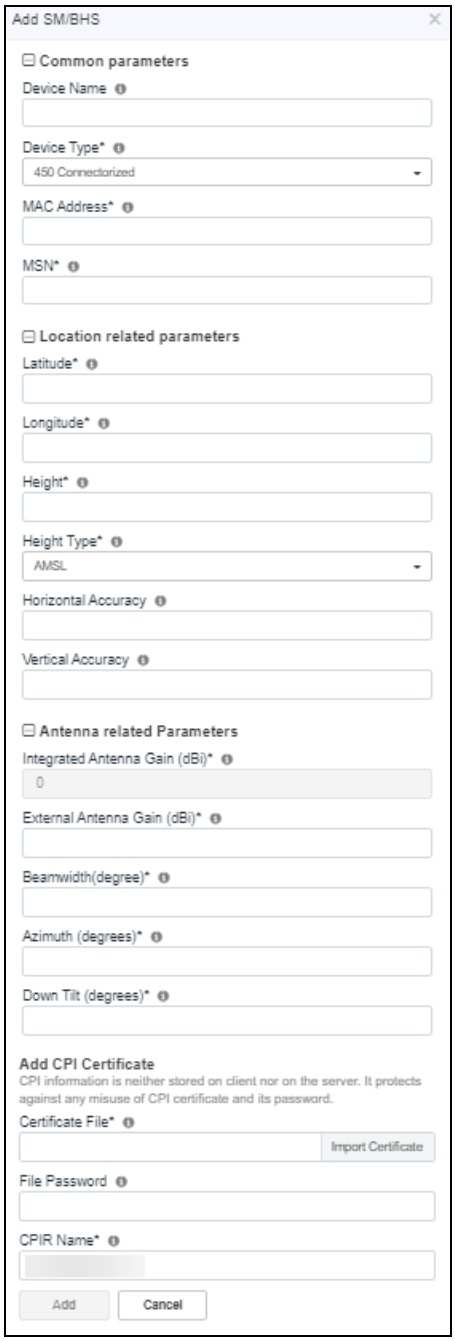
- **Start** and **Stop**: manage to start and stop CBRS procedure of a sector.
- **Reinitialize**: restarts the CBRS procedure and reinitializes the devices.

- **Deregister:** deregisters the device (single or multiple).
- **Spectrum Inquiry**: checks the availability of frequencies.
- **Delete**: deletes the device (single or multiple).
- **Unblock**: clears the de-registered state on an LTE, allowing a registration or reregistration request.
- **Export**: exports the sector data in .xlsx format.
- **Import:** imports the SM in the sector.
- **Relinquish Grant:** relinquishes grants generated in Wide-Grant mode.

- Once the sector is authorized (AUTHORIZED state), button transfers grant details from the Management Tool to real devices.

Add SM or BHS

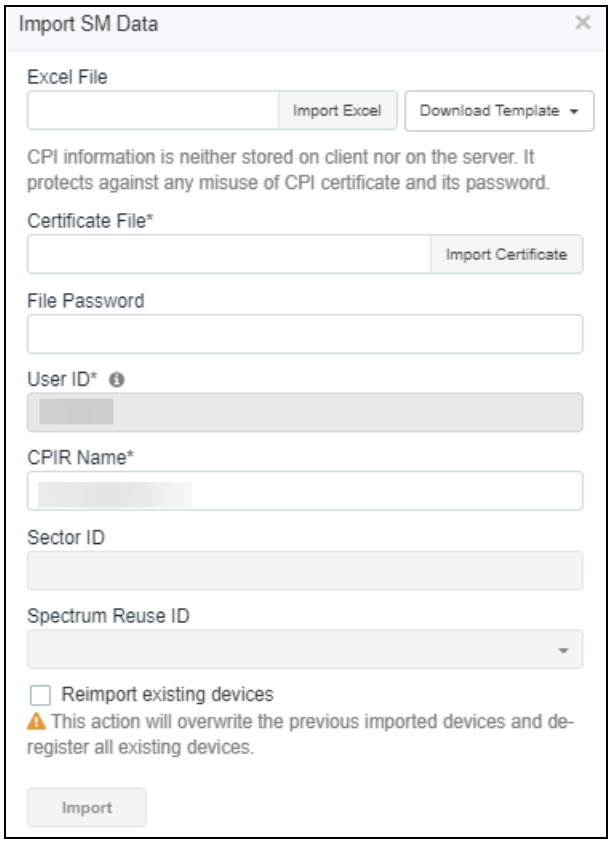
1. Navigate to **Services > CBRS > Management Tool >** select a sector.
2. Click **Add SM** or **BHS** to add SM in a sector.



3. Enter all parameters under following categories:
   a. **Common:** Device Name, Device Type, MAC Address, and MSN.
   b. **Location**: Latitude, Longitude, Height and Height Type, Horizontal Accuracy, and Vertical Accuracy.
   c. **Antenna Parameters**: Integrated Antenna Gain, Beam width, Azimuth, and Down Tilt.
   d. **Add Certificate**: Certificate File, File Password, and CPIR Name.
4. Click **Add** to add an SM.

Import SMs

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Import** button to import SMs into a sector.
3. Enable the **ReImport Devices** to overwrite the previous imported data and deregister all existing devices.



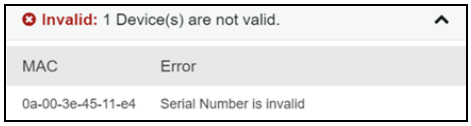
4. Click **Download Template** if user does not have Import Sector template. Users can download two different template formats:
   - PMP: Excel or ODS
   - LTE: Excel or ODS
5. Click **Import Excel** to select Import Sector template file. File must be Microsoft Excel format (.xlsx) or Open Document Spreadsheet (ods) formats.
6. Enter the following CPI credentials:

- Upload CPI Certificate File by clicking **Import Certificate** button.
- Enter CPI File Password.
- Enter CPI Registered Name.

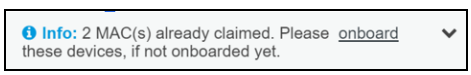
7. Click **Import**.

Import status will be shown under **Success, Info,** and **Invalid** sections.

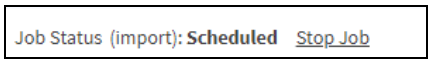
8. Details of **Success**, **Info** and **Invalid** can be seen by clicking .



9. If the devices is already claimed, it can be onboarded by clicking the **onboard** link.

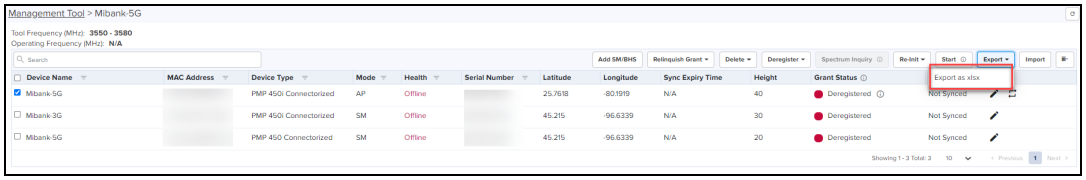


10. Once the user clicks **Import**, a job is scheduled.

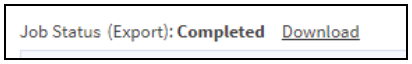


Export Sector

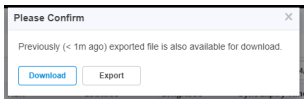
1. Navigate to **Services > CBRS > Management Tool** and then select a sector.
2. Click **Export** button to export the sector (export as xlsx).



3. Once the user clicks **Export**, a job is scheduled.



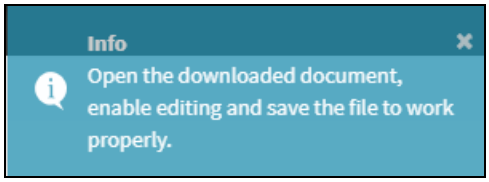
4. Once the Job status is Completed, **Download** the Sector xlxs.



NOTE:

Download button is enabled only for two hours after the export job completes.

5. User can use the .xlxs file for importing back into the sector. To import, save the file as shown in the below figure.

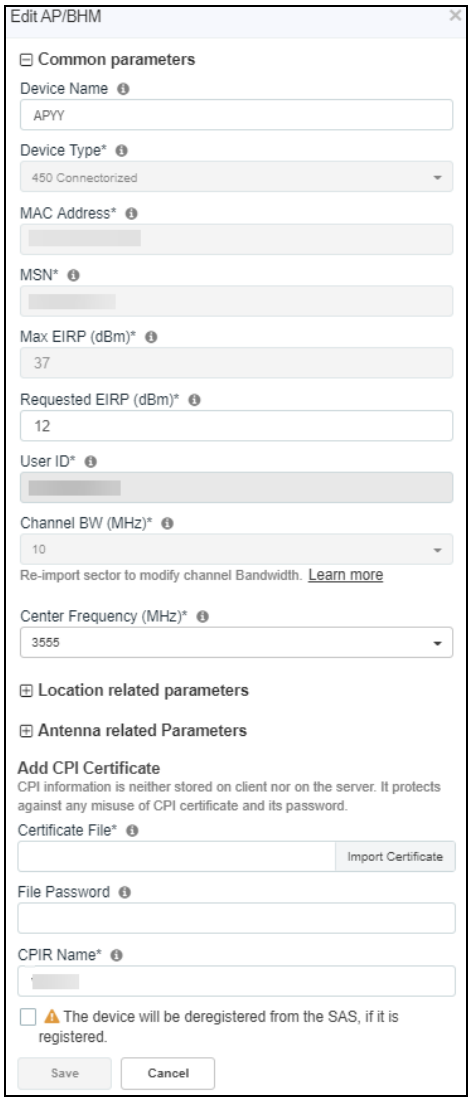


Edit Device

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Stop** button if the CBRS procedure is running.
3. Click **Edit** button to edit device parameters.
4. Enter CPI credentials:

- Upload CPI Certificate File by clicking **Import Certificate** button.
- Enter CPI File Password.
- Enter CPI Registered Name.

5. After editing the device. The device should go to derigestered state.



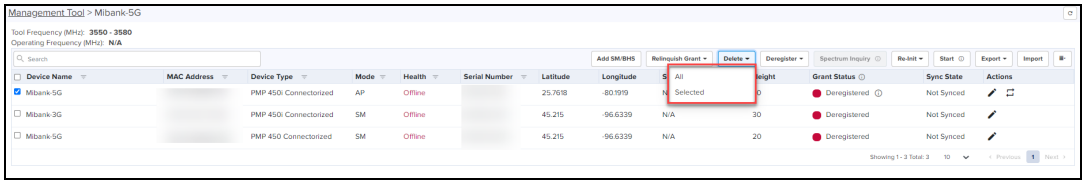
6. Click **Save**.

Delete Device

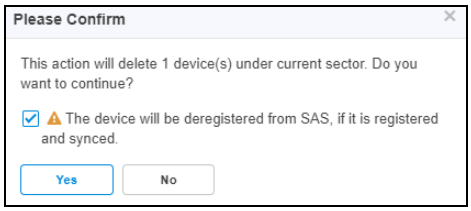
1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Stop** button if the CBRS procedure is running (the CBRS procedure is running if the START procedure described below has been invoked, and if all devices in AUTHORIZED state).
3. Deleting SM:

- Select SM to deregister if it is not in UNREGISTERED state (Refer to the Live Status Update)

4. Once the SM selected click **Delete** and display popup **All** or **Selected.** click **Selected:**
   - **All** :deletes the complete registered SM devices.
   - **Selected** :deletes the selected single device.



5. Click **Yes** to confirm.



6. Once the user clicks **Yes**, a job will be scheduled.

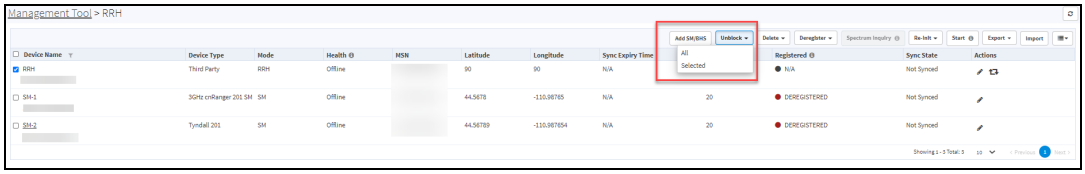
7. Deleting AP:

- All SMs of the sector must be deregistered and deleted before deleting the AP. Refer to the Deregistration procedure to deregister all SM devices.
- Select AP of the sector to delete.
- Click **Delete**.

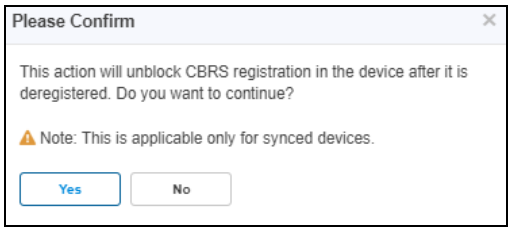
	NOTE: If the procedure is started for the device and it is registered, then, while deleting the device, Deregister checkbox should be selected otherwise the deletion fails.

Unblock Device

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. If LTE device is **Config Synced**, and if device deregister flag is enabled, unblock removes the deregistartion flag on the device.
3. Once the device is selected, click **Unblock** and choose **All** or **Selected** from the drop-down.
   - **All** :unblock the complete registered devices.
   - **Selected** :unblocks the selected single device.



4. Click **Selected** display the **Please Confirm** window.



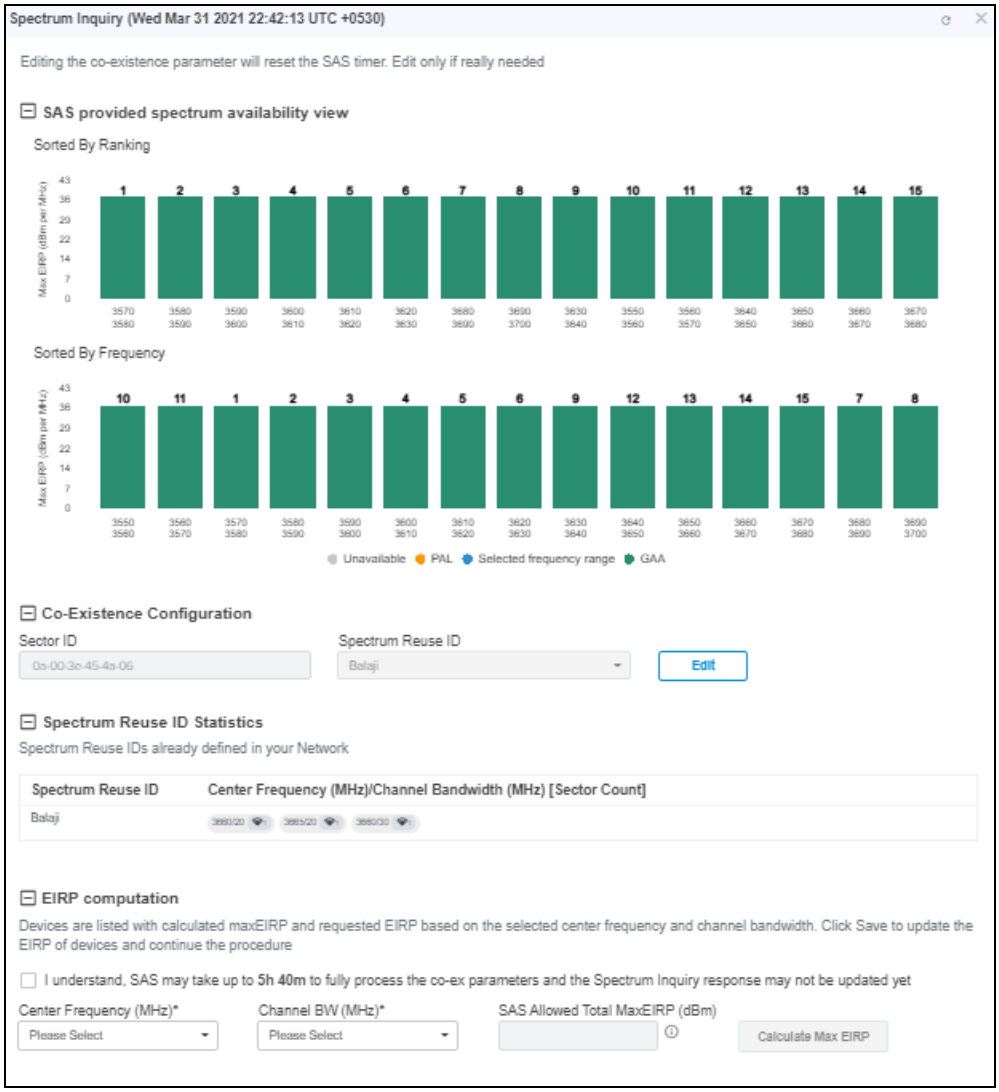
5. Click **Yes** to confirm the action.

Start CBRS Procedure

The Start button starts the CBRS procedure for a sector.

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Start** to start CBRS procedure of a sector.

3. Once the user clicks start, the **Spectrum Inquiry** window pops up.

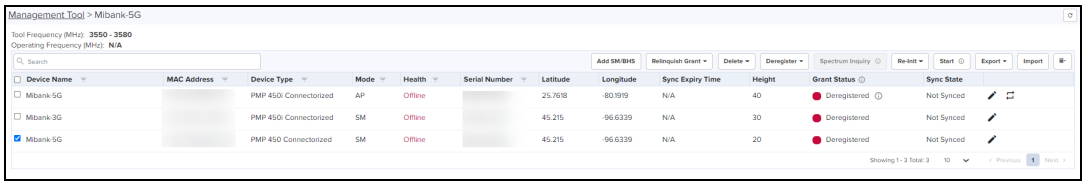


Note:

- Multi-Grant is enabled by default.
- **Sorted By Ranking** is applicable for users selecting Google or Federated Wireless SAS.
- User can enable or disable the multigrant only if the device version is less than 21, if device version is 21 and above only multigrant is possible.

4. User can disable the Multi-Grant feature by disabling the checkbox **This feature will enable multi grant on the tool**. For more details refer Multiple Grant.
5. Click **Edit** to edit **Co-Existence Configuration** and **EIRP Computation.**
   - **Spectrum Reuse ID Statistics** displays the devices running on different sector, channels, and bandwidth based on the **Spectrum Reuse ID**.
6. Once the Spectrum Inquiry is verified, click **Save**.

The Sector is created displays as shown below:



NOTE:

- If the device is already synced with the Management Tool, the CBRS Start and Stop procedures are not applicable for all the synced devices.
- If user does not see the **Start** button, it means the CBRS procedure is already running.
- If all devices of the sector are in AUTHORIZED or HALT status and the user tries to start the CBRS procedure, the **Start** button will go to Stop state (as CBRS procedure is completed for all devices).

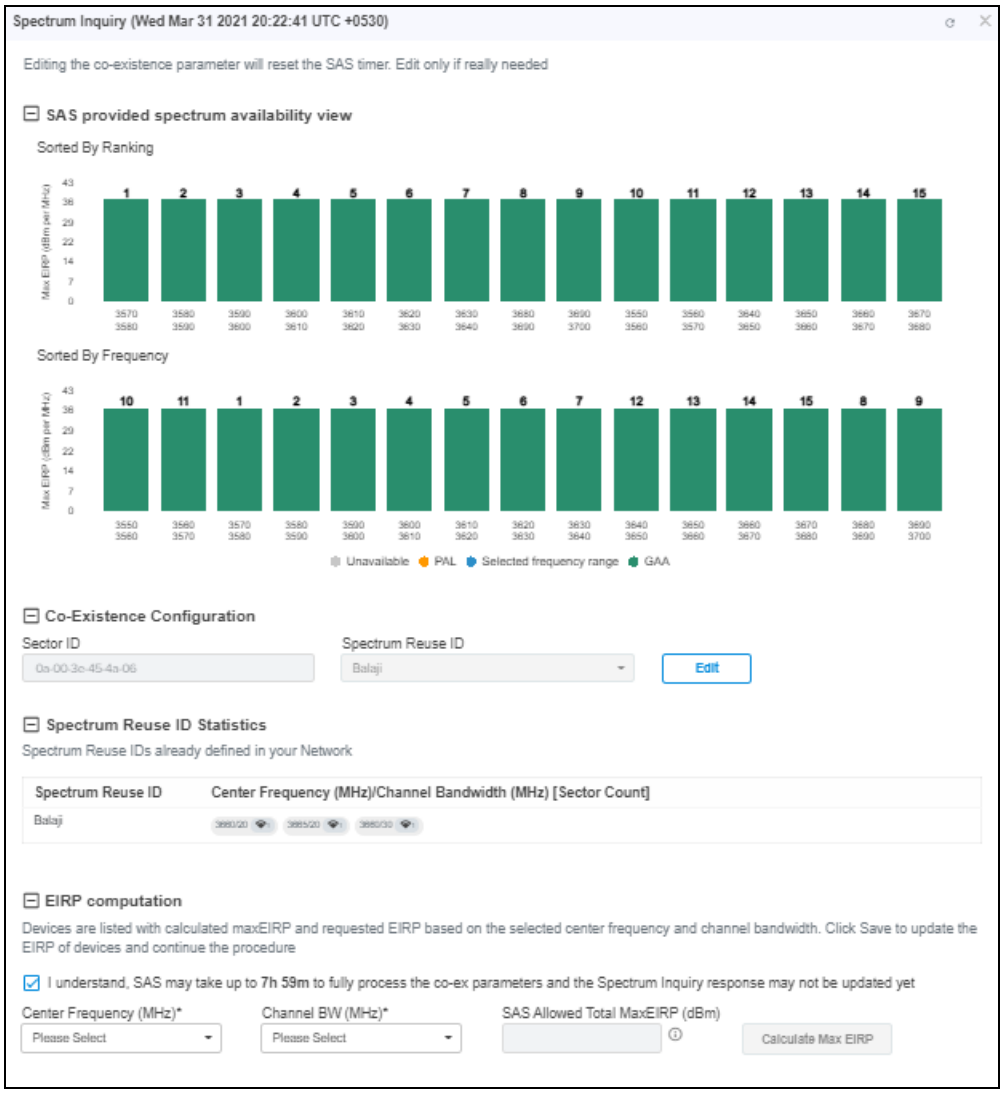
Multi-Grant

Multi-Grant feature divides selected channel bandwidth into multiple of 10 MHz channels. If the selected channel bandwidth is 5 MHz or low/high frequency contains 5 MHz raster, the slice would be in 5 MHz channel. Each slice will initiate a separate Grant procedure.

To enable Multiple Grant for a new sector:

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Start** to start CBRS procedure of a sector.
3. Once the user clicks **Start**.

The Spectrum Inquiry window pops up as shown below.



	NOTE: • Multi-Grant is enabled by default. • Include User ID is applicable only for PMP devices, if user selects SAS is either Federated Wireless.

4. Click **Edit** to edit Co-Existence Configuration and EIRP Computation.

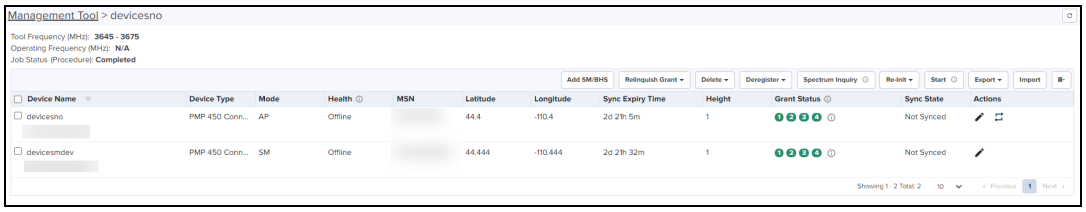
   - Spectrum Reuse ID Statistics displays the devices running on different sector, channels, and bandwidth based on the Spectrum Reuse ID.

5. Accept the checkbox process of the Co-Existence parameters.

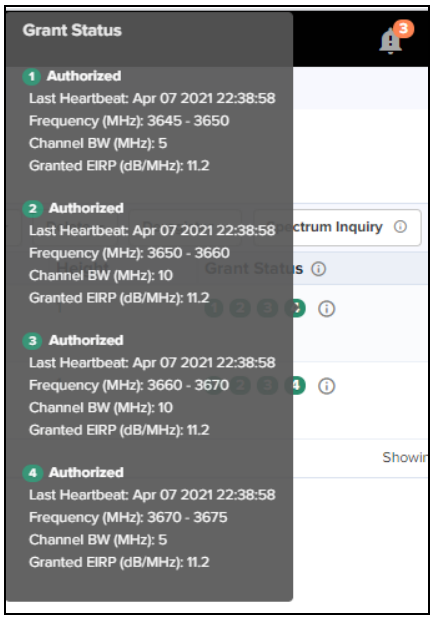
	NOTE: The Federated Wireless or Google SAS might need hours to fully process the Co-Existence parameters in the Registration, (before they are properly reflected in the Spectrum Inquiry Response). For more details see the CBRS Standalone Procedures Guide.

6. Once the Spectrum Inquiry is verified, click **Save**.

A Sector created with Multiple Grants will be displayed as shown below:



To view the Grant Status click the info icon .

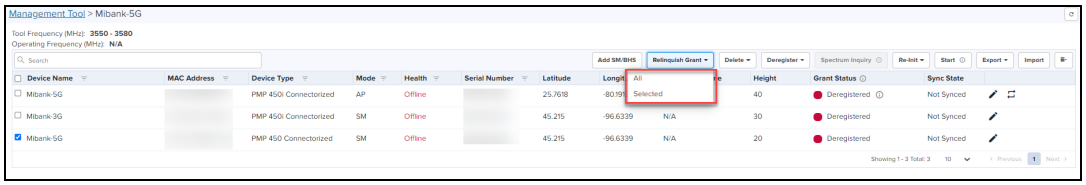


Relinquish Grant

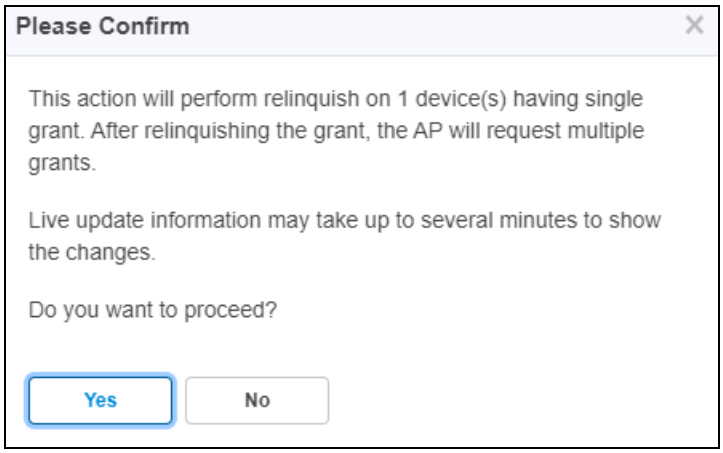
Relinquish Grant relinquishes all grants of selected sector. This will make devices enter the Registered state. The device will start Multi-Grant procedure if Multi-Grant feature is enabled on it.

To Relinquish Grant Perform as follows:

1. Navigate to **Services > CBRS > Management Tool** and select a sector with Single Grant.
2. Once the SM is selected, click **Relinquish Grant** to display **All** or **Selected.** Click **Selected.**
   - **All**: relinquish all the registered devices.
   - **Selected**: relinquish the selected device.

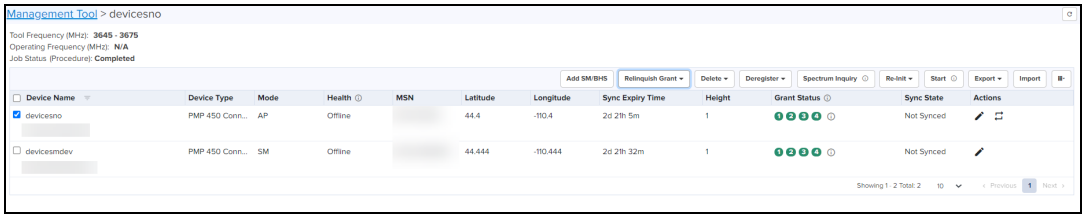


3. Click **Yes** to confirm the action.



	NOTE: Live update information may take upto several minutes to display the changes of reflected relinquish status.

Once the user clicks **Yes**, **Wider Grant** gets converted to the **Multiple Grants** as shown below:



Stop CBRS Procedure

The **Stop** button stops the CBRS procedure for a sector.

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Stop** button to stop CBRS procedure.

	NOTE: • If the device is already synced with the Management Tool, the CBRS Start and Stop procedures are not applicable to the synced devices. • If user does not see the **Stop** button, it means the CBRS procedure is already in stopped state, **Start** and **Stop** are toggles. • If all devices of the sector are in AUTHORIZED state, the CBRS procedure will automatically stop.

Reinitialize CBRS Procedure

The **Re-init** button allows the user to start the CBRS procedure for a sector and reinitialize selected devices (Reinitialize = Start of sector + Reinitialization of user selected devices). At least one device must be selected in order to enable the **Re-init** button. Clicking **Re-init** reinitializes selected devices to UNREGISTERED (irrespective of previous CBRS state).

1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Stop** if the CBRS procedure is already running.

3. Select one or more devices to be reinitialized.

> **NOTE:**
>
> You might notice some delay in enabling **Re-init** button after pressing **Stop.** It is due to a delay in properly stopping the CBRS procedure.

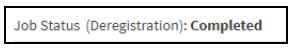
4. Click **Re-init** to start the reinitialization procedure
5. Confirmation window pops up:
   - Click **Continue** or
   - Select **Spectrum Inquiry** to edit the **EIRP values** as shown in Start procedure.

> **NOTE:**
>
> - Synced devices cannot be reinitialized.
> - Reinitialize modifies or corrects the parameters. For example, if a device is in HALT state due to a parameter error, the user can stop the CBRS procedure and reinitialize the device after modifying device parameters.

Deregistration

The deregistration procedure allows user to deregister the devices from the SAS server .

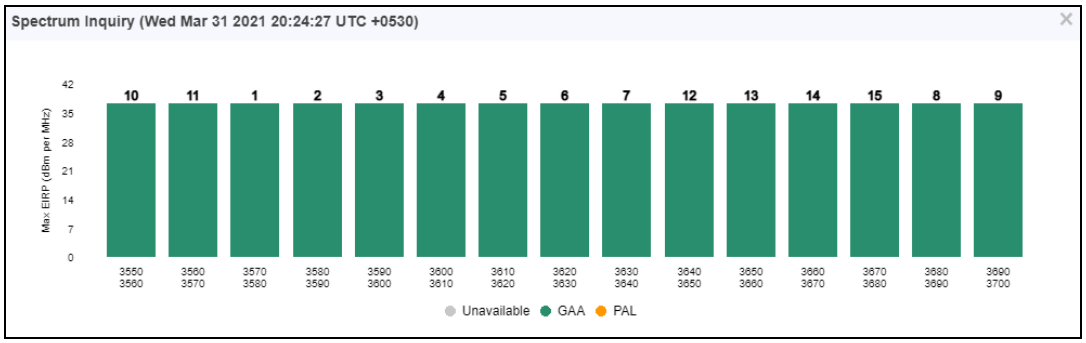
1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Stop** button if the CBRS procedure is already running.
3. Select one or many devices which need to be deregistered.
4. Click **Deregister** button to deregister selected devices.
5. Once the user clicks **Deregister**, a job will be scheduled.



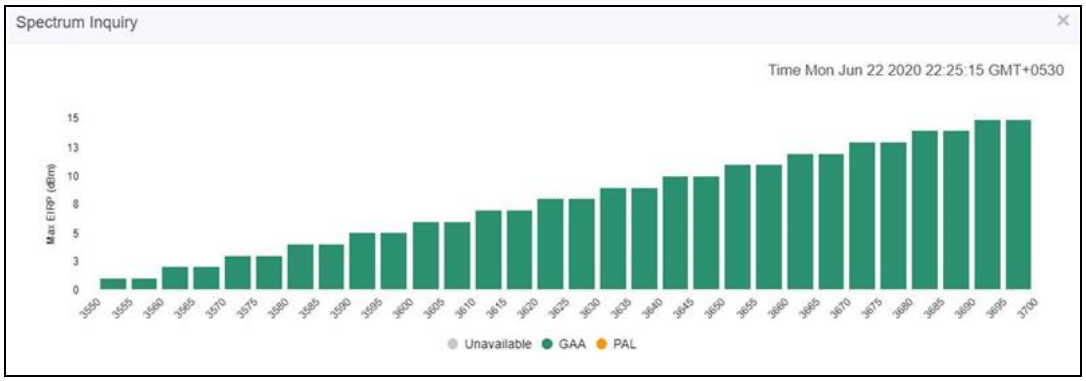
6. If deregistration fails, the reasons will be indicated under .

Spectrum Inquiry

1. Navigate to **Services > CBRS > Management Tool** and select a Sector.
2. Click **Spectrum Inquiry** button.
3. **Spectrum Inquiry** status button is enabled once the device is registered (REGISTERED state) to the SAS.
   - If the selected SAS is not Google, EIRP is unsupported, and Spectrum Inquiry is displayed as shown below:



- If the users is selected SAS is **Google,** it supports **EIRP.** Spectrum Inquiry displays as below:



- **GAA**: General Authorized Access
- **PAL**: Priority Access License

Spectrum availability can be checked by hovering over frequencies.

Device Sync

The Sync procedure allows user to transfer grant information from Management Tool to respective device.

For a PMP sector, the Sync action can only be performed on an AP or BHM. The SM and BHS gets synced automatically when it comes online.

For an LTE sector, which supports a Cambium SM with a 3rd party BBU and RRH, the sync action will sync the Cambium SMs in this sector.

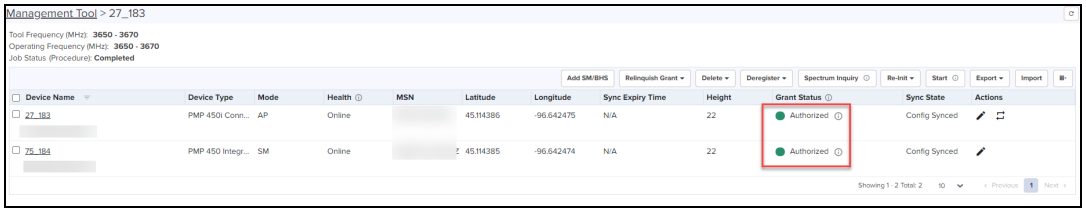
1. Navigate to **Services > CBRS > Management Tool** and select a sector.
2. Click **Sync** button to perform sync procedure.
3. Click **Yes** on the pop-up or click **NO** to cancel the sync procedure.

Once **Yes** is clicked, the Management Tool will check the accessibility of AP/BHM before proceeding with sync.

	NOTE: • PMP SM cannot be manually synced. It is only synced automatically. • Once the device is synced, for both PMP and LTE devices, primary management is transferred from the tool to the device itself. However, some actions and procedures are still supported on the tool. See the CBRS Consolidated Procedures Guide for more details. • Sync procedure copies complete CBRS parameters to device and enables CBRS to transmit with configured parameters.

Live Status Update

Once the device is **Config synced**, CBRS details like CBSD ID, Grant ID, CBSD Grant State, and Last Heartbeat Time are read from the device every 5 minutes.

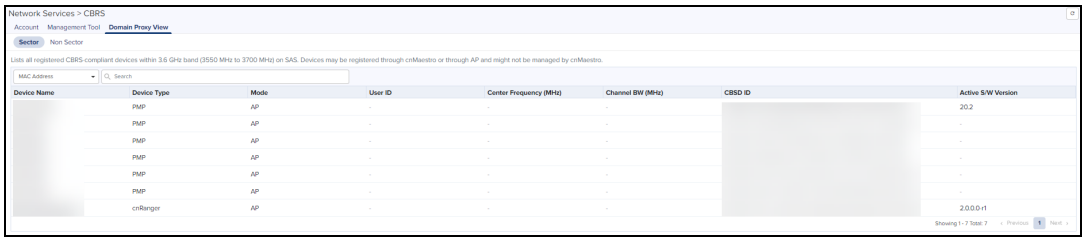


It displays the possible single Grant state such as:

- Authorized
- Deregistering
- Grant
- Grant Suspended
- Grant Terminate
- Registered
- Registering
- Relinquished Spectrum
- Relinquishing Spectrum
- Unregistered
- Unknown

Domain Proxy View

In Domain Proxy view, Sectors and Non-Sector page helps check CBRS-complaint devices connected through this server and On-Premises server using the token ID of this server. This page displays all the devices connected to CBRS.



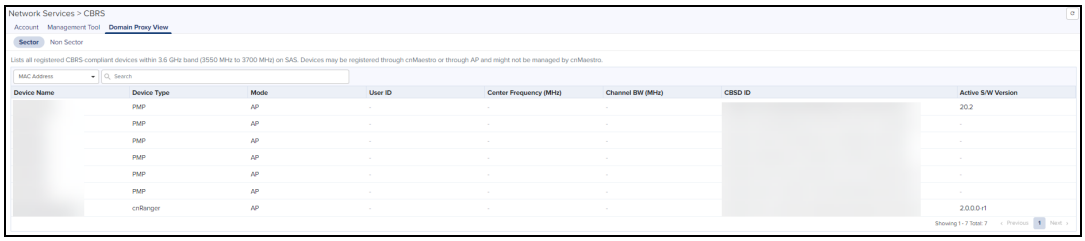
- **Sectors Page**: displays the devices according to the parenting AP list.
- **Non-Sector Page**: displays each individual AP and SM of **LTE** and **PMP**.

Searching a Domain Proxy Sector

To search a sector:

1. Navigate to **Services** > **CBRS** > **Domain Proxy View > Sector** page.
2. Select search option **CBSD or MAC.**

- For **CBSD**: Search by CBSD ID
- For **MAC**: Search by MAC ID.



3. Enter text in search box.

	NOTE: • If AP device is entered , it displays the both AP devices and the related SM device in the search result. • If SM devices is entered , it displays only the SM devices in the search result.

4. Filtered device can be cleared by clicking **Clear** button.

Domain Proxy Sector view

1. Click a Sector from Sector AP column to get the list of devices.
2. All the devices of the sector will be displayed.

3. CBSD state shows current status of device and whether it is registered or deregistered with SAS.
4. User can use the click **Deregister** button to Deregister the device from CBRS.
5. The Sectors view displays the following columns by default:

   Device Name, Device Name, Mode, Health, MSN, Latitude, Longitude, Height, Status, and Actions.

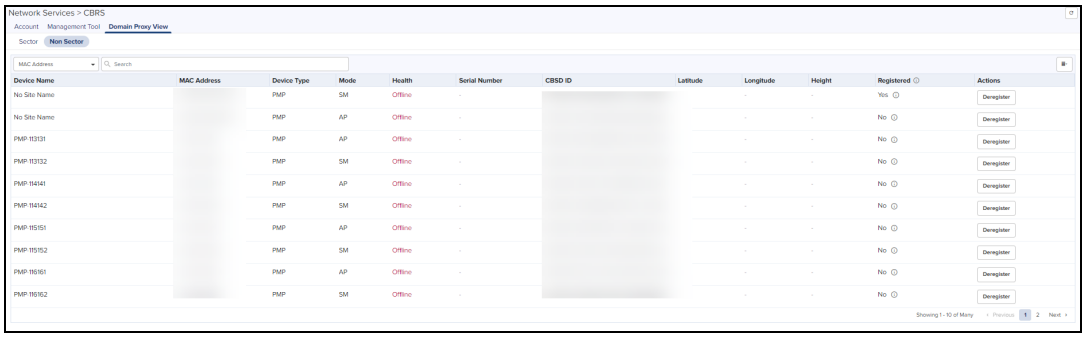
	NOTE: User can select the additional columns by clicking on top bar **Column Chooser** to include additional fields.

Searching a Domain Proxy Non Sector View

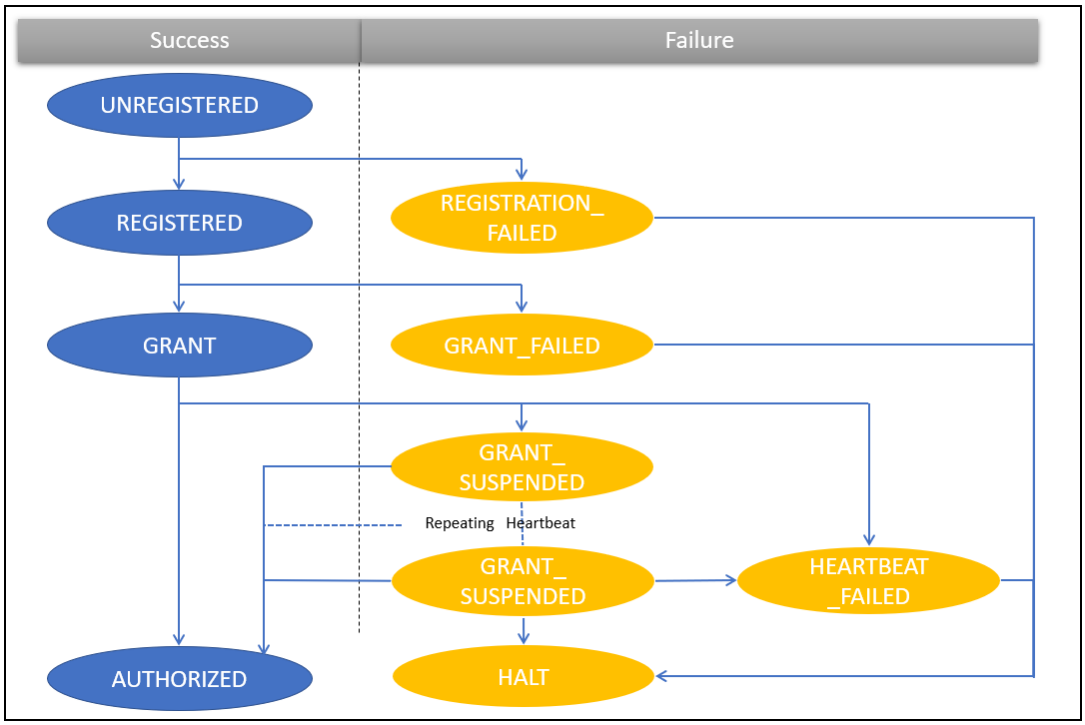
To search for a Non sector:

1. Navigate to **Services** > **CBRS** > **Domain Proxy View > Non Sector** page.
2. Select search option **CBSD or MAC.**

- For **CBSD**: search by CBSD ID
- For **MAC**: search by MAC ID.



CBRS State Diagram



NOTE:

GRANT_SUSPENDED is a temporary suspend state where HEARTBEAT message will be sent for an extended period of time prior to getting AUTHORIZED.

The CBRS procedure has the following states:

CBRS Device Parameters

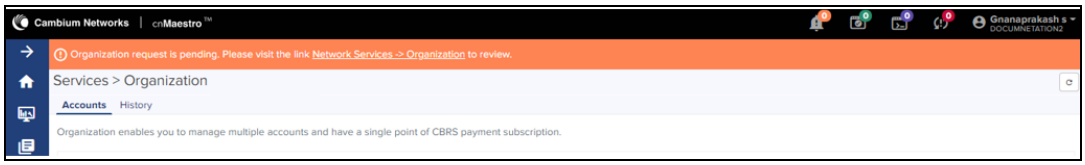
Category	Parameter	Details
Common	Channel BandWidth (MHz)	Channel Bandwidth of AP or BHM in MHz.
	Center Frequency (MHz)	Center frequency of AP or BHM in MHz.
	Device Name	Name given to device on SAS Admin (max 120 characters. It does not get copied to the device via sync.
	Device Type	Drop-down selection of supported devices types.
	MAC Address	MAC address of the device.
	MSN	Serial number of device.
	User ID	Unique identifier is assigned by the SAS. The User ID is part of the registration request message. The wrong User ID leads to REGISTRATION_FAILED.
Location	Height	Device antenna height in meters.
	Height Type	Should be AGL or AMSL as follows: • AGL height is measured relative to the ground level. • AMSL height is measured relative to the mean sea level.
	Horizontal Accuracy	A positive number in meters to indicate the accuracy of the device antenna horizontal location.
	Latitude	Latitude of the device antenna location in degrees.
	Longitude	Longitude of the CBSD antenna location in degrees.
	Vertical Accuracy	A positive number in meters to indicate the accuracy of the device antenna vertical location.
Co-Existence Related Parameters	Sector ID	The default AP MAC address (allows editing the default MAC).
	Spectrum Reuse ID	The Spectrum Reuse ID defined in the network.
	Include User ID	Prefixes the User ID to the Sector ID and Spectrum reuse ID.

Category	Parameter	Details
ECGI Related Parameters	PLMN ID	Public and Mobile Network Identifier.
	ECI	E-UTRAN Cell Identifier. It is a length of 28 bits and contains the eNodeB-ID.
	ECGI	Enter the both PLMN ID and ECI parameters and it displays in the ECGI field.
Antenna Parameters	Azimuth (degrees)	Boresight direction of the horizontal plane of the antenna in degrees with respect to True North.
	Beamwidth (degree)	3-dB antenna beam width of the antenna in the horizontal-plane in degrees.
	Downtilt (degrees)	Antenna downtilt in degrees.
	External Antenna Gain (dBi)	Peak gain of external antenna connected to device in dBi.
	Integrated Antenna Gain (dBi)	Peak gain of integrated antenna in dBi.
Add Certificate	Certificate File	CPI (Certified Professional Installer) certificate.
	CPIR Name	CPI registered name.
	File Password	CPI private password.

Actions for Existing CBRS On-Premises Users

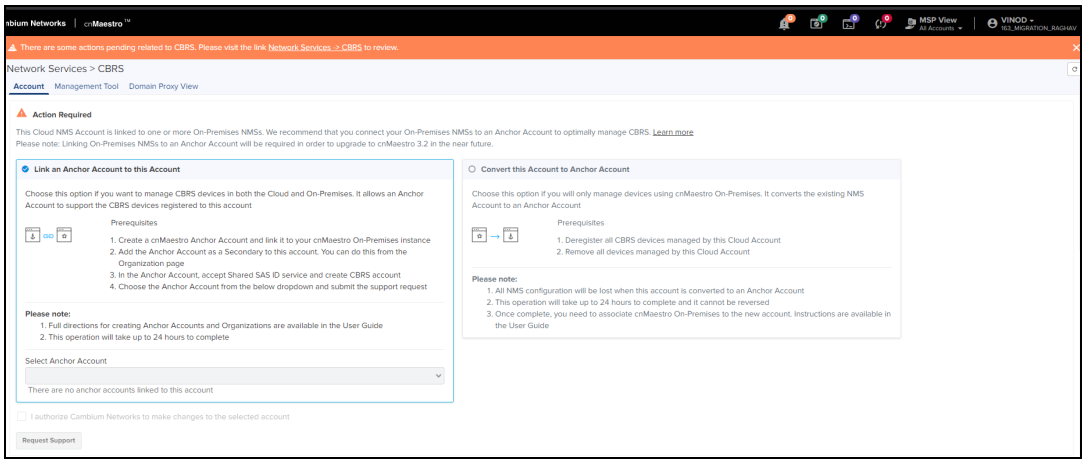
Current CBRS On-Premises customers maintain their CBRS billing and SAS configuration in an NMS Account. This must be updated to support Anchor accounts. To create an anchor account, refer to Manage Instances.

If an action is required for existing Cloud NMS users, the UI will display the following notification:



After clicking the notice, navigate to **Services.**

- **Link an Anchor Account to this Account:** Select if managing CBRS devices in both Cloud and On-Premises. It creates an Organization that shares configuration between a Primary NMS account and a Secondary Anchor account (without deregistering existing CBRS devices).
- **Convert this Account to Anchor Account:** Select only if managing devices On-Premises and NMS do not have any devices. It converts the existing NMS Account to an Anchor Account.



Link an Anchor Account to this Account

Select this to manage CBRS devices in both Cloud and On-Premises. An Anchor account must be created to manage the CBRS On-Premises devices without deregistration.

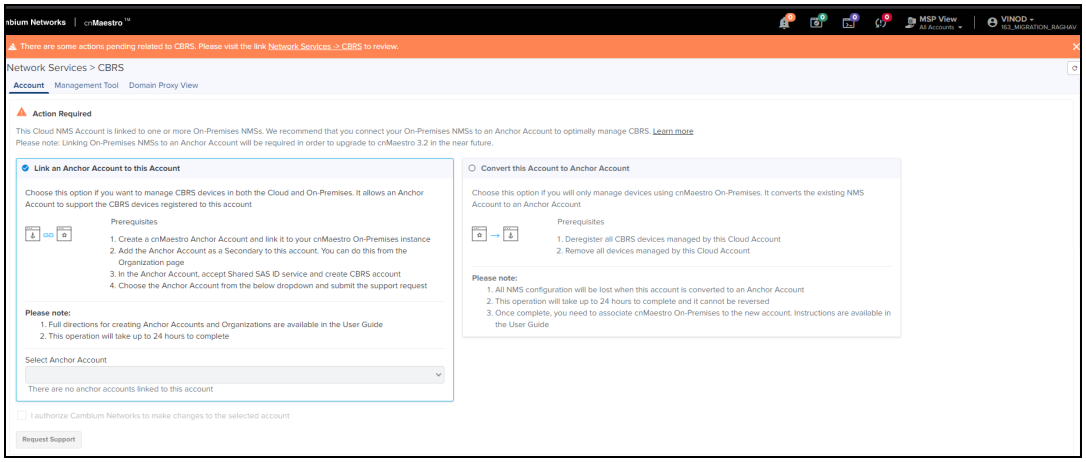
	NOTE: Cambium recommends selecting this option when the user is managing devices in both cnMaestro Cloud and On-Premises.

Before linking an Anchor account, please do the following:

- Ensure the cnMaestro Anchor account is linked to the cnMaestro On-Premises instance(s).
- Add the Anchor account as a Secondary account to Primary NMS account. Refer to Create Organization.

To convert the existing account:

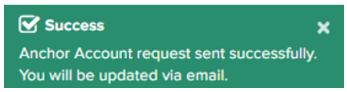
1. Navigate to **Services** > **CBRS** > **Account** page.



2. Select **Anchor Account** from the drop-down list.

	NOTE: Users are allowed to select only one Anchor account from the drop-down list.

3. Enable **I authorize Cambium Networks to make changes to the selected account**.
4. Click **Request Support** and a **Success** window pops up.



NOTE:

The Cambium Support team validates the request and creates an Organization from the NMS and Anchor accounts within 24 hours. Alternately, you can create the Organization yourself using the directions specified earlier in this document.

Convert this Account to Anchor Account

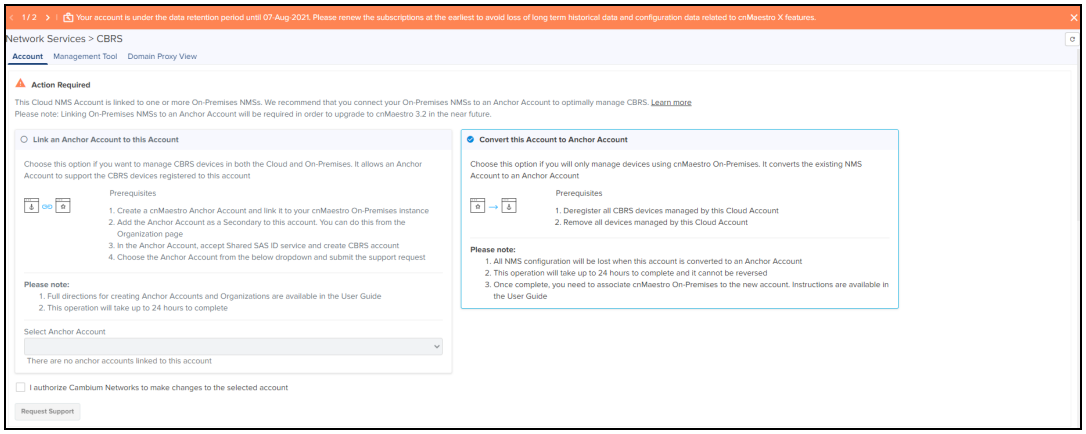
Select this to manage CBRS devices in On-Premises only. It converts an existing NMS account to an Anchor account.

NOTE:

Cambium recommends selecting this option when the user only plans to manage devices using cnMaestro On-Premises. Cloud account devices must be deregisted and deleted from the NMS account and registered back to On-Premises before the conversion.

To convert the existing account:

1. Navigate to **Services** > **CBRS** > **Account** page.

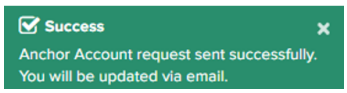


2. Select **Convert this Account to Anchor Account.**

NOTE:

- Deregister and remove all devices from the NMS account before the conversion.
- All NMS configuration will be lost when the account is converted to Anchor, including:
  - Guest Access Portal
  - Templates
  - Performance Graph Data, etc.
- The process of converting an NMS account to an Anchor account cannot be reversed.

3. Enable **I authorize Cambium Networks to make changes to the selected account**.
4. Click **Request Support** and a **Success** window pops up.



	NOTE: The Cambium Support team validates the request and create an Organization from the NMS and Anchor accounts within 24 hours.

Organizations for CBRS

An Organization allows multiple accounts to share CBRS billing and SAS ID. The Primary Account owns this configuration, and the Secondary Account can optionally share it. Both accounts must authorize the sharing.

	NOTE: • There is only one Primary Account in an Organization. • CBRS configuration can be set in the Primary Account and optionally shared to Secondary Accounts.

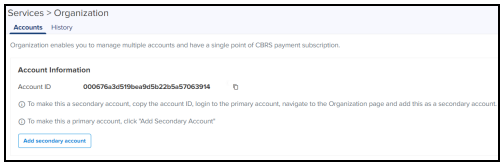
This chapter provides the following information:

Create an Organization

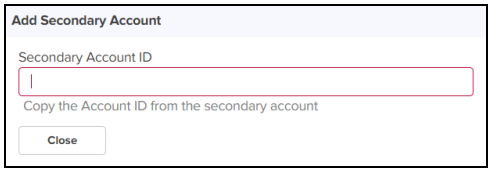
Primary Account

Perform the following steps on the Primary Account:

1. Navigate to **Network Services** > **Organization** > **Accounts**.

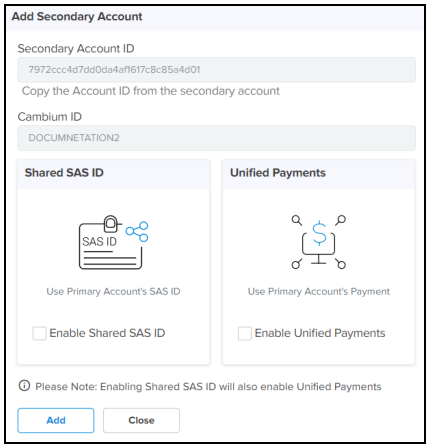


2. Click **Add Secondary Account**.



   - Navigate to the planned Secondary Account and copy the Account ID of the Secondary Account using the Copy to Clipboard.

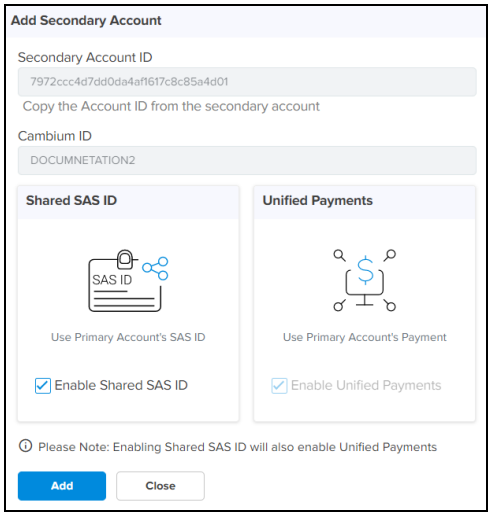
3. Paste the copied **Account ID** in the **Secondary Account ID** text box.
4. Once the Secondary Account is validated, the **Cambium ID** is displayed as shown below.



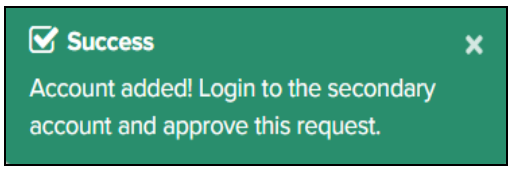
5. The Primary Account can offer services such as:
   - **Shared SAS ID**: This allows the Secondary Account to use the CBRS SAS ID configured in the Primary Account.
   - **Unified Payments**: This allows the Secondary Account to use payment details configured in the Primary Account.

	NOTE: Sharing the SAS ID automatically enables **Unified Payments**.

6. Enable the Services **Shared SAS ID** or **Unified Payments**.

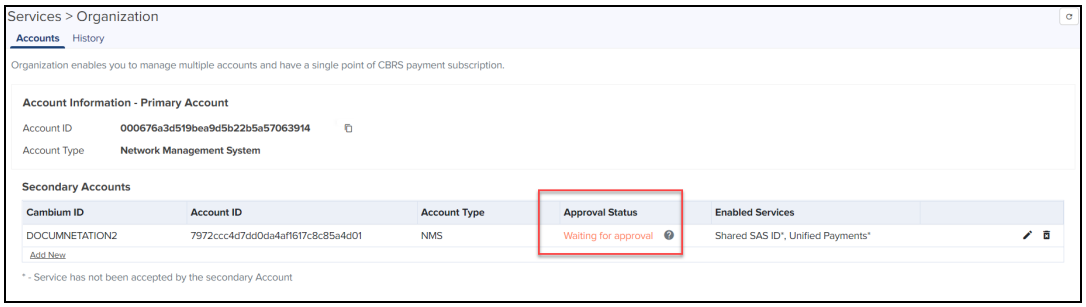


7. Click **Add**. It displays the **Success** message as shown below:



	NOTE: The Secondary Account administrator must approve this request from the Primary Account to join the Organization.

8. In the **Secondary Accounts** table, the **Approval Status** is displayed as **Waiting for approval**.

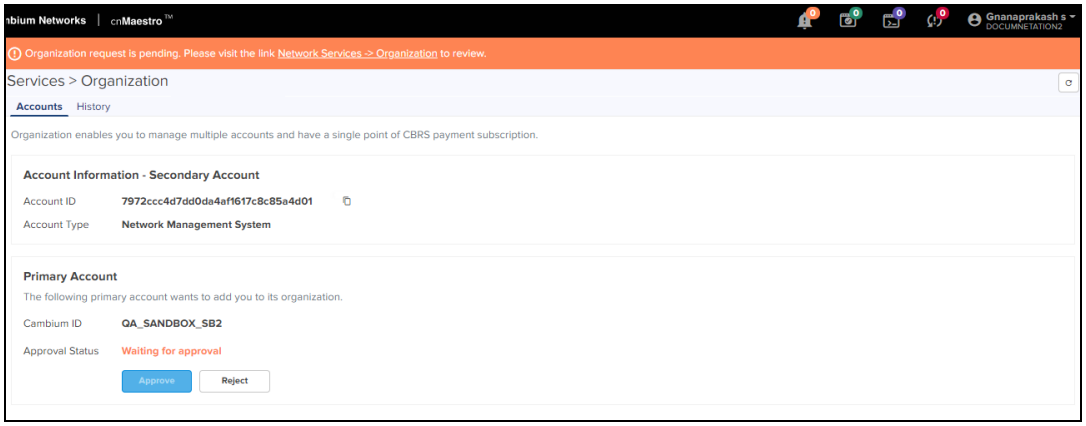


Secondary Account

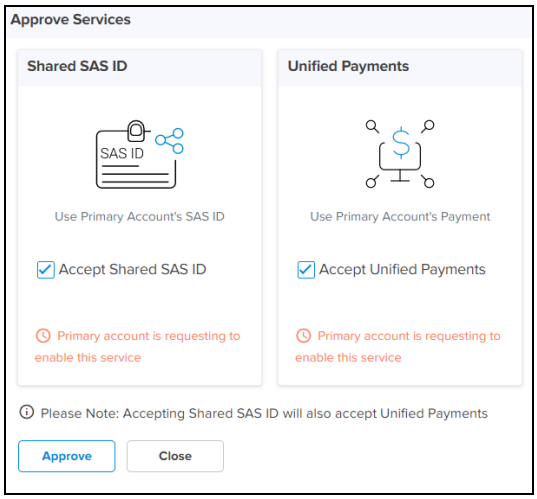
Login to the Secondary Account to complete Organization creation. The Secondary Account must approve the request and authorize the shared services. The Secondary Account can also request additional services (which must be approved by the Primary Account).

Perform the following steps in the Secondary Account:

1. Navigate to **Network Services** > **Organization** > **Accounts**.
2. Click **Approve**.



3. The **Approve Services** window pops up. Review the services requested and click **Approve**.



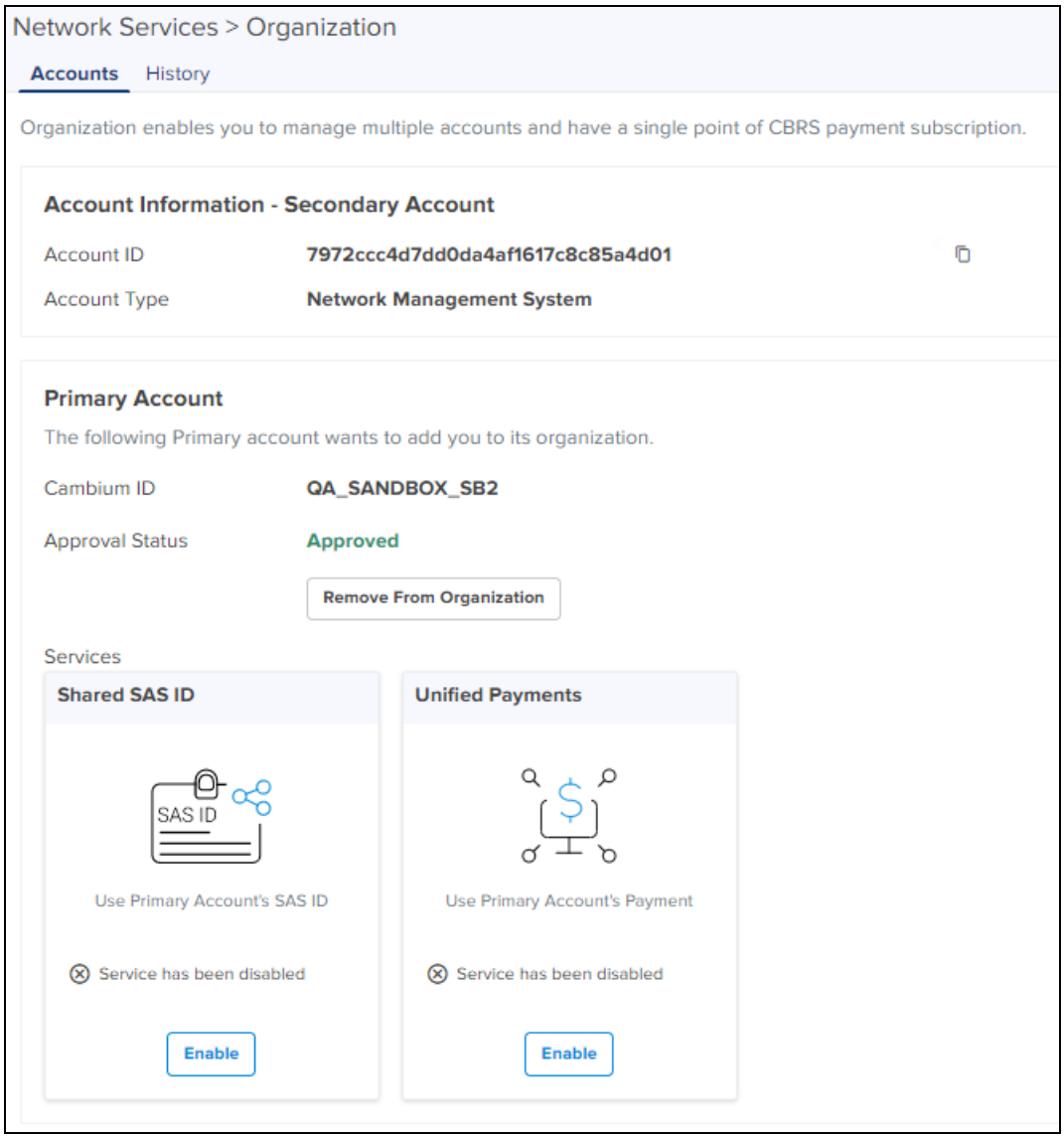
Additional service requests from the Secondary Account

Additional services can be added after the Secondary Account joins the Organization, such as including the Unified Payments Service.

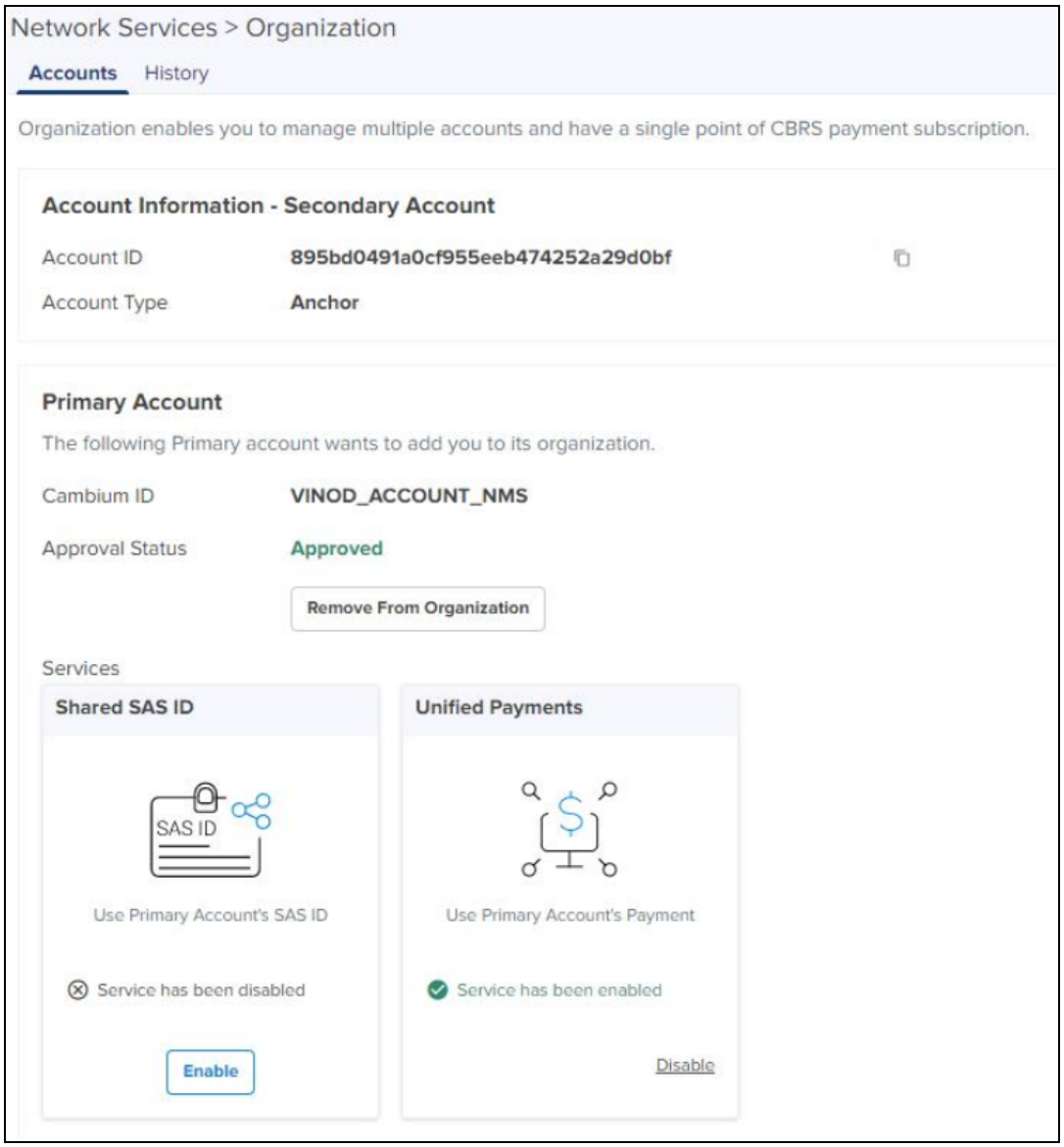
Perform the following steps on the Secondary Account:

1. Navigate to **Network Services** > **Unified Payments** and click **Enable.**

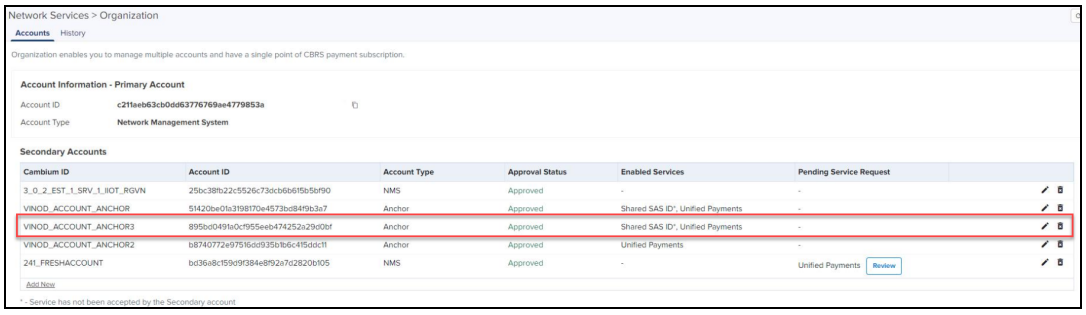
	NOTE: This generates a request to the Primary Account to provide support for Unified Payments.



2. Once the services are enabled and approved in the Primary Account, the following displays in the Secondary Account.



3. The enabled services will be displayed in the Primary Account.

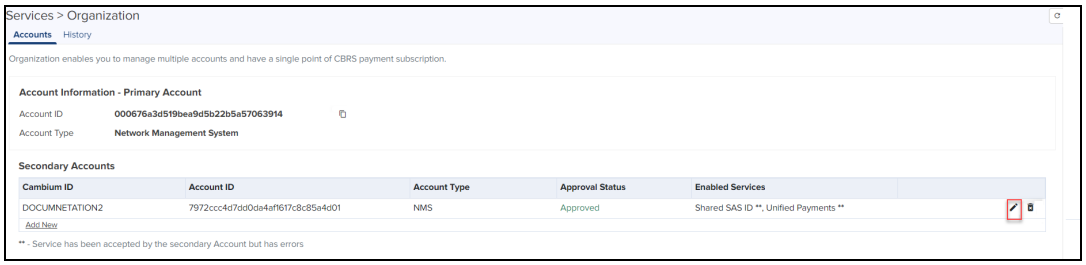


Removing Accounts

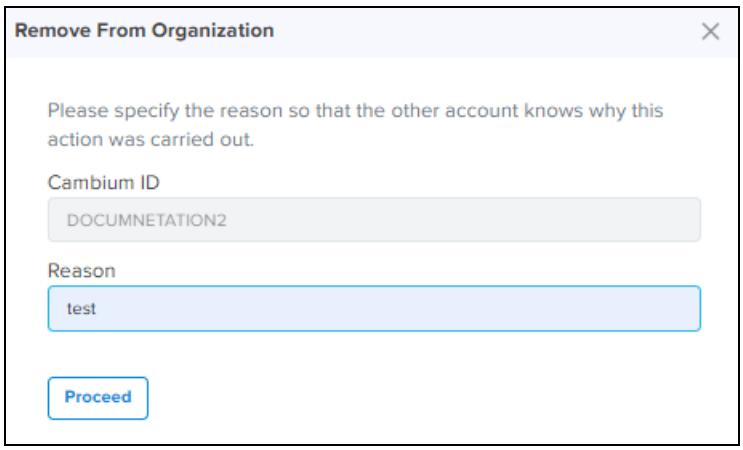
Remove through Primary Account

Perform the following steps on the Primary Account to remove the Secondary Account:

1. Navigate to **Network Services** > **Organization** > **Accounts**.
2. In the **Secondary Accounts**, click Delete ( ) icon.



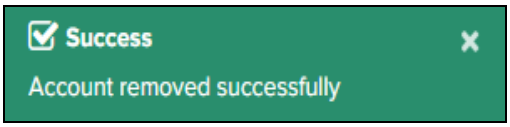
3. The **Remove From Organization** window pop up.



4. Enter the **Reason.**
5. Click **Proceed.**

Without Active Services

- If services such as **Shared SAS ID** or **Unified Payments** are inactive in the Secondary Account, it can be deleted without any approval.
- The following message displays if successful.

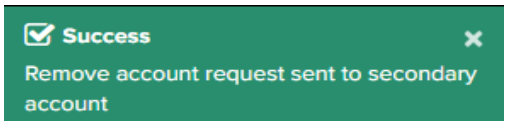


With Active Services

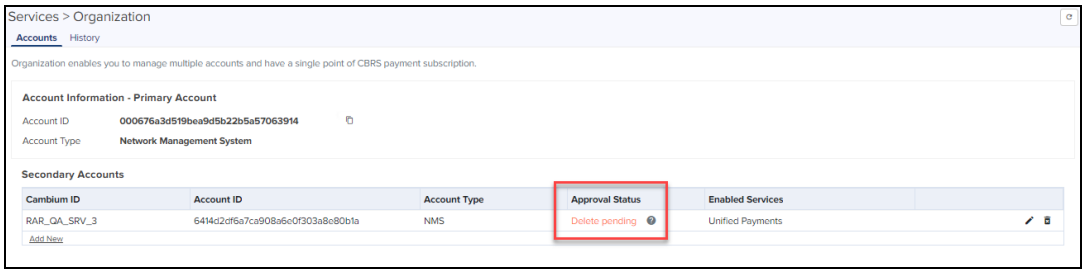
- If services such as **Shared SAS ID** or **Unified Payments** are active in the Secondary Account, the services need to be disabled from the Secondary Account, and the request must be approved by the Secondary Account administrator.

	NOTE: • User needs to disable the active services such as Shared SAS ID and Unified Payments before removing the Secondary Account, or an Error message is shown. • Shared SAS ID can be removed by contacting Cambium support to deactivate the current CBRS account to stop using Shared SAS ID. • Active Services will be highlighted in **Green** color.

- The following message displays if successful.



- In the **Secondary Accounts** table, the UI displays the **Approval Status** as **Delete Pending**.

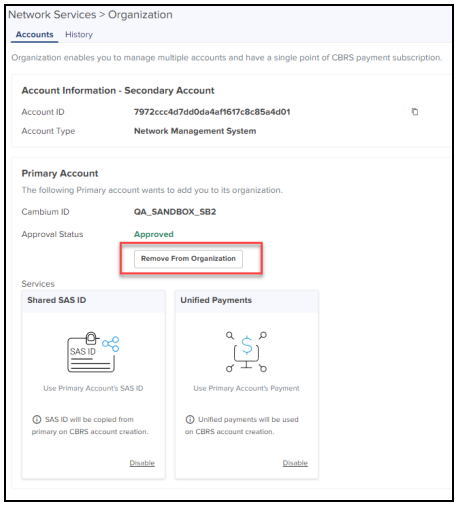


The Secondary Account administrator must approve the remove request from the Primary Account. For more details, refer to Approve Remove Request (with active services).

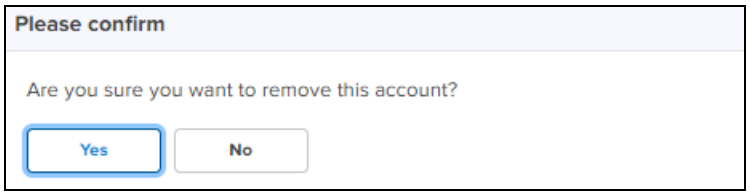
Remove Organization from Secondary Account

Perform the following steps on the Secondary Account to remove an Organization:

1. Navigate to **Network Services** > **Organization** > **Accounts**.
   a. Click **Remove From Organization** (without active services).
      - To remove the Secondary Account from an Organization with no active services.



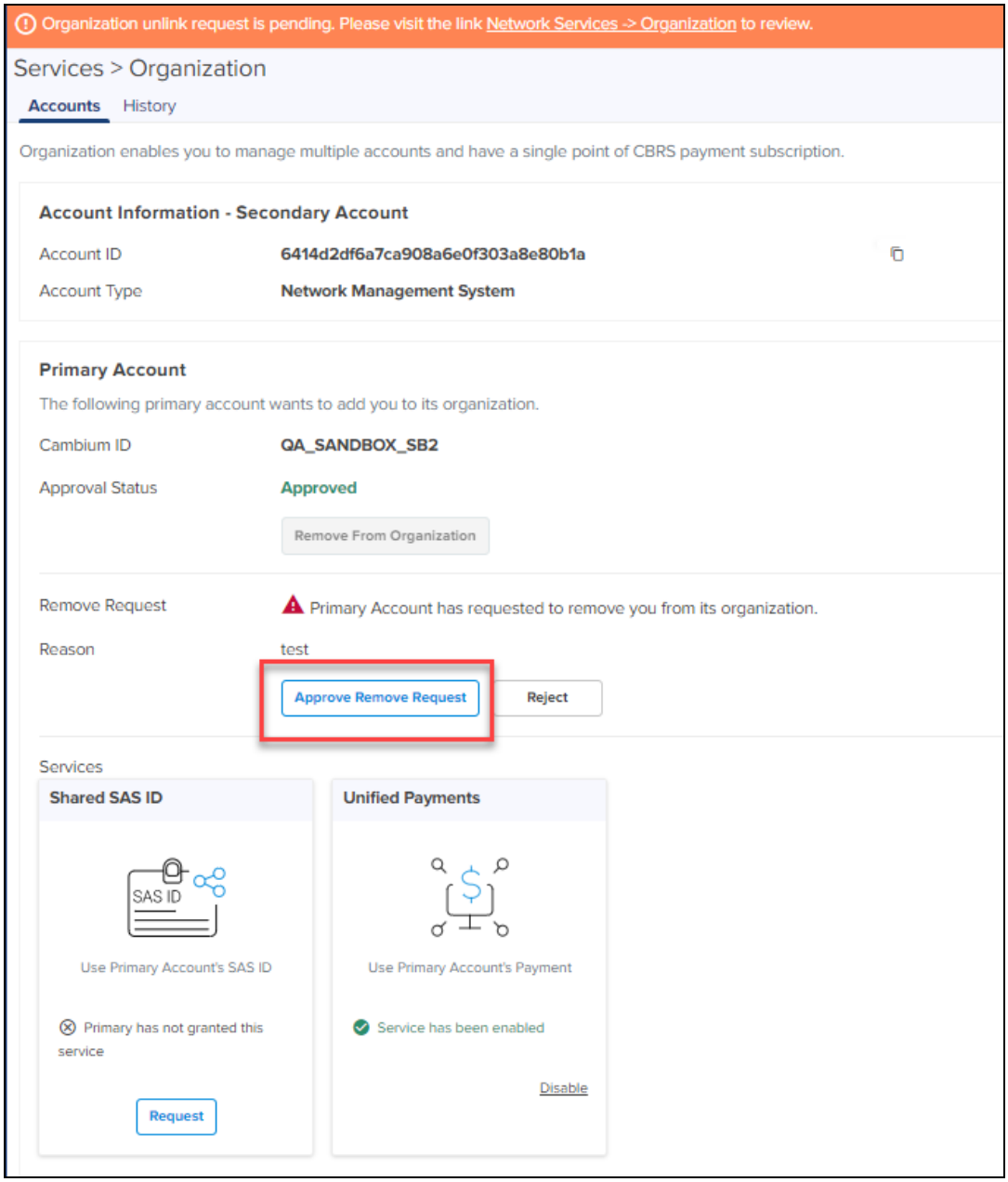
      - Click **Yes** in **Please confirm** window to remove this account.



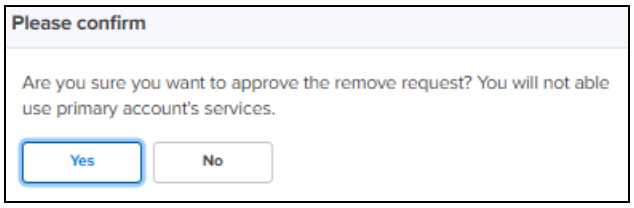
   b. **Approve Remove Request** (with active services).

	NOTE: Disable active services before **Approve Remove Request**.

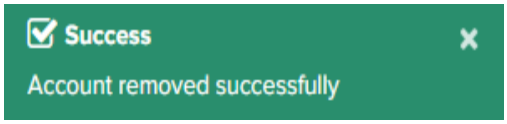
- If the Secondary Account is using services such as **Shared SAS ID** or **Unified Payments**, the following message displays.



- Click **Yes** in **Please confirm** window to approve the request.



2. The following message displays if successful.

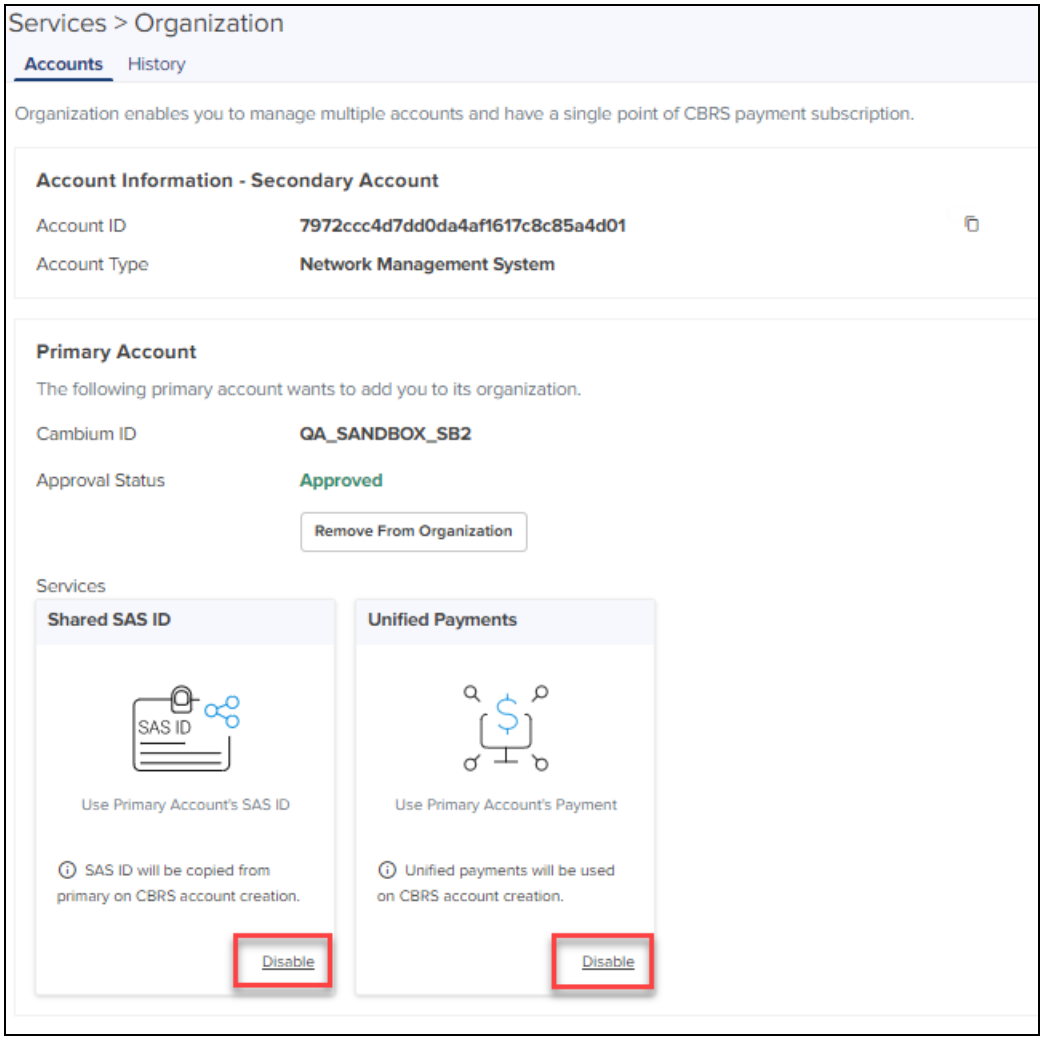


Disable Secondary Account services

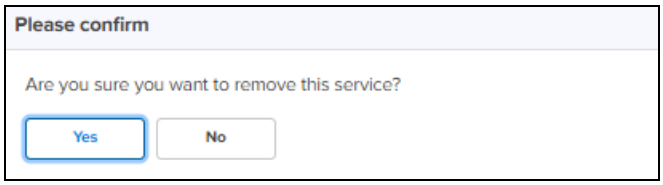
With no active services

The Secondary Account user can disable services without leaving the Organization.

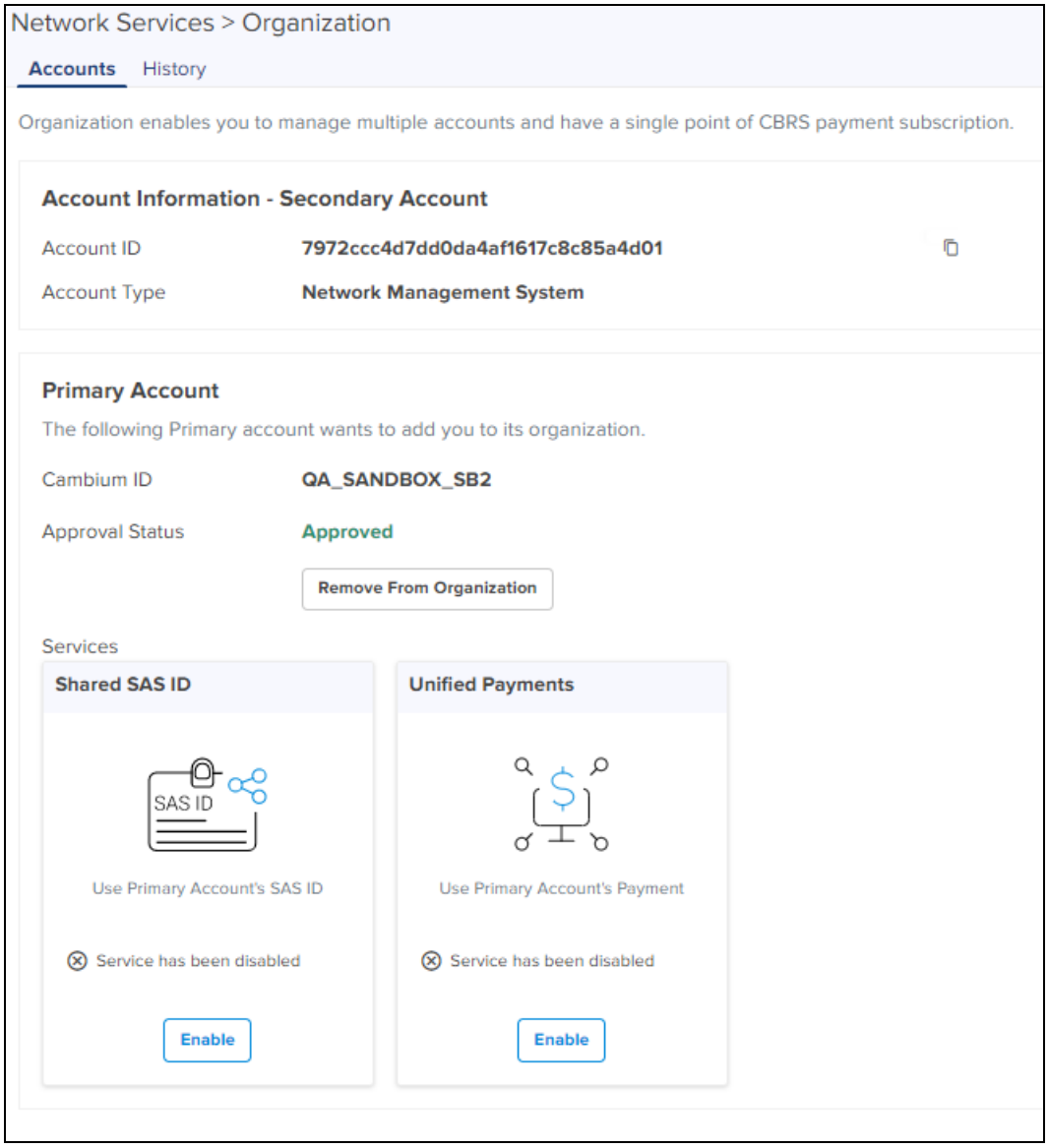
1. Navigate to **Services** > **Organization** > **Accounts** and select **Services.**
2. Click **Disable**.



3. Click **Yes** in the **Please confirm** window.



4. After disabling, the following displays.



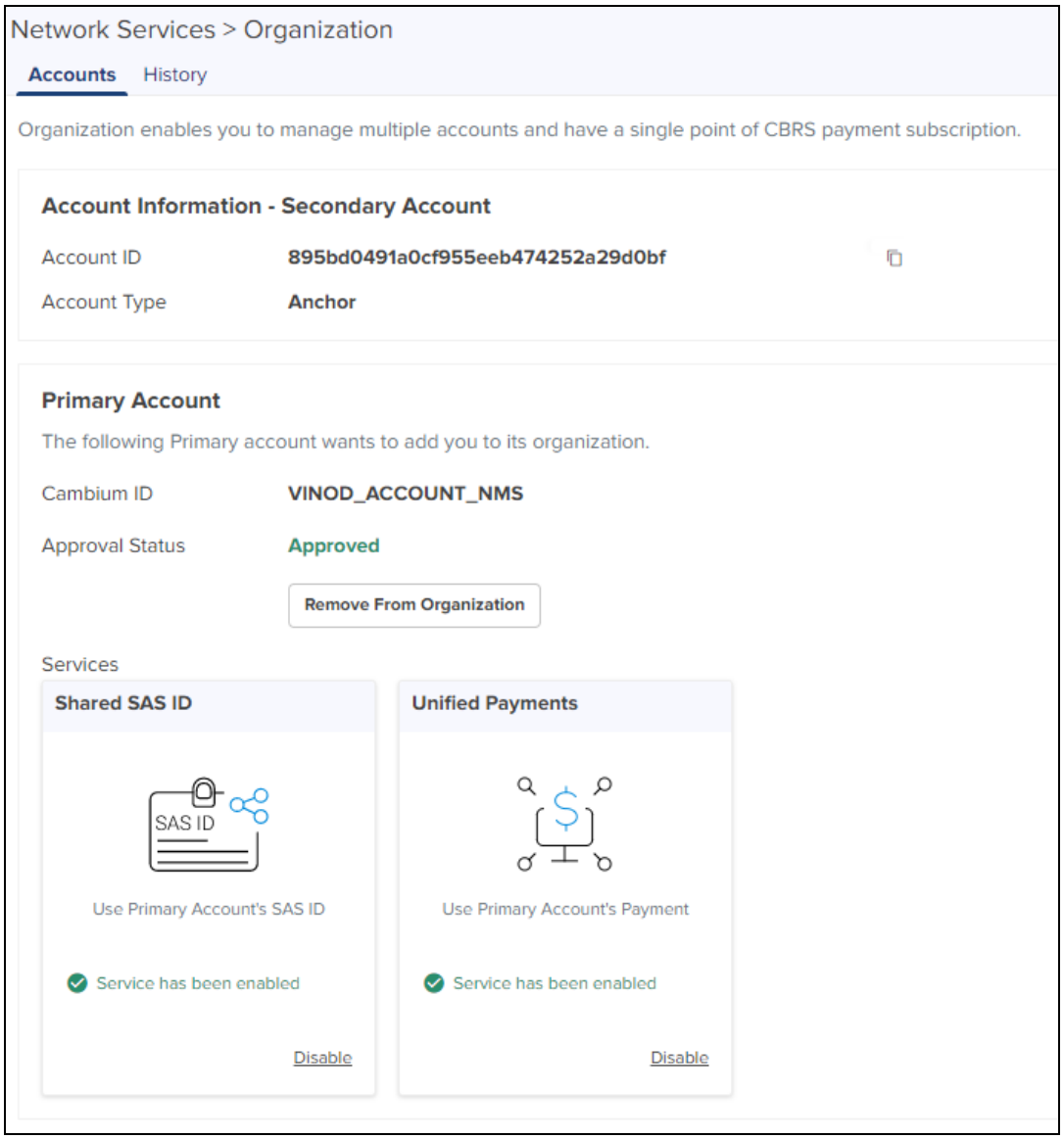
5. Click **Enable** to reactivate the services.

With active shared SAS ID services

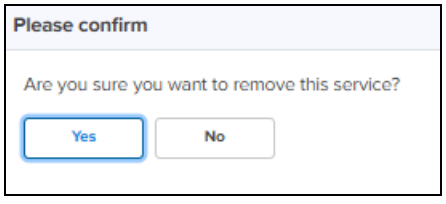
	NOTE: Active Services are highlighted in **Green** color.

The Secondary Account user can disable the **Shared SAS ID** services.

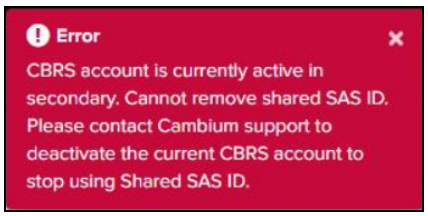
1. Navigate to **Services** > **Organization** > **Accounts** and select **Services.**



2. Click **Disable** in the **Shared SAS ID.**
3. Click **Yes** in the **Please confirm** window.

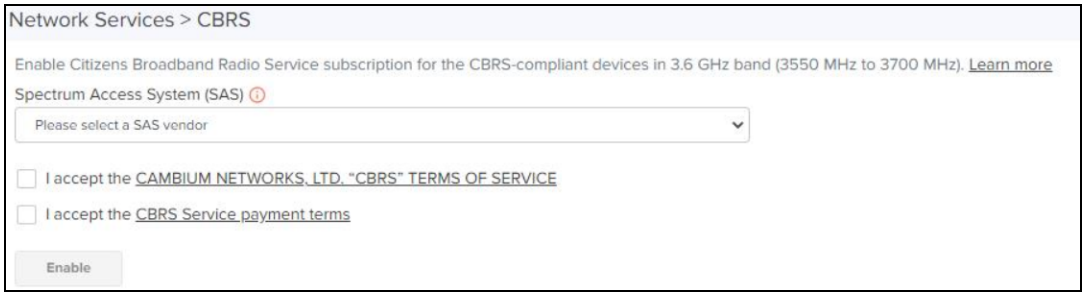


4. If CBRS account is active in Secondary Account, while disabling it displays the following error message.



If an **Error** message pops up, the user needs to raise a request to Cambium Support for the SAS vendor cancellation. Cambium Support will disable the CBRS services and deregister all devices associated to the Secondary Account.

Once disabled, the Secondary Account user can view the SAS vendor page and create a new CBRS account as shown below.



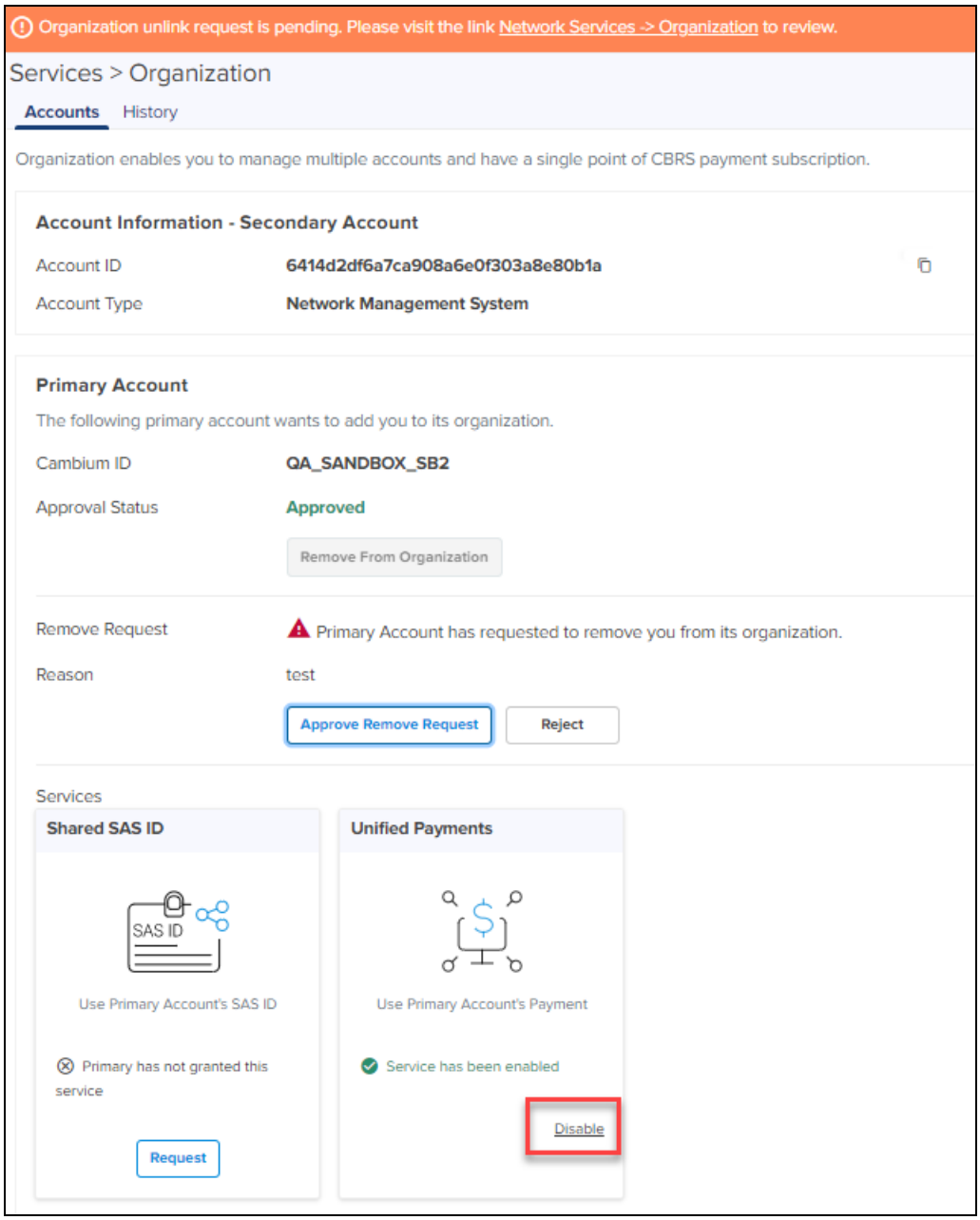
For further information on creating a new CBRS account, refer to CBRS.

	NOTE: Services in the Secondary Account cannot be disabled unless CBRS is inactive in Secondary Account. Contact Cambium Support to disable CBRS operation or change SAS Vendor.

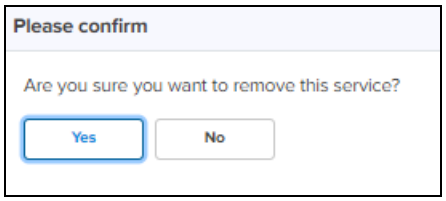
With active Unified Payments

The Secondary Account user can disable Unified Payments.

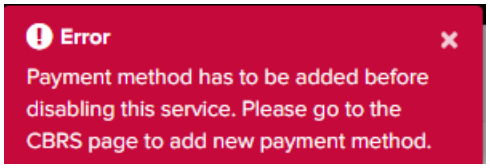
1. Navigate to **Services > Organization > Accounts** and select **Services.**



2. Click **Disable** within **Unified Payments**.
3. Click **Yes** in **Please confirm** window.



4. If **Unified Payments** is active in CBRS of the Secondary Account, it displays an **Error** message.



If this happens, the user needs to add new CBRS payment details into the Secondary Account.

For further information on Payment details, refer to CBRS.

The user can disable the **Unified Payments** once the new payment details are added successfully to the Secondary Account.

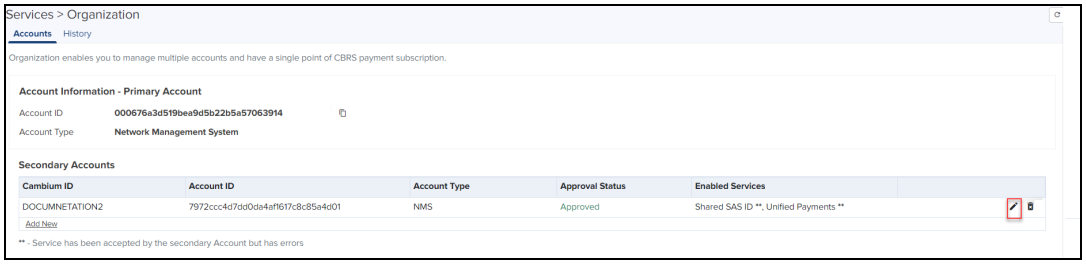
Edit Services

Enable services in the Primary Account

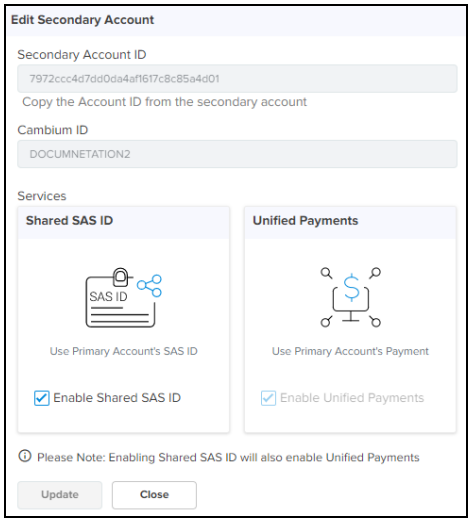
The Primary Account can edit or disable services shared with the Secondary Account as shown below:

	NOTE: When the services are active in CBRS of the Secondary Account, the Primary Account cannot disable those services.

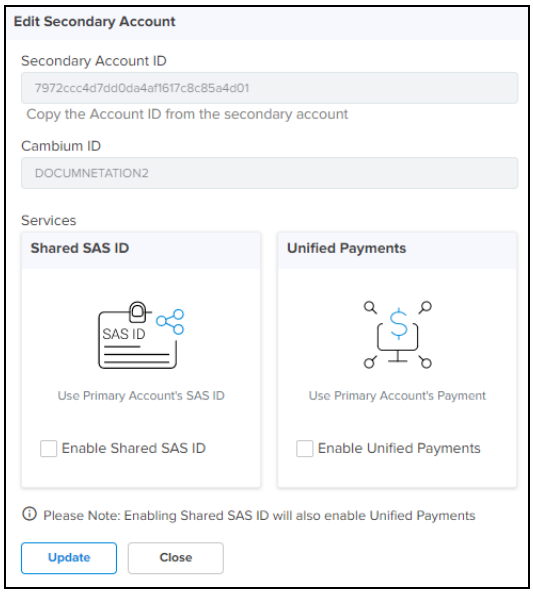
1. Navigate to **Accounts** > **Secondary Accounts** tab.
2. Click Edit ( ) icon.



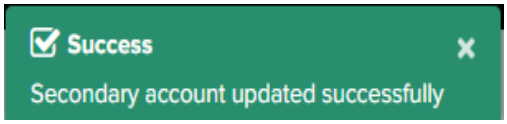
3. **Edit Secondary Account** window pops up.



4. Disable the **Services** and click **Update**.



5. The following message displays if successful.

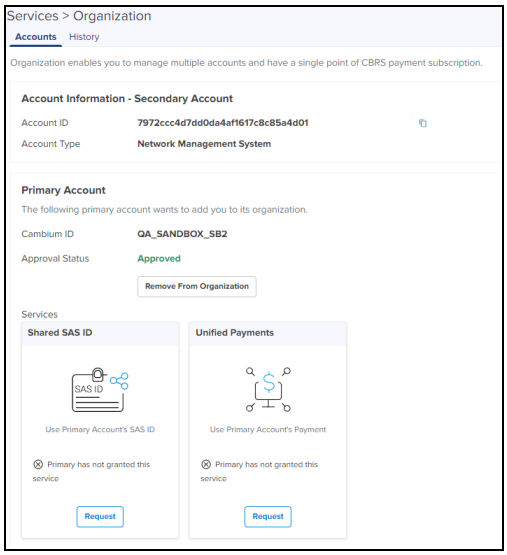


Request services from Secondary Account

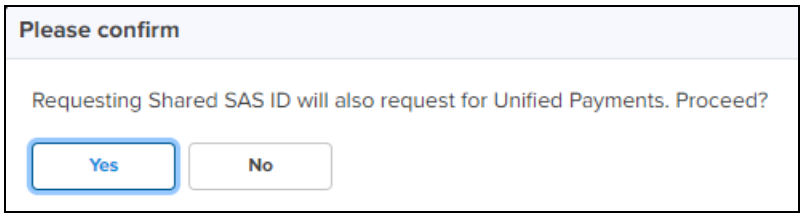
If the services are disabled, the Secondary Account needs to make a request to the Primary Account to activate them.

To request activation, perform the following on the Secondary Account:

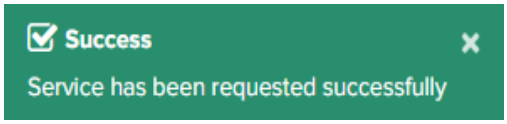
1. Navigate to **Network Services** > **Organization** > **Accounts**.
2. Click **Request**.



3. Click **Yes** in **Please confirm** window.



4. It displays the **Success** message as shown below:



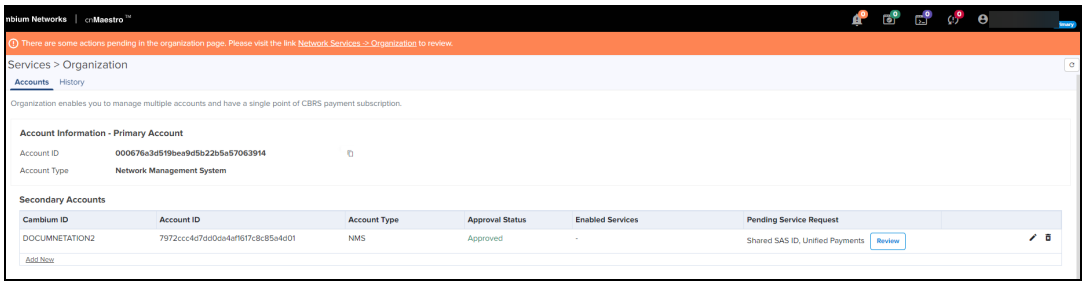
5. Once requested, login to the **Primary Account** page and **Approve** the request.

The Primary Account administrator must approve this request from the Secondary Account in order to enable the services.

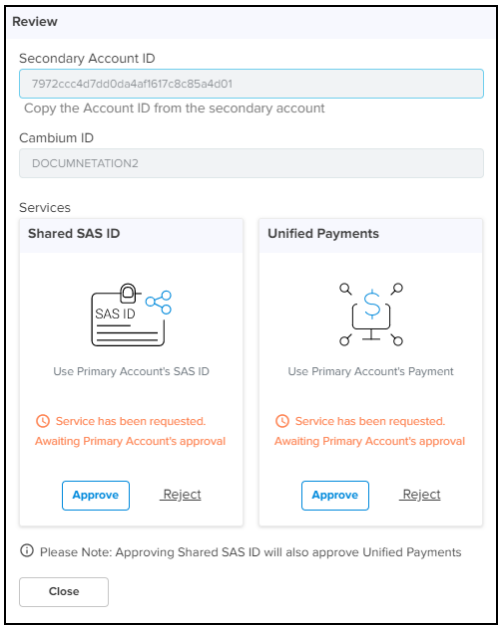
Review service request in Primary Account

Perform the following steps on the Primary Account.

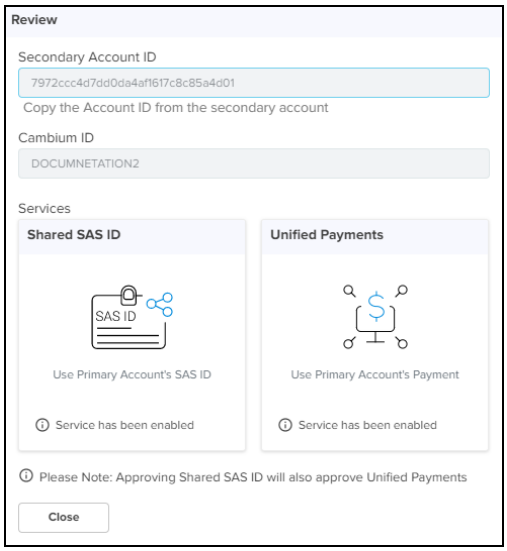
1. Navigate to **Services** > **Secondary Accounts** tab.
2. Click **Review** in **Pending Service Request**.



3. The **Review** window pops up. Click **Approve**.



4. Once approved, the requested services are enabled in the **Secondary Account.**

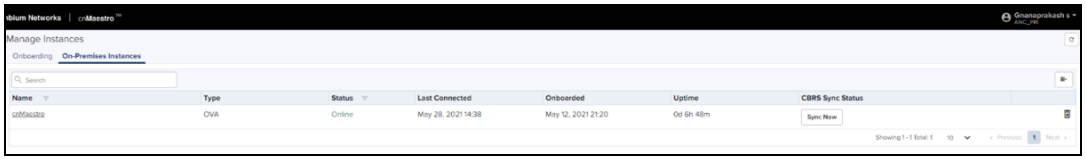


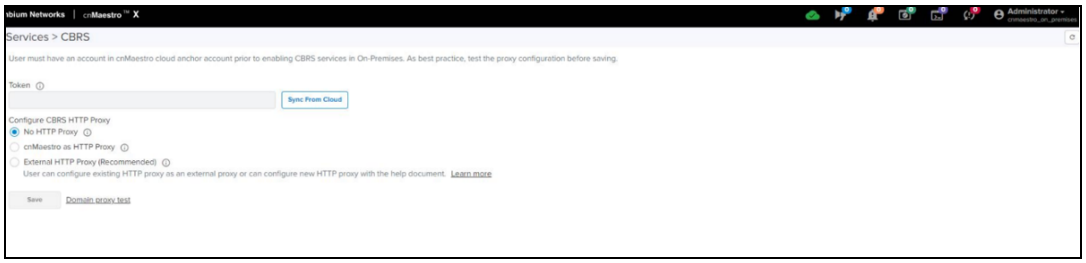
Share CBRS Configuration with the On-Premises Instance

NOTE:

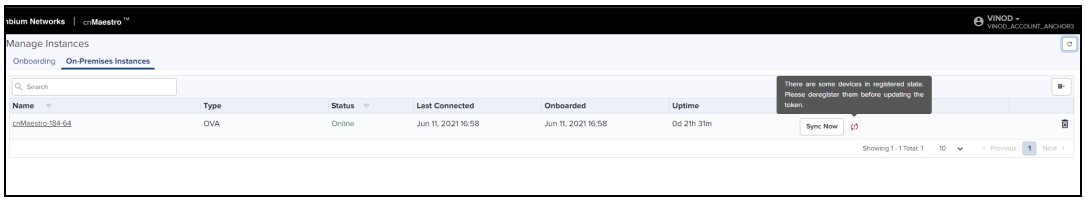
Starting with version 3.0.3, cnMaestro supports synchronizing CBRS Configuration to On-Premises instance.

Once On-Premises is connected to the Anchor Account, the user can synchronize CBRS details (SAS ID, Token) to the cnMaestro On-Premises instance to register CBRS devices.





- If the user shares (sync) CBRS details configured on Anchor account to connected On-Premises and if any devices are registered in On-Premises with different CBRS token or SAS ID it displays the deregister error as shown below.

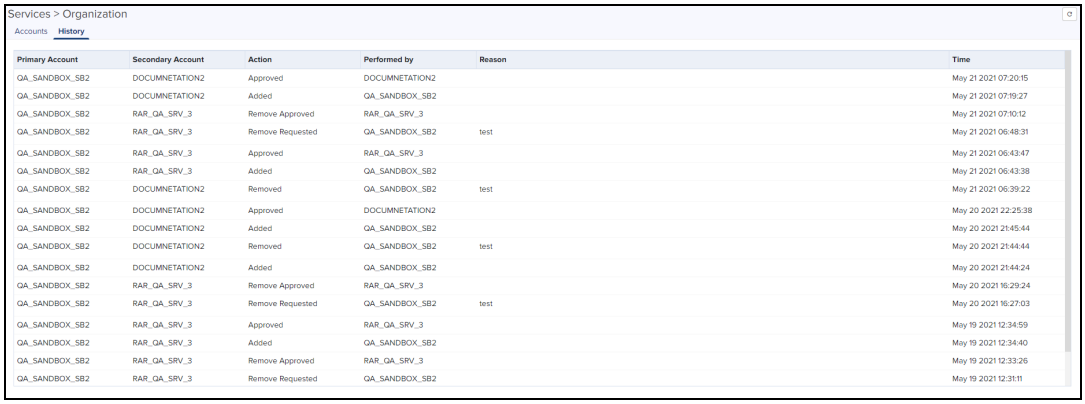


Organization History

In Organization History user can view changes to the Organization status over time. This includes details of Primary Account, Secondary Account, Action, Performed by, and Reason.

To view Organization History:

Navigate to **Network Services** > **Organization** > **History** tab.



LTE

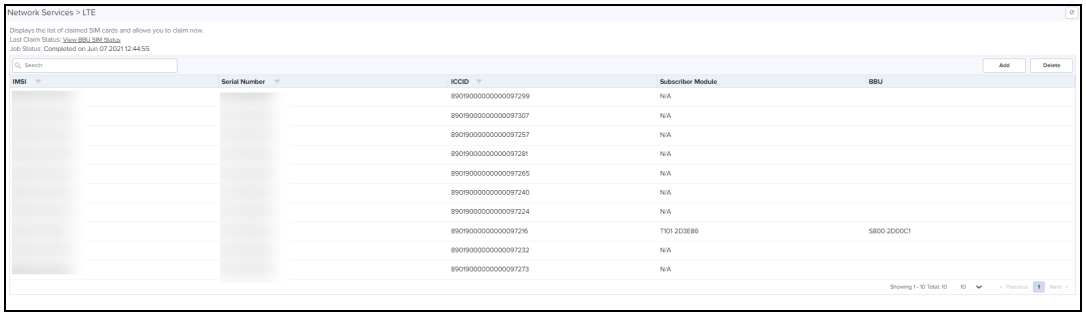
cnMaestro supports LTE as part of its cnMaestro deployment. LTE allows customers to onboard the SM with IMSI into cnMaestro.

System access in cnRanger is dependent on installation of SIM credentials on every BBU in the operator network. To ease the operations aspects of SIM card management, cnMaestro provides utilities for claiming, managing, and distributing Cambium Networks cnRanger SIM card credentials (3rd party SIM cards are not currently supported on cnRanger).

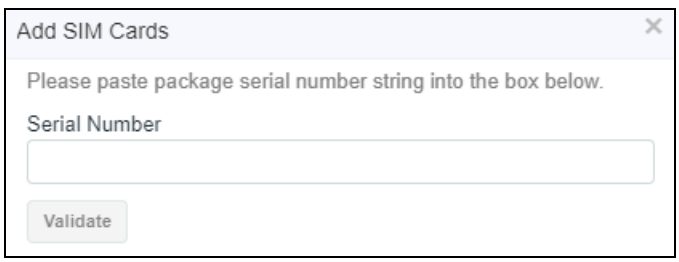
Adding SIM Cards

To add a SIM card, complete the following steps:

1. Navigate to **Services > LTE**.



2. Click **ADD**. The following window appears.

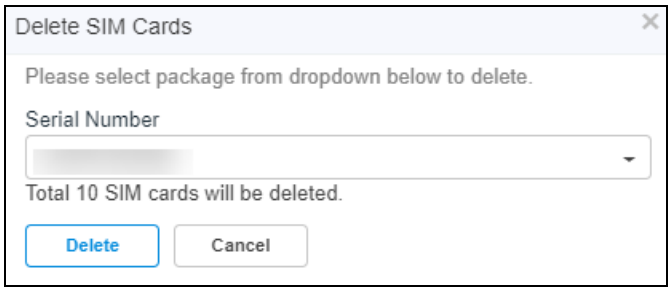


3. Enter proper **Serial Number** of SIM package and click **Validate** then Add.

	NOTE: User can download the .CSV file from the Cloud account once the Serial Number is validated from the cnMaestro Cloud data base.

Delete SIM Cards

To delete a SIM card from the list, click **Delete**. The following window appears.

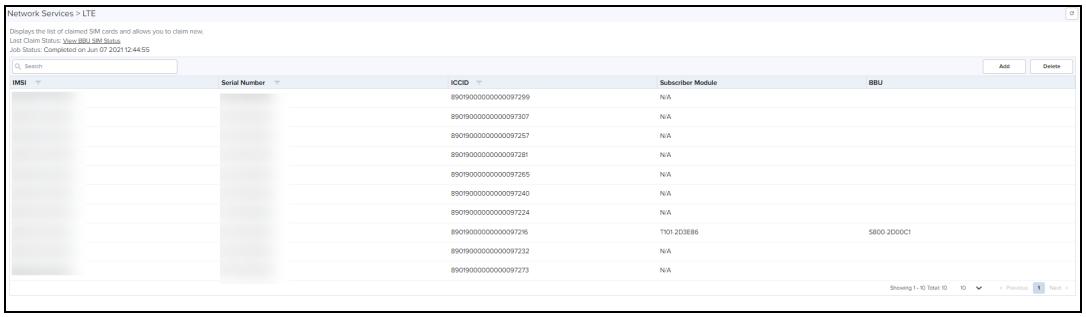


	Note: IMSI numbers get deleted with the mapped Serial Number.

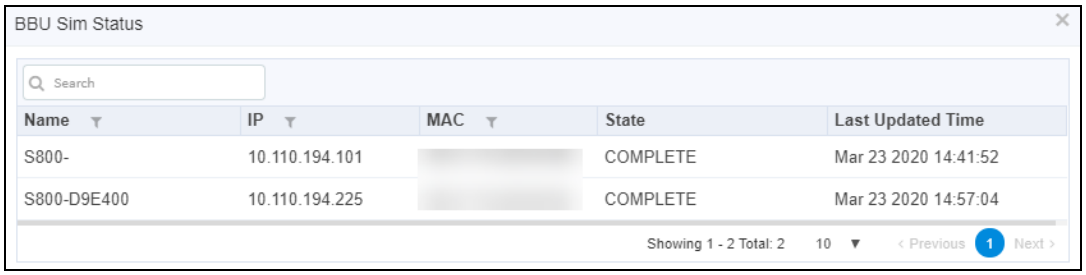
Viewing BBU SIM Status

Allows the users to view the status of the SIM connected to the BBU:

1. Navigate to **Services > LTE.**



2. Click **View BBU SIM Status.**



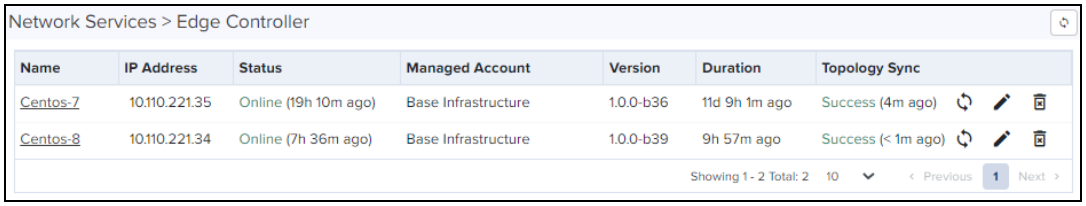
Managing Edge Controller

This chapter provides the details about how Edge Controllers are configured to discover PTP 820/850 devices in a network using SNMP protocol. To view the onboarded Edge Controllers in cnMaestro, perform the following steps:

1. Navigate to **Network Services** > **Edge Controller**.

A list of onboarded Edge Controllers in a table format is displayed, as shown in Figure 405.

Figure 405 Edge Controllers



The following parameters are available to view in a table format: Name, IP Address, Status, Managed Account, Version, Duration, and Topology Sync Status. You can perform the following actions in the Edge Controller page.

- Topology Sync
- Edit
- Delete

Select the required Edge Controller name in the page, to perform the following actions:

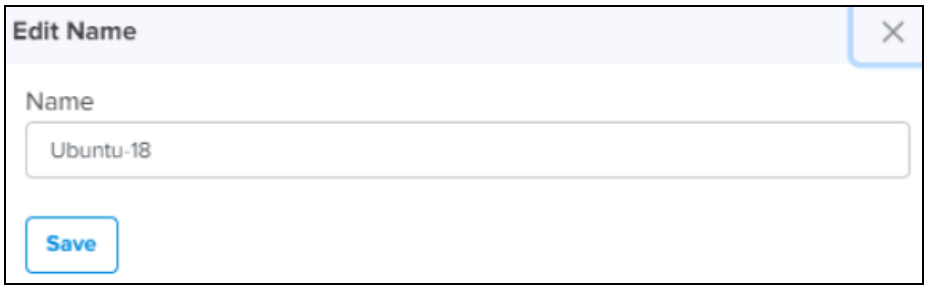
Topology Sync

Click on the **TopologySync** ( ) icon to run topology synchronization for the required Edge Controller.

Edit

1. Click the edit ( ) icon in the Edge Controller page.

The **Edit name** window appears, edit the name of the Edge Controller.

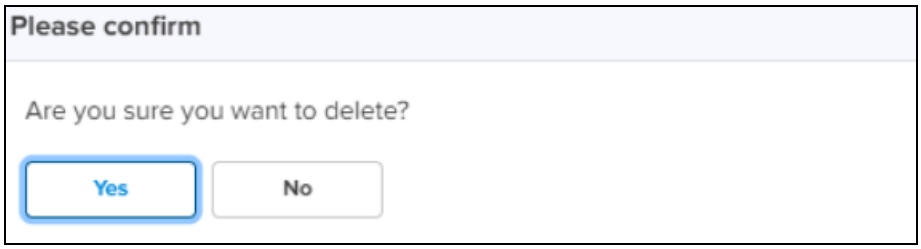


2. Click **Save**.

Delete

1. Click the delete ( ) icon in the Edge Controller page.

The delete confirmation window appears.



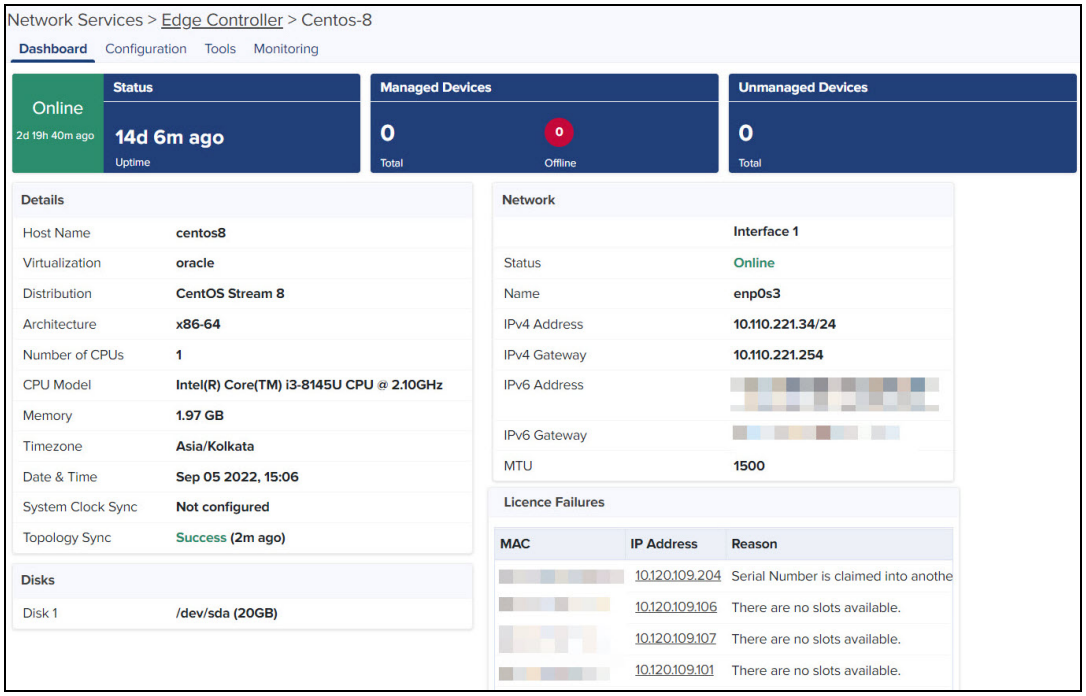
2. Click **Yes**.

In the Edge Controller page, you can navigate to the following tabs:

- Dashboard
- Configuration
- Tools
- Monitoring

To view the Edge Controller dashboard, click on the name of the Edge Controller. The Edge Controller dashboard page appears as shown in Figure 406.

Figure 406 The Edge Controller dashboard



Dashboard

The dashboard page displays status of managed and unmanaged PTP 820/850 devices, details of Edge Controller, disk space availability, and network details of Edge Controller as shown in Table 124.

Figure 407 Edge Controller and PTP 820/850 devices status

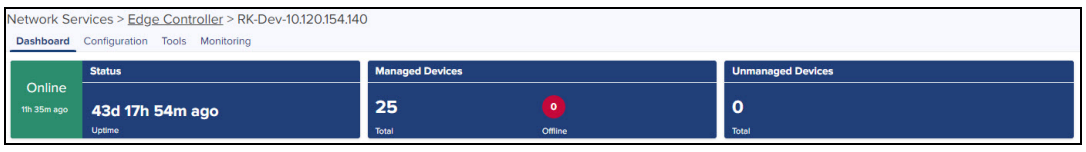


Table 124: Fields in the Edge Controller dashboard

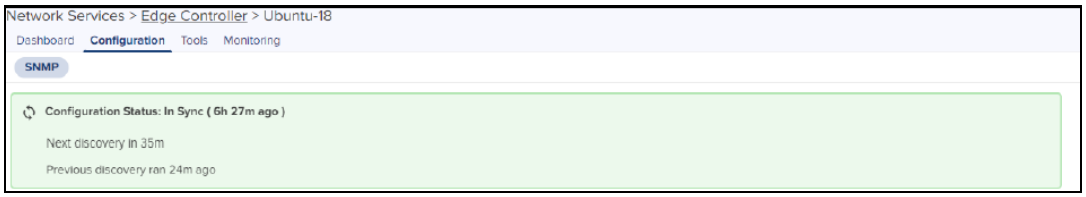
Field	Description
Host name	Name of the host.
Virtualization	Type of virtualization such as VMware or Oracle.
Distribution	Type of distribution such as Ubuntu and CentOS versions.
Architecture	CPU and Operating System installed.
Number of CPUs	Total number of CPUs utilized.
CPU Model	Type of CPU model.
Memory	Available memory.
Timezone	Current timezone.
Date & Time	Current date and time.
System Clock Sync	Configuration of System Clock Synchronization.
Disk	Current Disk space usage.
Status	Status of Network Interface Online or Offline.
Name	Name of the Network Interface.
IPv4 Address	Configured IPv4 Address.
IPv4 Gateway	Configured IPv4 Gateway.
IPv6 Address	Configured IPv6 Address.
IPv6 Gateway	Configured IPv6 Gateway.
MTU	Maximum Transmission Unit of network interface of Edge Controller.
License Failures	Displays MAC, IP Address, and Reason. The reasons for license failure are as follows: When the discovery exceeds the slot availability. When the individual devices are already onboarded in other Cloud account.
Topology Sync	Status of Topology Sync.
Version	Software version of the device.

Configuration

In the **Configuration** page, you need to configure SNMP rules to discover and onboard PTP 820/850 devices. The **SNMP** tab in the **Configuration** page displays **Configuration Status.** The**Configuration Status** displays when

the Edge Controller is **In Sync** or **Not Sync** with cnMaestro. The synchronization status is shown in days, hours and minutes. **Next discovery** and **Previous discovery** ran is displayed in minutes as shown in Figure 408.

Figure 408 Configuration Status

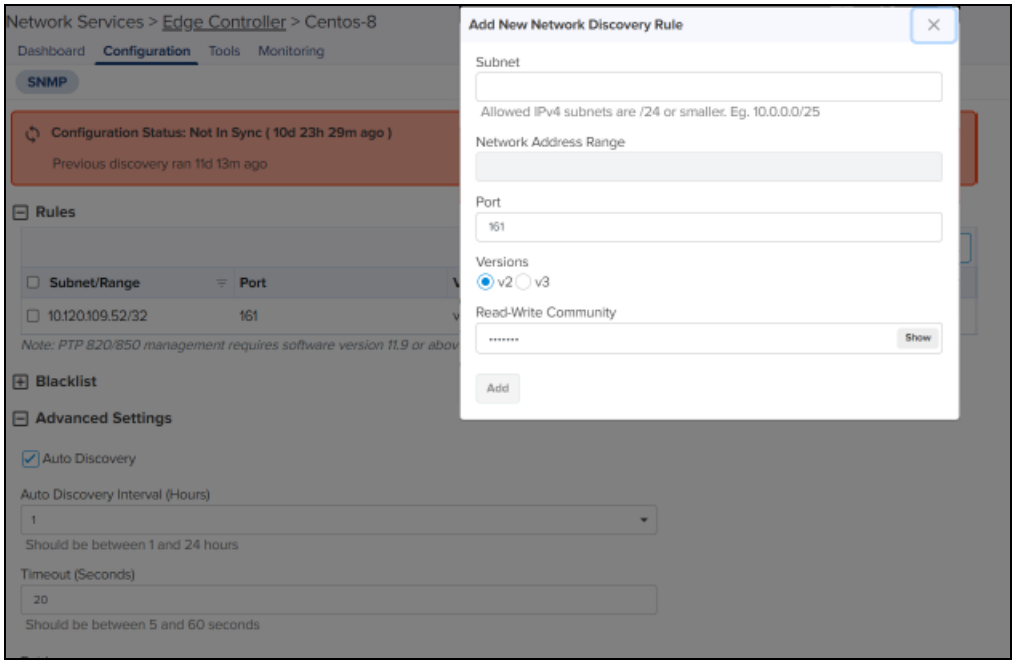


Rules

To add a new rule, perform the following steps:

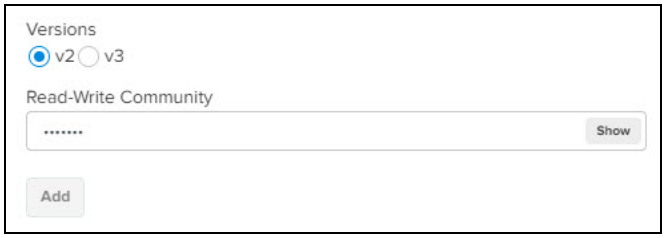
1. Click **Add New**.

The **Add New Network Discovery Rule** window appears.



2. Type **Subnet** range in CIDR format (for example, 10.204.88.0/28) to discover PTP 820/850 devices.
   The range of IP addresses in the **Network Address Range** field is displayed.
3. Type **Port** number.
4. Choose SNMP **Version**:
   For SNMP Version **v2**, perform the following:

a. Enter preferred community string when you create a SNMP discovery rule.

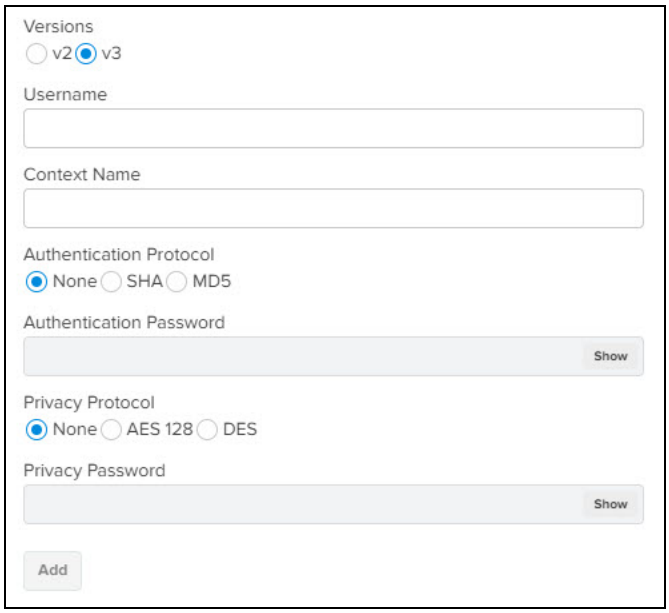


b. Click **Add.**

	NOTE: Default community string is private.

For SNMP Version **v3,** perform the following:

a. Choosing SNMP v3 version allows you to enter the parameters as shown in the following figure.



b. Enter the following fields:
   - **Username**.
   - **Context Name** field is optional.

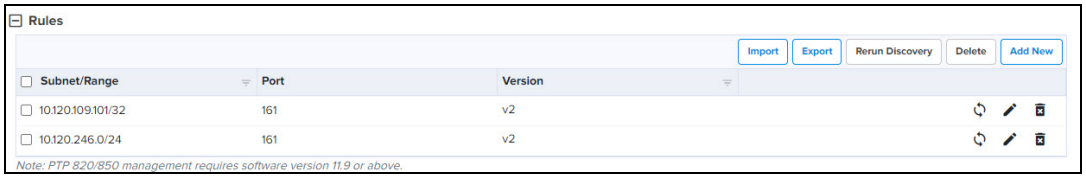
c. Choose any one of the **Authentication Protocol.**
   - None
   - SHA
   - MD5

d. Choose any one of the **Privacy Protocol**.
   - None
   - AES128
   - DES

e. Type **Privacy Password**.

f. Click **Add**.

SNMP Rules added are listed in the Rules table as shown in the following figure.



5. Click **Rerun Discovery** to start SNMP discovery for the rules added in the table or select specific **Subnet/Range** in the table and manually run **Rerun Discovery** (↻) icon.

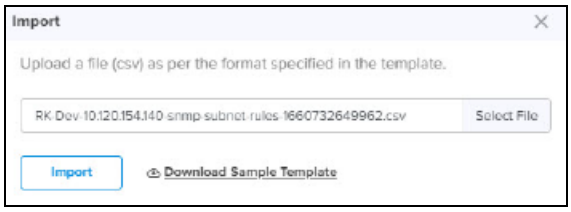
Import

To import SNMP rules, perform the following steps:

1. Click **Import.**

Import window appears.

2. Browse to **Select File** or **Download Sample Template** to change or configure the SNMP as per the requirements in **Downloaded Sample Template.**

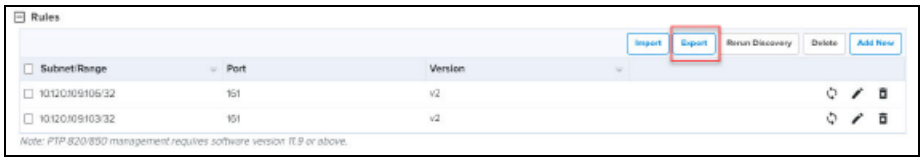


3. Click **Import**.

Export

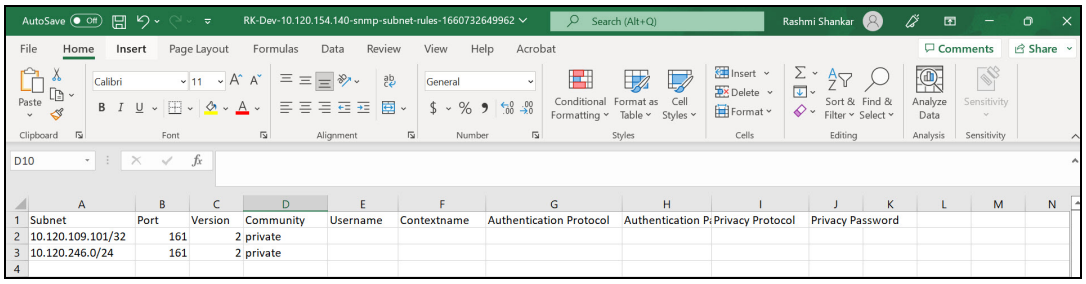
To export SNMP rules, perform the following steps:

1. Select one or more SNMP rules required to export.
2. Click **Export**.



3. It exports .csv file format as shown in the following figure.

	NOTE: By default all SNMP rules are exported, if none of the rules are selected from the table.



Delete

To delete SNMP rules in the table, perform the following steps:

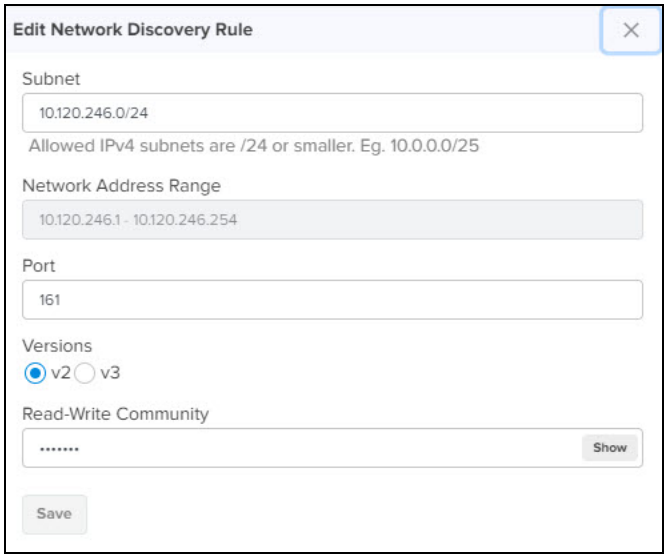
1. Select one or more SNMP rules in the table.
2. Click **Delete**, to delete one or more entries in the table or click **Delete** ( ) icon to delete specific rule in the table.

Edit

To edit SNMP rule in the table, perform the following steps:

1. Click Edit ( ) icon to edit SNMP rule.

Edit Network Discovery Rule window appears. Edit the required field values.



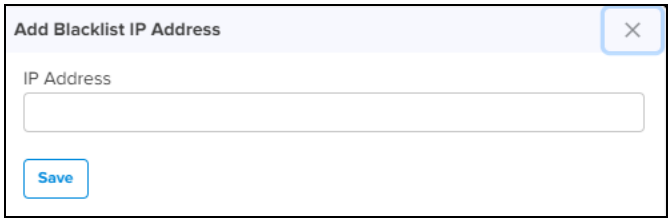
2. Click **Save**.

Blacklist

To blacklist PTP 820/850 devices, perform the following steps:

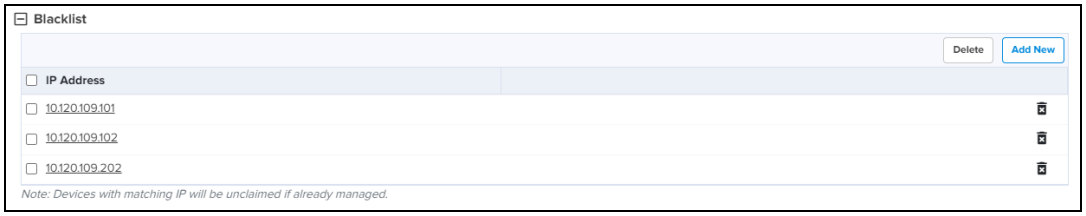
1. Click **Add New.**

Add Blacklist IP Address window appears.



2. Type **IP Address.**
3. Click **Save.**

Blacklisted IP Addresses are displayed in the table.



4. Select one or more blacklisted IP addresses in the table.
5. Click **Delete**, to delete one or more entries in the table or click **Delete** (🗑) icon to delete specific blacklist entry in the table.

Advanced Settings

In **Advanced Settings** section, configure the following parameters:

	NOTE: • By default, **Auto Discovery** option is disabled. • By default, **Auto Discovery Interval** option is 24 hours, when enabled and fields are auto-filled.

Enable **Auto Discovery** if you want to run SNMP discovery rules manually and perform the following steps:

1. Select **Auto Discovery Interval** option from the drop-down.
2. Enter **Timeout** in seconds between 5 to 60 seconds.
3. Enter **Retries** values between 0 and 3.

4. Click **Save**.

Tools

The Tools page allows you to perform the following actions:

- Diagnostics
- Operations
- Services

Diagnostics

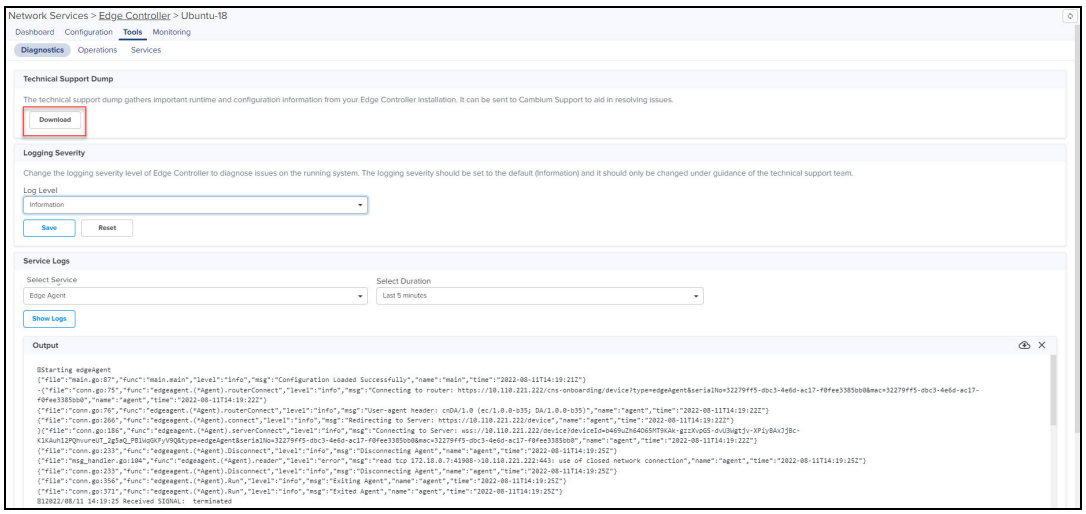
Diagnostics page allows you to gather technical support dump which can be downloaded and sent to Cambium Networks support team.

Technical Support Dump

The Technical Support Dump gathers important runtime and configuration information from the Edge Controller. It can be sent to Cambium Support to aid in resolving issues.

1. Navigate to **Edge Controller** > **Tools** > **Diagnostics**.
2. Click **Download** under Technical Support Dump**.**

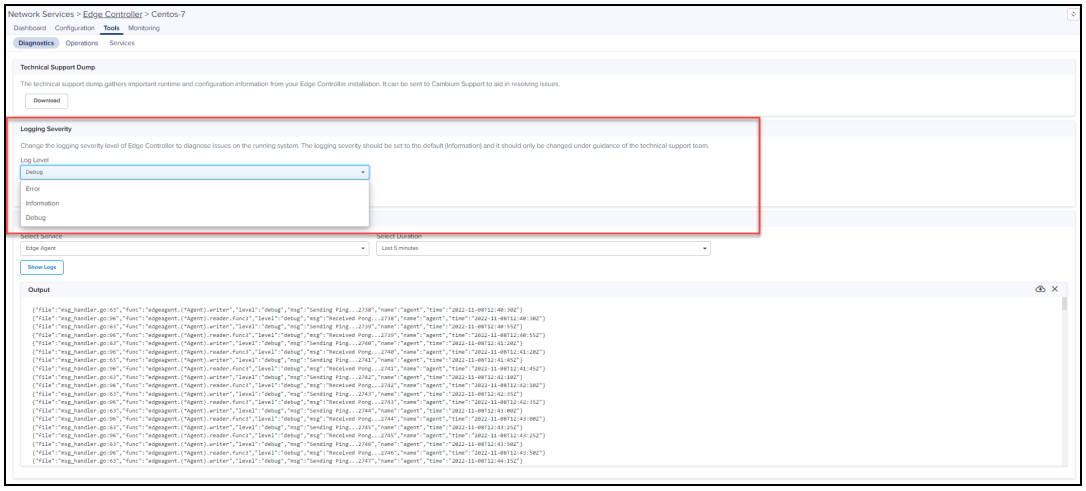
Figure 409 Diagnostics



Logging Severity

The Logging Severity level of Edge Controller diagnose issues on the running system. The logging severity should be set to the default (Information) and it should only be changed under guidance of the technical support team.

1. Navigate to **Edge Controller** > **Tools** > **Diagnostics.**
2. In **Logging Severity** section, select one of the log level from **Log level** drop-down.
   - Error
   - Information
   - Debug



3. Click **Save.**
4. Click **Reset** to revert to the previous **Log level** option.

Service Logs

The Service Logs allows you to diagnose any issues in the services running in the Edge Controller.

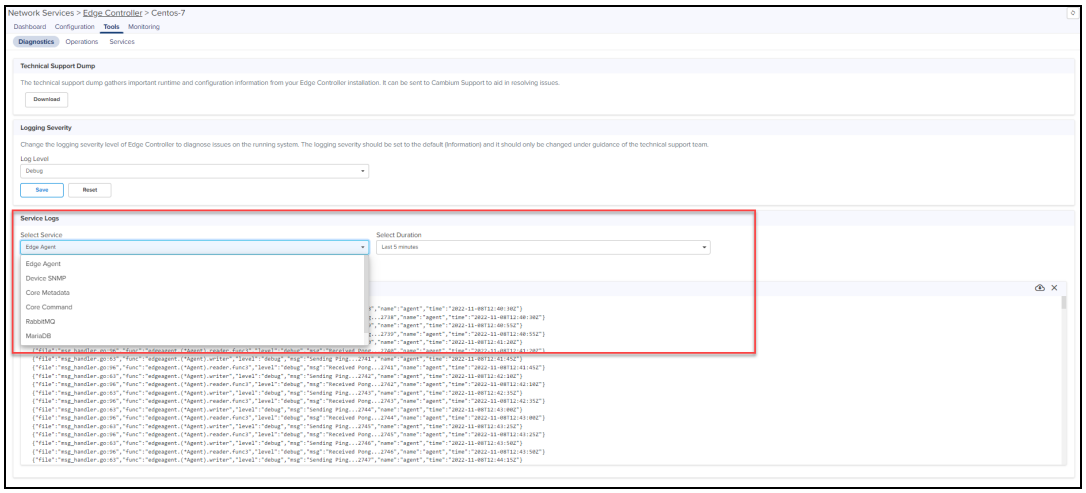
1. Select **Service** and **Duration** from the drop-down.

The following list of service and duration (5 minutes, 15 minutes, 30 minutes and last 1 hour) are available from the drop-down:

- Edge Agent
- Device SNMP
- Core Metadata
- Core Command
- RabbitMQ
- MariaDB
- SFTP

2. Click **Show Logs.**

The output for the selected criteria appears as shown:

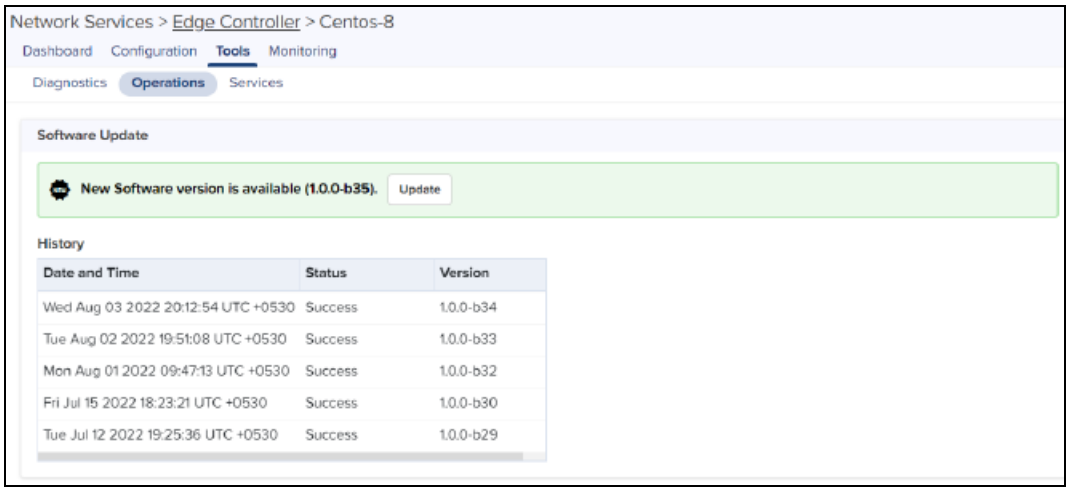


3. Click download ( ) icon to download the generated output.
4. Click clear (✕) icon to clear the output.

Operations

In the **Operations** page, you can view the current software version of the Edge Controller. You can also view history of the last five software updates.

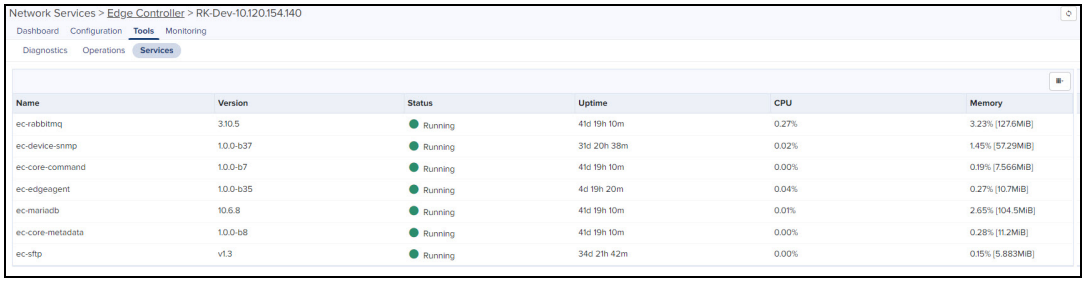
1. Navigate to **Tools > Operations**.
2. Click **Check for new software update**, checks for any new available software update.



Services

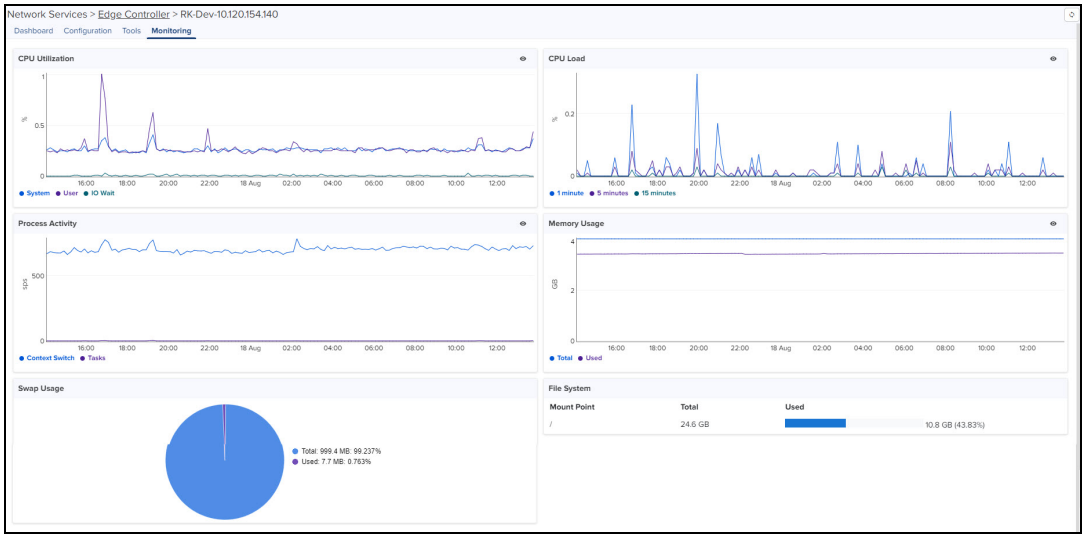
In **Services** page you can view the services running in the Edge Controller.

Figure 410 Services



Monitoring

In the **Monitor** page, you can view details of CPU utilization, CPU Load, Process Activity, Memory Usage, Swap Usage, and File System.



cnArcher Installation Summary

cnArcher is a mobile application used to install PMP Subscriber Modules (SMs), ePMP (SMs), and cnRanger SMs. The installation summary provides an overview of the data collected by cnArcher during the installation process.

NOTE

- cnArcher Installation Summary is a cnMaestro X feature.
- cnArcher Installation summary of PMP SM is available for users in cnMaestro Cloud and OnPremises from 3.1.0 release.
- cnArcher Installation summary of ePMP SM is available for users in cnMaestro Cloud and OnPremises from 3.1.1 release.
- ePMP PTP 550 (two radio devices) and ePMP Elevate are not supported for cnArcher Installation Summary.

To view the installation summary:

1. Navigate to **Network Services** > **cnArcher Installation Summary.**

   The **cnArcher Installation Summary** page appears.
2. You can **Search** cnArcher Summary details by using **MAC Address**, **Name at Installation**, **Date** and **Time**, **Added By**, and **Comments.**

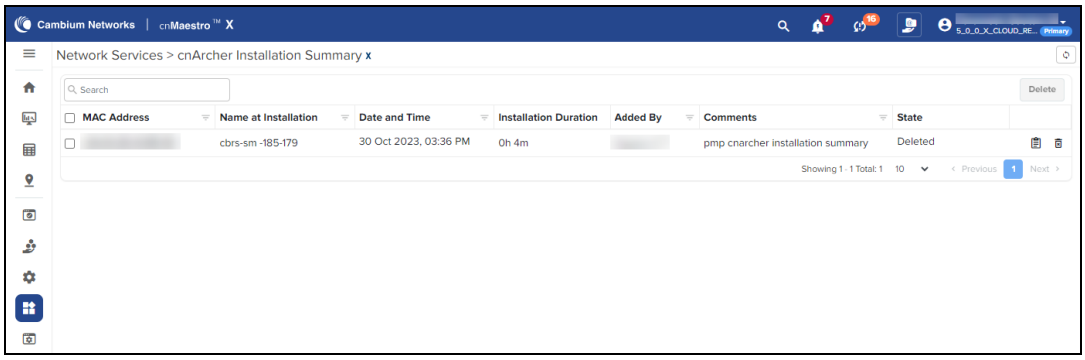


Table 125: Fields in cnArcher Installation Summary

Field	Description
MAC Address	MAC address of the device.
Name at Installation	Name given to the device when installed.
Date and Time	Date and time of installation.
Installation Duration	Duration of installation.
Added By	Name of the user adding the device.
Comments	Comments about the installation.
State	Current state of the device such as Managed or Deleted.

3. Click **View Details** icon to view detailed Installation Summary.

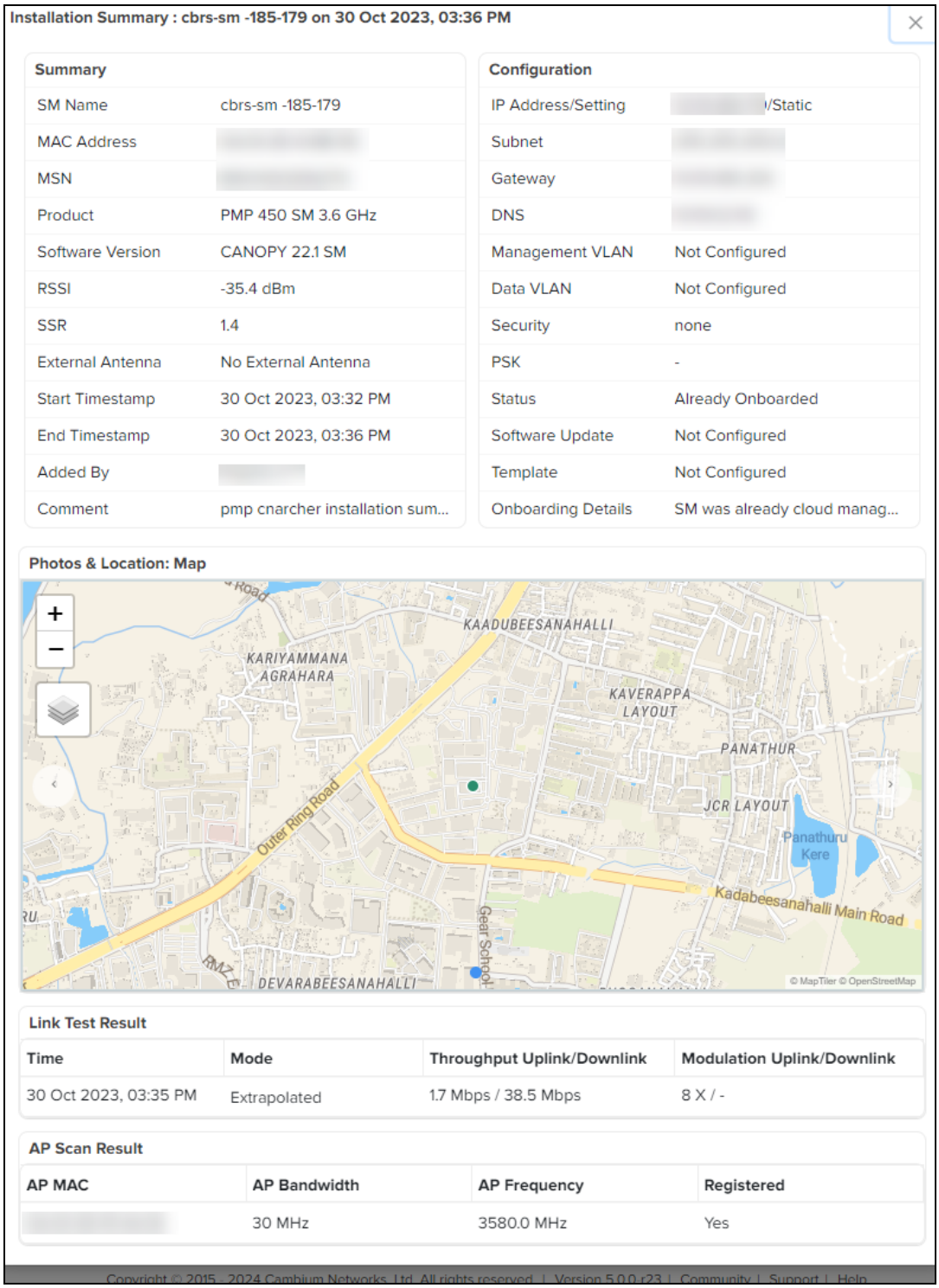


Table 126: Summary fields in cnArcher Installation

Field	Description
SM Name	Name of the device.
MAC Address	MAC address of SM.
MSN	Serial number of device.

Table 126: Summary fields in cnArcher Installation

Field	Description
Product	Device model and type.
Software Version	Software version of device.
RSSI	Receiver Signal Strength Indicator (RSSI) of SM.
SSR	Signal Strength Ratio (SSR).
External Antenna	Peak gain of external antenna connected to the device.
Start Timestamp	Start time of the summary.
End Timestamp	End time of the summary.
Added By	Name of the user adding the device.
Comment	Comments about the installation process.

Configuration

Table 127: Configuration fields in cnArcher Installation

Field	Description
IP Address/Setting	IP settings such as for DHCP or Static IP allocation.
Subnet	Subnet mask of the device.
Gateway	IP address of the gateway.
DNS	Name of the DNS server.
Management VLAN	Configured Management VLAN.
Data VLAN	Configured Data VLAN.
Security	Security settings.
PSK	Type of PSK (Pre-Shared Key): WPA or WPA2.
Status	Current SM state such as Onboarded or Already Onboarded.
Software Update	Software version provided to upgrade.
Template	Name of the configuration template to apply.
Onboarding Details	Onboarding details related to SM.

Photos and Location

Photos and Location displays the photos taken during installation. You can view a maximum of four photos at a time.

Link Test Result

Link Test Result displays the link related test results with respect to throughput.

Table 128: Link Test Results fields

Field	Description
Time	Time at which the link test was performed.
Mode	Modes such as Extrapolated Link Test or Link Test with Bridging.
Throughput Uplink/Downlink	Uplink and Downlink Throughput.
Modulation Uplink/Downlink	Uplink and Downlink Modulation.

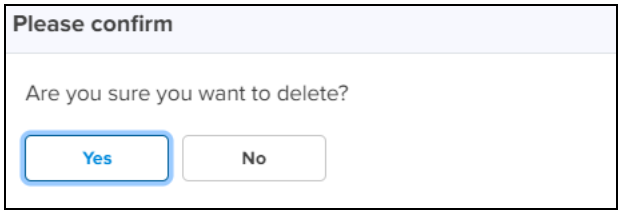
AP Scan Result

AP Scan Result displays a list of scanned APs.

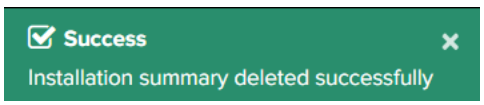
Table 129: Fields in AP Scan Result

Field	Description
AP MAC	MAC address of the AP.
AP Bandwidth	Bandwidth of the AP.
AP Frequency	Frequency of the AP.
Registered	Details of the registered SM.

4. Click **Delete** icon to delete single or multiple entries from the **cnArcher Installation Summary** page.
5. Click **Yes** to proceed to delete.



6. A confirmation message is displayed on a successful delete.



	NOTE cnArcher uploads Installation Summary with cnMaestro when Internet connection is available to users mobile device. This feature is support only in Android.

Spectrum Analyzer X

The Spectrum Analyzer feature monitors and analyzes wireless spectrum for PMP AP and SM devices, allowing users to optimize network performance.

	NOTE • The Spectrum Analyzer is a cnMaestro X feature. • Spectrum Analysis is supported on devices running PMP software version 22.1.0 and above. • Spectrum Analyzer feature is available for users in cnMaestro Cloud and On-Premises.

To view Spectrum Analyzer page:

1. Navigate to **Network Services** > **Spectrum Analyzer**.
2. You can view the Spectrum Analyzer details by using **Name**, **Status**, **Type**, **Sector Count**, **Start Time**, and **End Time**.

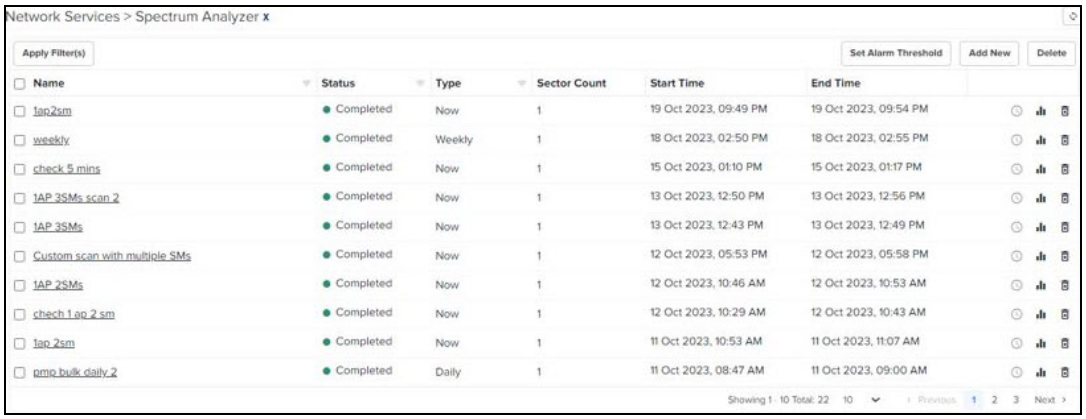


Table 130: Fields in Spectrum Analyzer

Field	Description
Name	The user-defined name for the spectrum analysis job or scan.
Status	The current status of the spectrum analysis.
Type	The type of analysis performed (for example, Now, Weekly).
Sector Count	The number of sectors or wireless areas analyzed in the spectrum scan.
Start Time	The scheduled start time for the spectrum analysis job.
End Time	The scheduled end time for the spectrum analysis job.

3. Click **View Result** icon on top right corner to view the detailed Spectrum Analyzer summary.

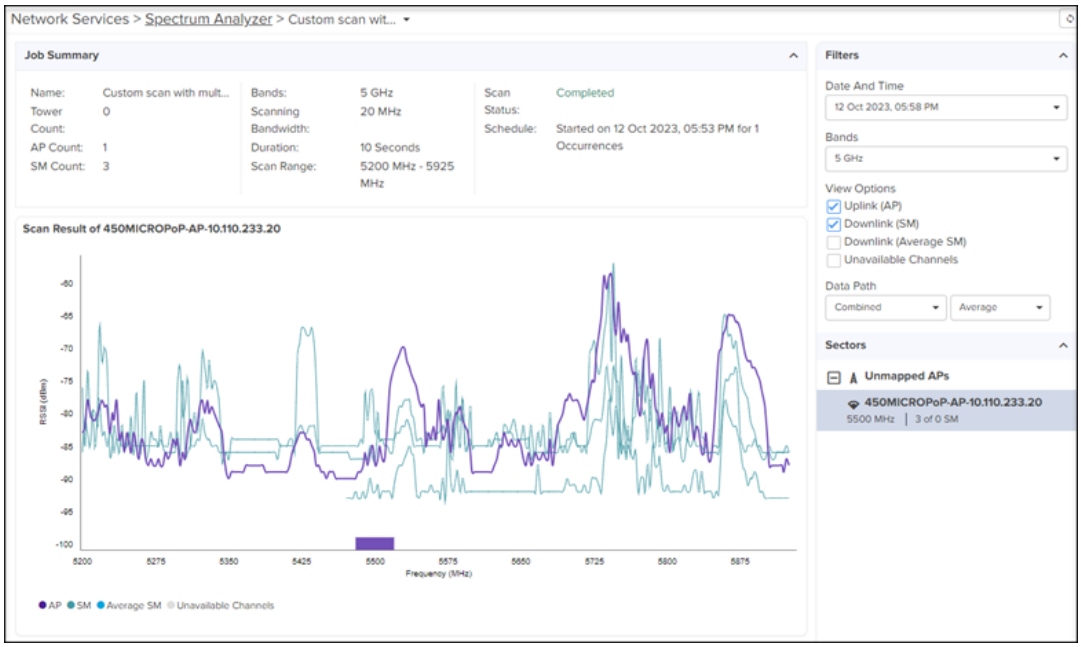


Table 131: Job Summary parameters

Field	Description
Name	The user-assigned name for the analysis job.
Tower Count	The number of towers included in the analysis.
AP Count	The number of APs in the analysis.
SM Count	The number of SMs in the analysis.
Bands	The frequency bands under analysis.
Scanning Bandwidth	The width of the frequency band being scanned.
Duration	The duration of the analysis job.
Scan Range	The spectrum range analyzed.
Scan Status	The current status of the analysis job.
Schedule	The scheduling details for the analysis job.

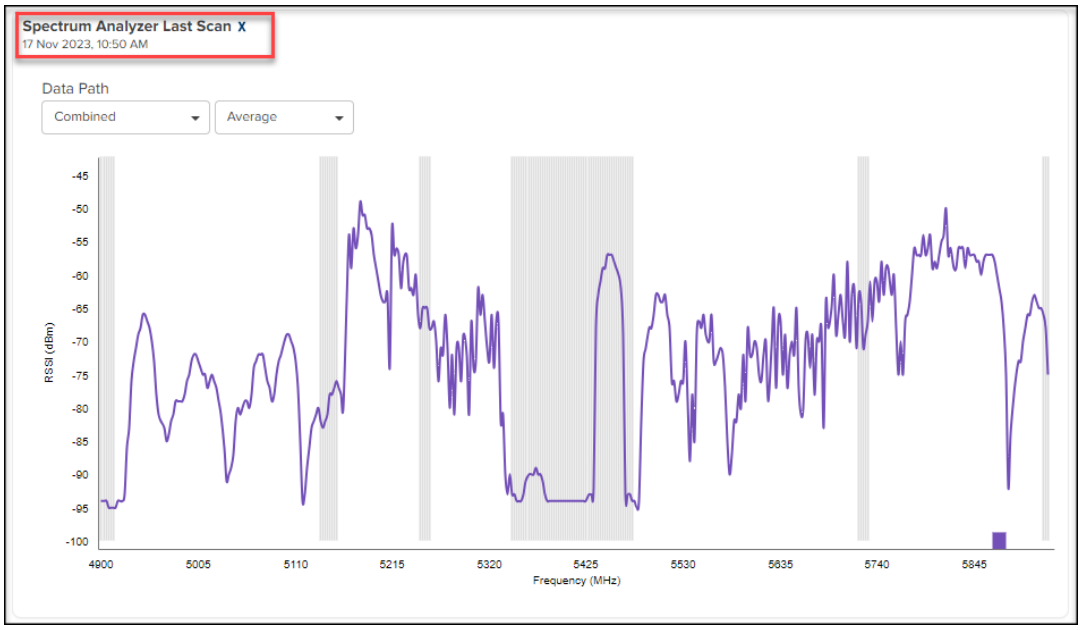
Table 132: Filters parameters

Field	Description
Date and Time	The specific date and time when the spectrum analysis is conducted.
Bands	The frequency bands included in the analysis.
View Options	The viewing options for analyzing the spectrum.

Table 132: Filters parameters

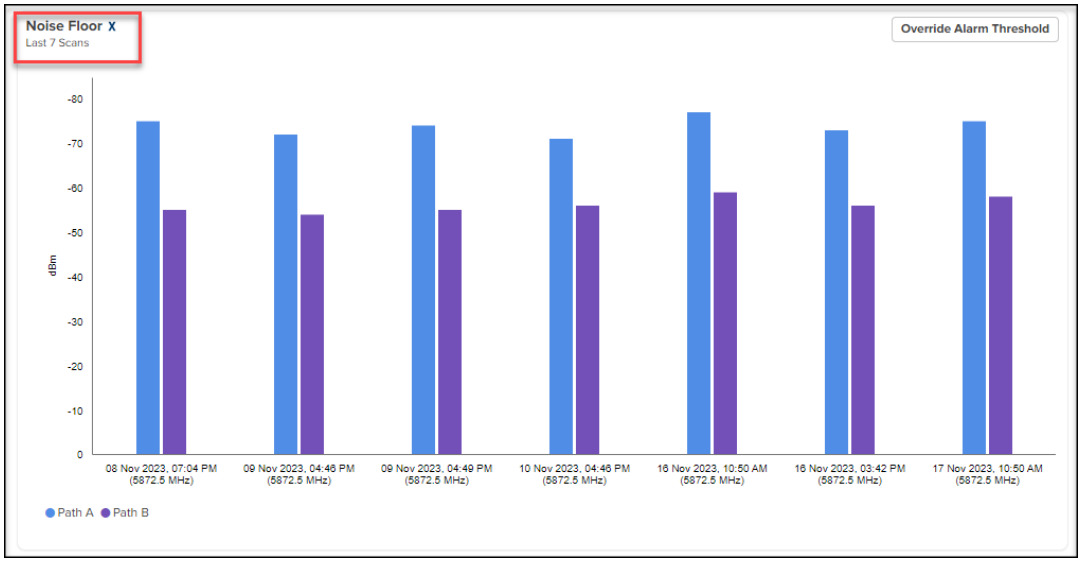
Field	Description
	• Uplink (AP) • Downlink (SM) • Downlink (Average SM) • Unavailable Channels
Data Path	The data path used for the analysis. • **Combined**: Combines data from Path A and Path B for analysis. • **Average**: Calculates the average and maximum values for the analysis data.

4. **Scan Result** displays the scanning result graph.
5. To view the last scan results at the device level:
   a. Navigate to PMP device **Dashboard** > **Spectrum Analyzer Last Scan**.



   b. The dashboard automatically generates the appropriate graph for AP and SM based on the device type.
   c. The default data path for displayed graphs is **Combined**, and users can customize it to their preferences.
   d. The dashboard displays **Noise Floor**, which provides noise floor information for both **Path A** and

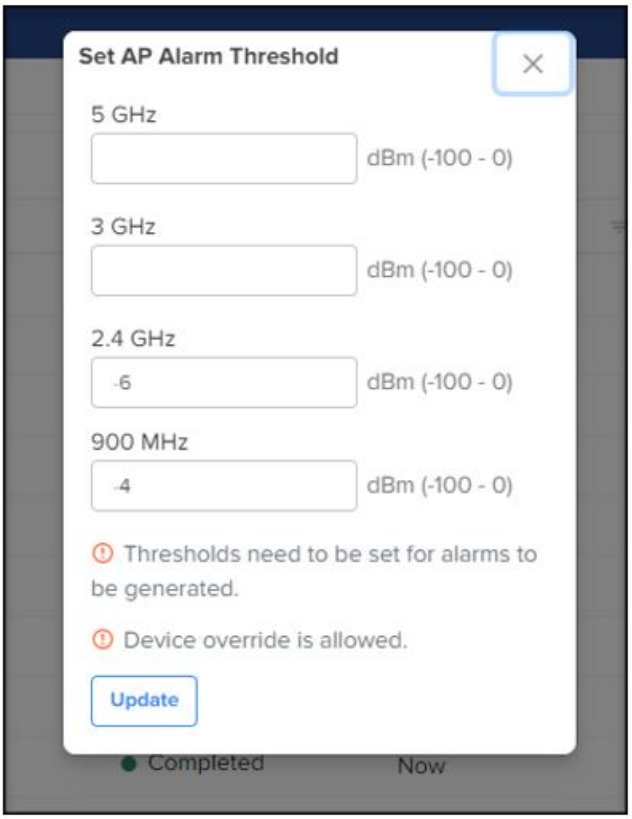
Path B. These two graphs are displayed for both AP and SM that are part of the scan.



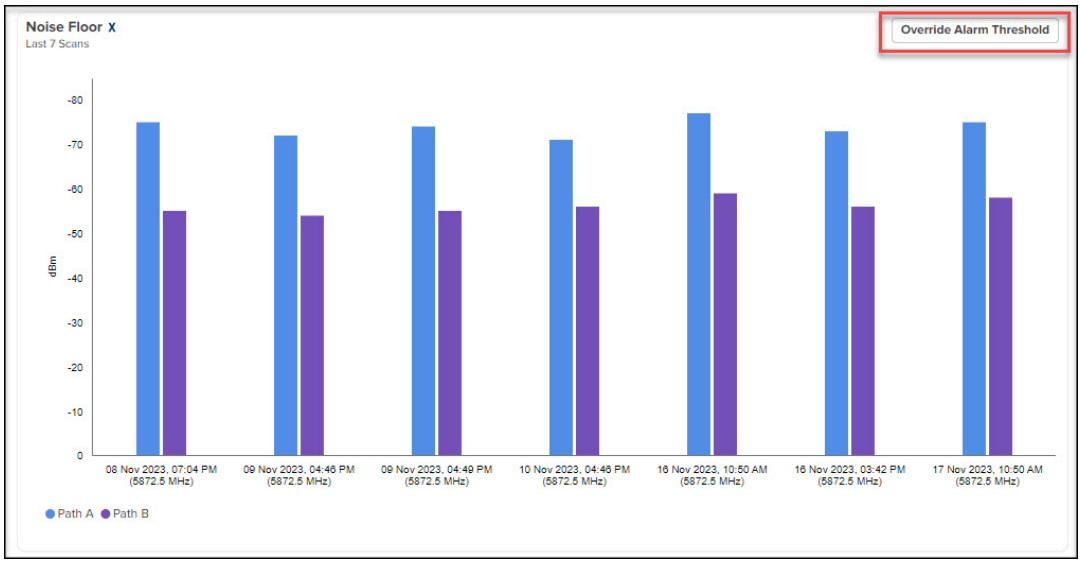
6. **Unmapped APs** display any APs that are not assigned to a tower.
7. Click **Delete** icon on the top right corner to delete a job.

To set Alarm Threshold:

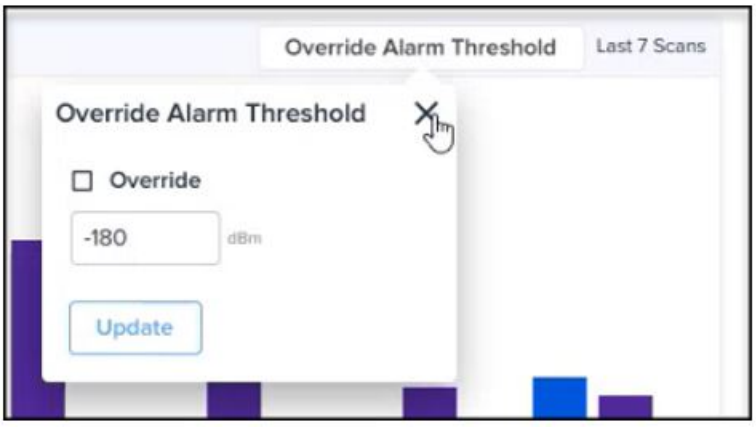
1. Navigate to **Network Services** > **Spectrum Analyzer**.
2. Click on the **Set Alarm Threshold** on the top right corner of the Spectrum Analyzer page.



3. Users can set band-specific alarms by configuring threshold values and alarm triggers for specific frequency bands (for example, 5 GHz, 3 GHz, 2.4 GHz, and 900 MHz).
4. These alarms are applied globally to all PMP devices operating in the same frequency band.
5. After configuration, the alarms are displayed on the alarm page, enabling easy monitoring and timely responses to network issues.
6. User can override alarm threshold for AP at the device level:
    a. Navigate to **Dashboard** > **Override Alarm Threshold**.



    b. Before overriding, users can review the global alarm threshold values that apply to the entire network.



    c. Choose the specific AP device for which you want to set custom alarm thresholds.
    d. Configure and set individual threshold values for the selected device, overriding the global thresholds only for that specific device.

To create a new job:

1. Navigate to **Network Services** > **Spectrum Analyzer**.
2. Click on **Add New** on the top right corner of the Spectrum Analyzer page.

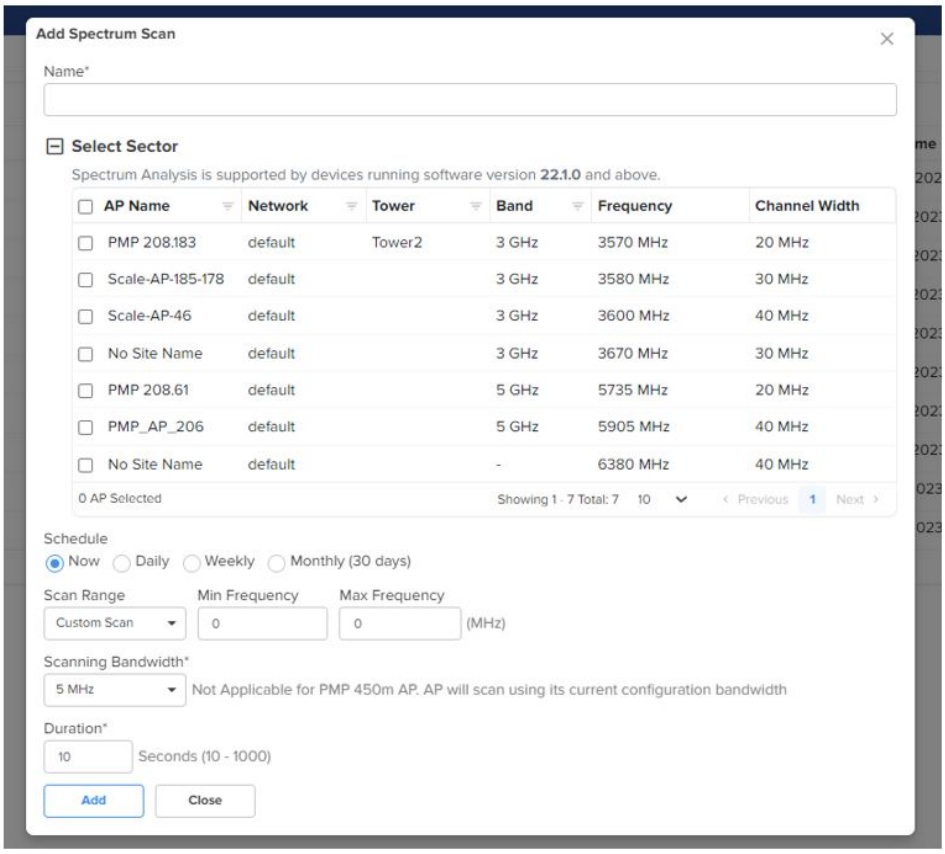


Table 133: Add Spectrum Scan parameters

Field	Description
Name	Job name to distinguish the analysis job within the Spectrum Analyzer.
Schedule	Scheduling options, including: • **Now**: Immediate execution of the spectrum analysis. • **Daily**: Set up a daily schedule for the analysis job. • **Weekly**: Configure a weekly schedule for the analysis job. • **Monthly**: Create a monthly schedule for the analysis job.
Scan Range	The desired scan range from a drop-down with two options: • **Full Scan**: Perform a comprehensive analysis of the entire spectrum. • **Custom Scan**: Set the Min Frequency and Max Frequency to precisely choose the frequency range for a more accurate spectrum analysis.
Scanning Bandwidth	The specific scanning bandwidth from the available options to adjust the spectrum analysis. **Note**: Scanning Bandwidth is not applicable for PMP 450m AP.
Duration	The analysis duration in seconds, ranging from 10 to 1000 seconds.

4. After creating the job, it appears on the home page with a **Scheduled** status.

Administration

This section includes the following topics:

- Managing Users
- Cloud Anchor Account
- Settings
- Audit Logs

Users

This chapter provides the following details:

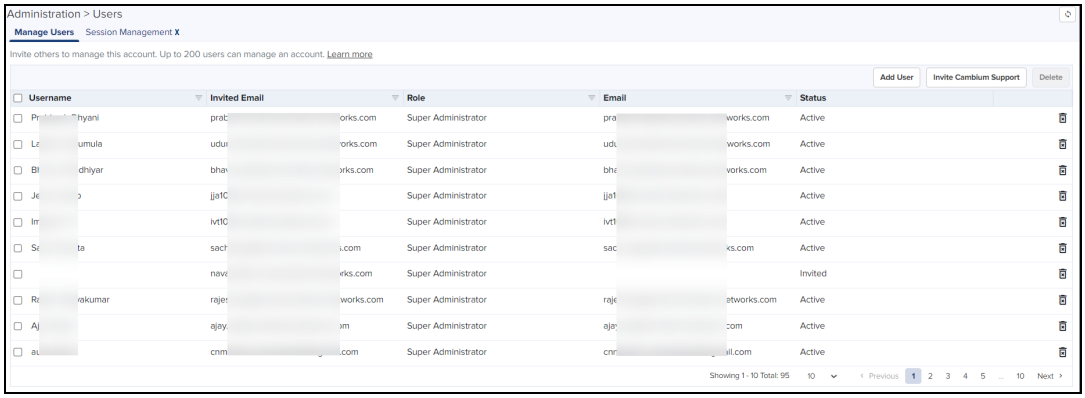
- Managing Users
- Session Management

Managing Users

cnMaestro allows you to add Users using the **Administration > Users** page.

	NOTE: • cnMaestro X account supports up to 200 users. • cnMaestro Essentials account supports only up to 10 users.

Figure 411 Adding Users



Role-Based Access

cnMaestro supports the following user Roles:

- **Super Administrator** – Super Administrators can perform all operations.
- **Administrator** – Administrators can modify cnMaestro application functionality, but they are not able to edit User, API, or Server configuration.
- **Operator** – Operators are able to configure device-specific parameters and view all configuration.
- **Monitor** - Monitors have only the view access.
- **CPI -** CPI can perform on-boarding the devices using the CBRS tool and has the view access only.

NOTE:

- cnMaestro allows one to limit the number of concurrent sessions for each Role and display current active user sessions.
- CPI role is authorized only when the **CBRS** is Enabled.

Role-Mappings

The table below defines how Roles are authorized to access specific features.

Table 134: Role-Mappings

Feature	Description
Application Operations	Application level operations such as to create, update and delete operations for Networks, Towers/Sites. Bulk device configuration. • Super Administrator - All • Administrator - All • Operator - None • Monitor - None • CPI - None
Application Settings	Change global application configuration and onboarding key. • Super Administrator - All • Administrator - All • Operator - None • Monitor - None • CPI - None
Configuration/Software Update	Manage configuration/software update jobs. • Super Administrator - All • Administrator - All • Operator - All • Monitor - None • CPI - None
Device Operations	Device operations such as reboot device, link test, connectivity test, tech support file download, and Wi-Fi performance test. • Super Administrator - All • Administrator - All • Operator - All • Monitor - None • CPI - None
Device Overrides	Per-device configuration, including updating AP Group and applying configuration. • Super Administrator - All

Table 134: Role-Mappings

Feature	Description
	• Administrator - All • Operator - All • Monitor - None • CPI - None
Floor Plan	Floor Plan configuration • Super Administrator - All • Administrator - All • Operator - View • Monitor - View • CPI - None
Global Configuration	The ability to create and apply configuration for global features such as Templates, WLANs, AP Groups, and bulk sync configuration. • Super Administrator - All • Administrator - All • Operator -View • Monitor - None • CPI - None
Guest Portal	Guest Portal configuration. • Super Administrator - All • Administrator - All • Operator -View • Monitor - View (Sessions Only) • CPI - None
Monitoring	Display of monitoring data at all levels. • Super Administrator - All • Administrator - All • Operator - All • Monitor - View • CPI - View
Notifications	Alarms and Events management. • Super Administrator - All • Administrator - All • Operator - All • Monitor - View • CPI - View

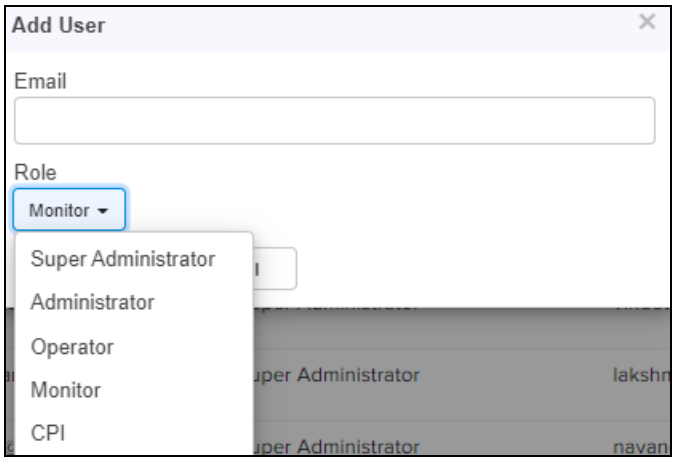
Table 134: Role-Mappings

Feature	Description
Onboarding	Device approval, modifying individual device configuration, and performing software update. • Super Administrator - All • Administrator - All • Operator - All • Monitor - None • CPI - All
Reporting	Report generation. • Super Administrator - All • Administrator - All • Operator - All • Monitor - All • CPI - All
Session Management	Capability to view and logout other users sessions. • Super Administrator - All • Administrator - All • Operator - None • Monitor - None • CPI - None
Software Upgrade	Upgrade the device with the latest software. • Super Administrator - All • Administrator - All • Operator - All • Monitor - None • CPI - None
User Management	User management operations such as manage users and roles. • Super Administrator - All • Administrator - View • Operator - None • Monitor - None • CPI - None

Creating Users and Configuring User Roles

To add an administrator:

1. Navigate to **Administration > Users** page.
2. Click **Add User** button. The following window is displayed:



3. Enter the ID in the **Email** textbox.
4. To configure the User Role, select any one of the role for the user from the **Role** drop-down list:

- Super Administrator
- Administrator
- Operator
- Monitor
- CPI

5. Click **Send** button to add this user.

To edit or delete a user, click the Edit icon or the Delete icon against the user in the **Administration > Users** page.

Whitelisting specific domains

Using the **Administration > Users** page, you can allow (or whitelist) a specific domain (for example, gmail.com). When users from the whitelisted (or allowed) domain are added, an invite email is sent directly to them. When the users accept the invite, they are allowed to access a particular cnMaestro UI account.

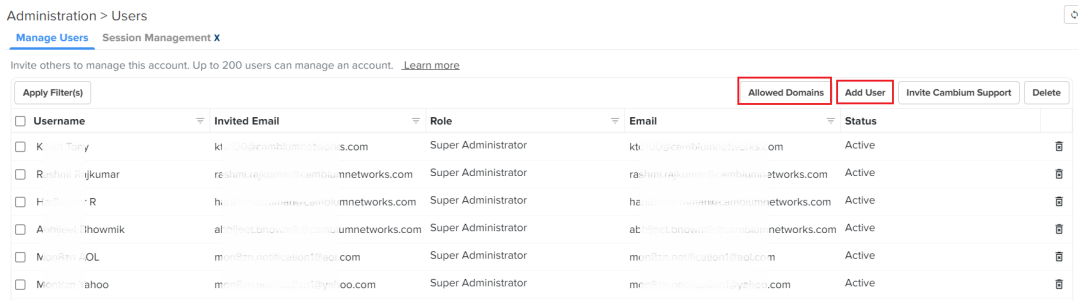
You can also blacklist or disallow a specific domain to prohibit all users of that domain from accessing the UI account.

	NOTE: • Domain whitelisting is not applicable to NFR User accounts. • For users from the whitelisted domains, you can create the MSP user account.

To whitelist or blacklist a specific domain, perform the following steps:

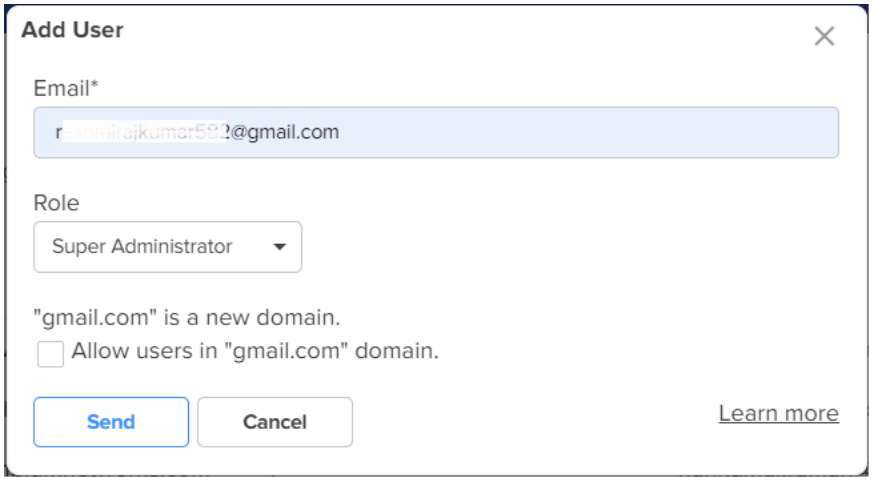
1. Navigate to **Administration > Users** page.

The **Manage Users** page appears.



2. To add a new domain (for example, a gmail ID), click on the **Add User** button.

The **Add User** window appears. You must set the fields, as described in the Creating Users and Configuring User Roles section. The **Add User** window also displays that the email ID used is a new domain, as shown in the following example (in this case, gmail.com is the new domain):



3. Select the **Allow users in "gmail.com" domain** check box (the domain name varies based on the email ID you add).

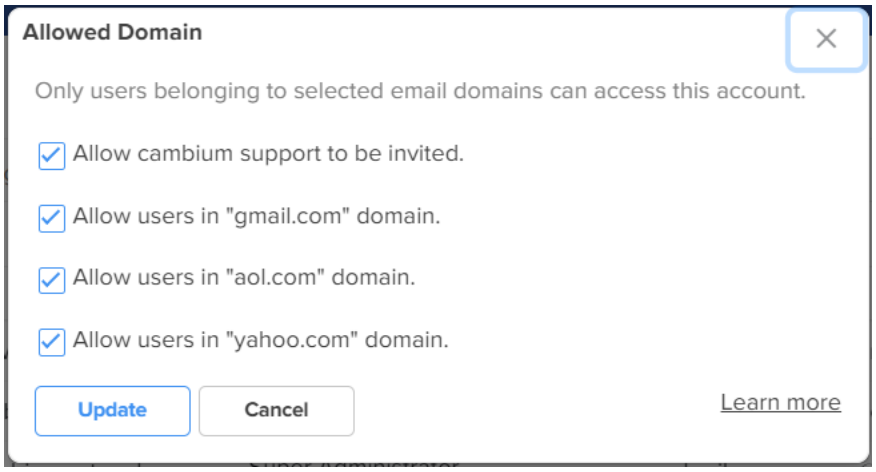
The new domain is added to the database.

When users who belong to this allowed domain (for example, gmail.com) are added (using the **Add User** button), an invite email is directly sent to the users. When the users accept the invite, they can access a particular cnMaestro UI account. The **Allow users in "gmailail.com" domain** check box is available only when you are adding a new domain.

when you are adding users from that allowed domain.

4. To blacklist or disallow a specific domain, click on the **Allowed Domains** button on the **Manage Users** page.

The **Allowed Domain** window appears with a list of whitelisted domains.



5. Uncheck the required domain check box to blacklist hat specific domain.
6. Select **Update**.

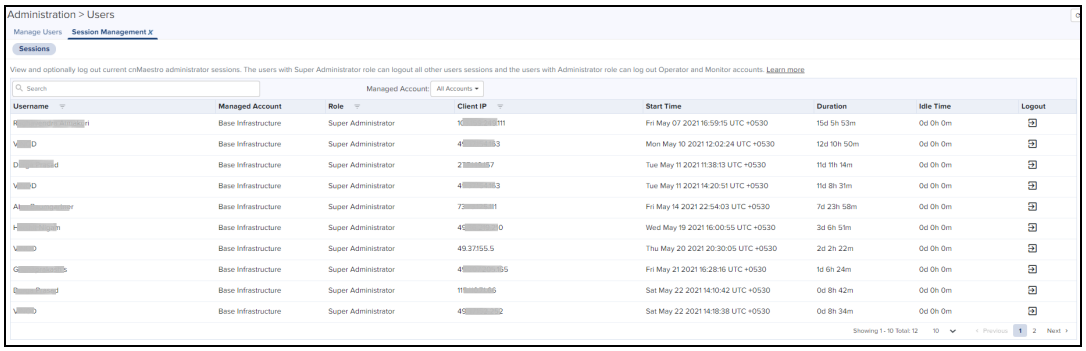
All users from that blacklisted domain are not allowed to access the UI. To allow the blacklisted domain, you must check the required domain check box on the **Allowed Domain** window.

Session Management

View and optionally log out current cnMaestro administrator sessions. The users with Super Administrator role can logout all other users sessions and the users with Administrator roles can logout Operator and Monitor accounts.

Sessions

Displays the detailed information on the user sessions.



Cloud Anchor Account

This chapter provides the following details:

- Manage Instances
- Inventory
- Administration
- Network Services
- Manage Subscriptions

Manage Instances

Registration of On-Premise customer accounts to Cloud is addressed by this feature. This will allow us to do many synchronization things in On-Premises instances, similar to Cloud will have the inventory stats from instances.

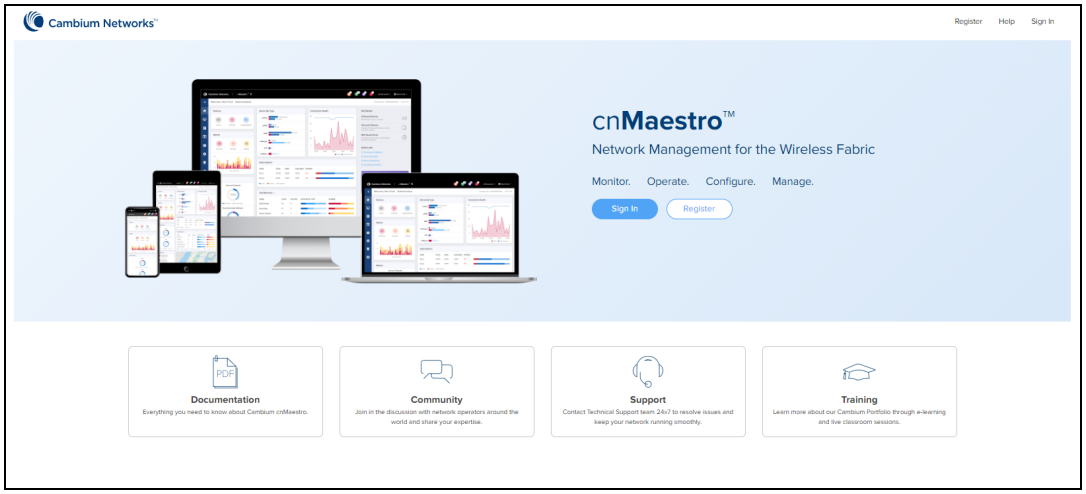
Manage Instances describes the following

- Onboarding
- On-Premises Instances
- Notifications

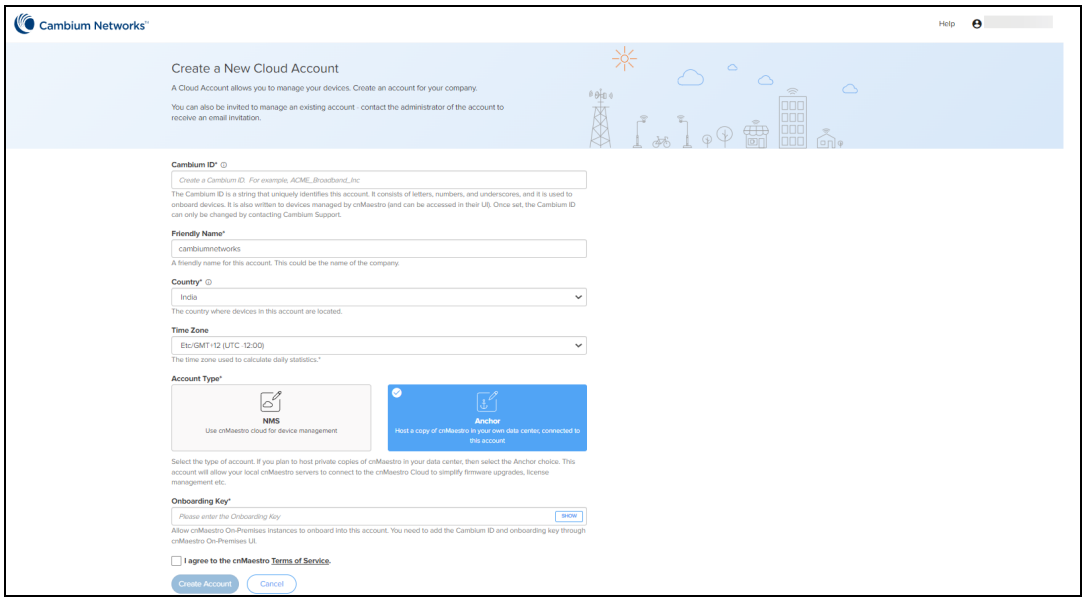
Onboarding

To onboard the devices to the Cloud Anchor Account, you need to create the Cloud account before connecting to cnMaestro On-Premises:

1. Log in to the cnMaestro UI https://cloud.cambiumnetworks.com.



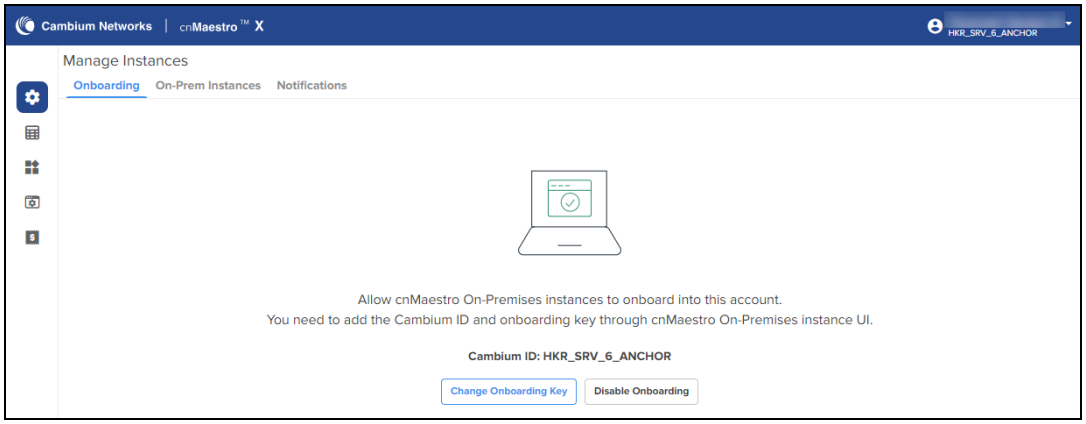
2. In **Account Type**, select **Anchor**.



3. Enter the On-Premises **Onboarding Key**.
4. Click I agree to the cnMaestro **Terms of Service**.
5. Click **Create Account**.

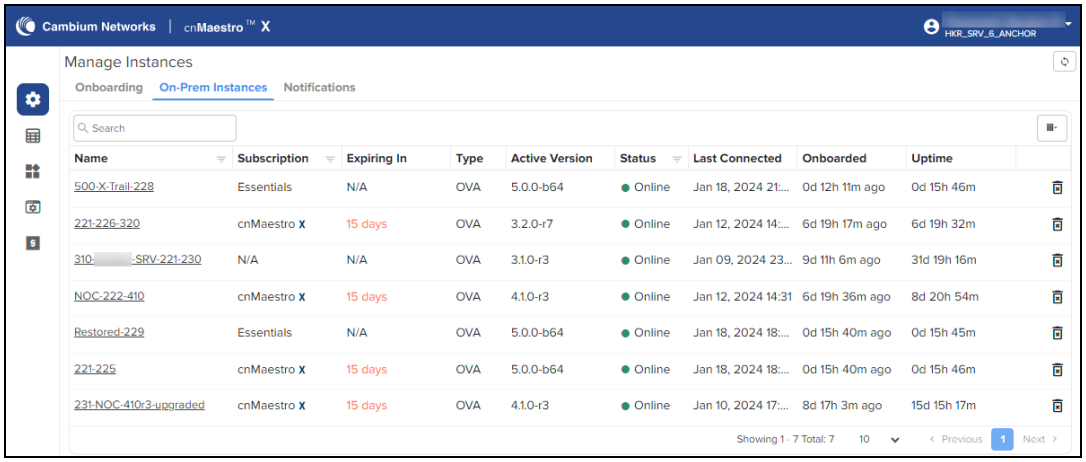
6. When the Anchor Account is created, an Onboarding Key must be set to allow On-Premises instances to connect.
7. Navigate to the **Manage Instances** page as shown below and allows you to change the **Onboarding Key** and **Disable Onboarding**.

   This key needs to be entered in the cnMaestro On-Premises UI to connect to the Anchor Account.

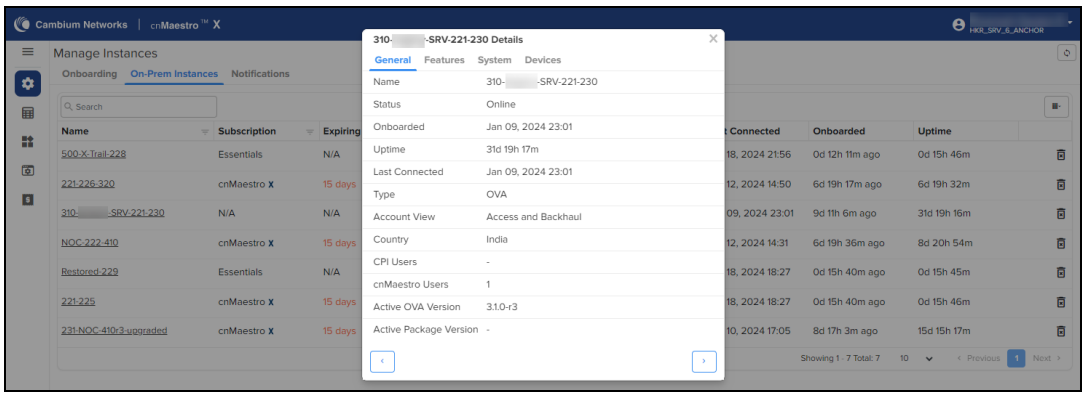


On-Prem Instances

Once the On-Premises server has been onboarded with the Key, it will be included in the **On-Prem Instances** page. Multiple On-Premises installations can be added to a single Anchor Account.

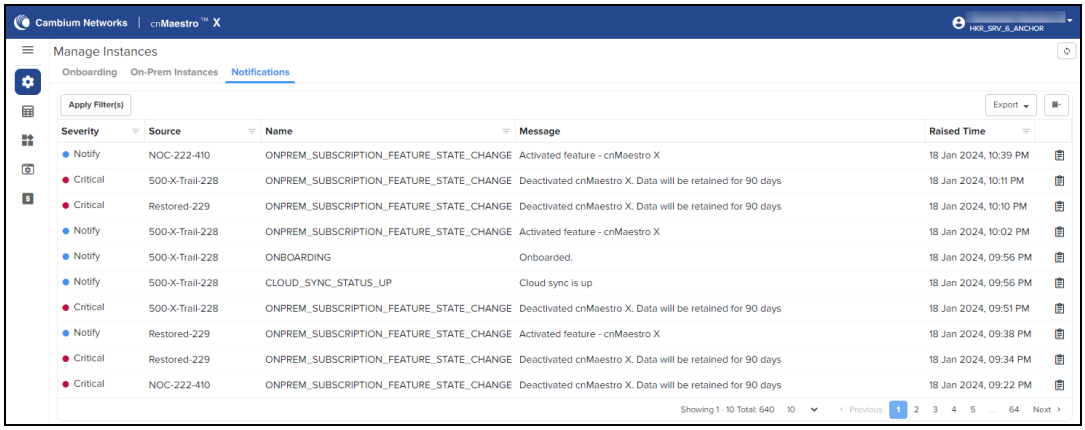


By clicking the instance host name, you can see the On-Premises server details such as General, Features, System, and CBRS:

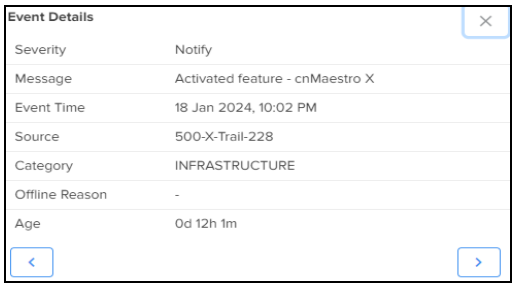


Notifications

Notification page displays the history of the most recent events notification of On-Premises instances with **Severity**, **Source**, **Name**, **Raised Time**, and **Message**.

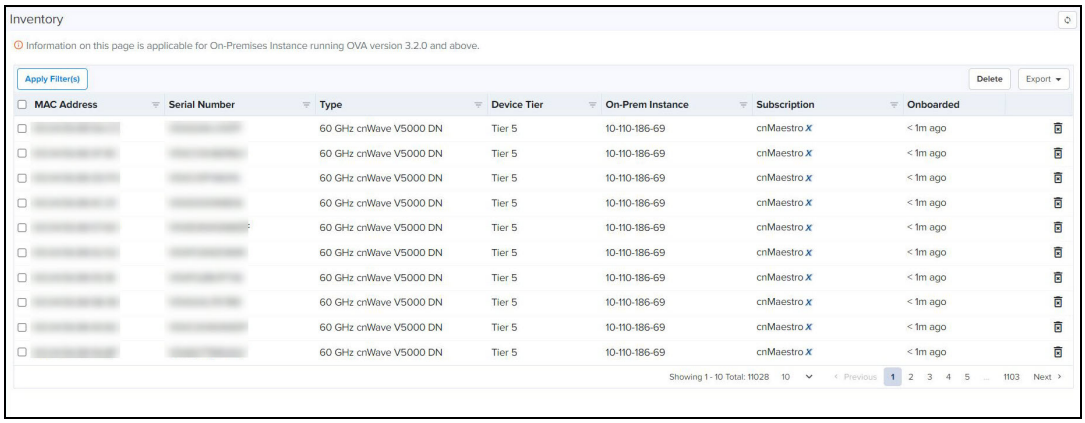


Click View Details to view the Event Details as shown below:



Inventory

The **Inventory** page displays a list of devices under the selected Node. It presents health and maintenance information provides a tabular view that allows for sorting and filtering. When selected for a single device, it presents a detailed customized page of that device.



Administration

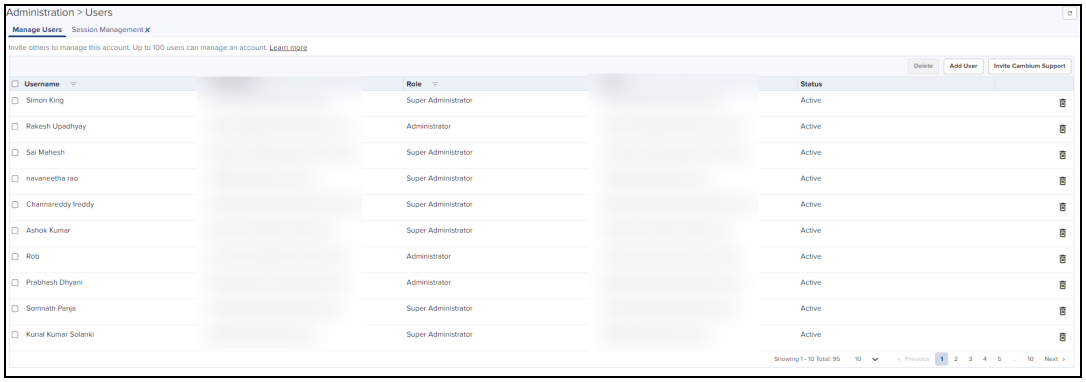
Administration provides the following details:

- Users
- Audit Logs

Users

cnMaestro allows to add Users using the **Administration > Users** page. A maximum of ten users are currently allowed in the system.

Figure 412 Adding Users



Role-Based Access

On successful authentication, every request from this user is processed in light of their Role.

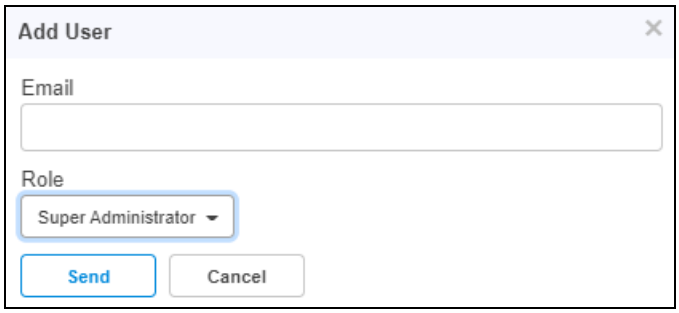
cnMaestro supports the user Role:

- **Super Administrator** – Super Administrators can perform all operations.

Creating Users and Configuring User Roles

To add an administrator:

1. Navigate to **Administration > Users** page.
2. Click **Add User** button. The following window is displayed:

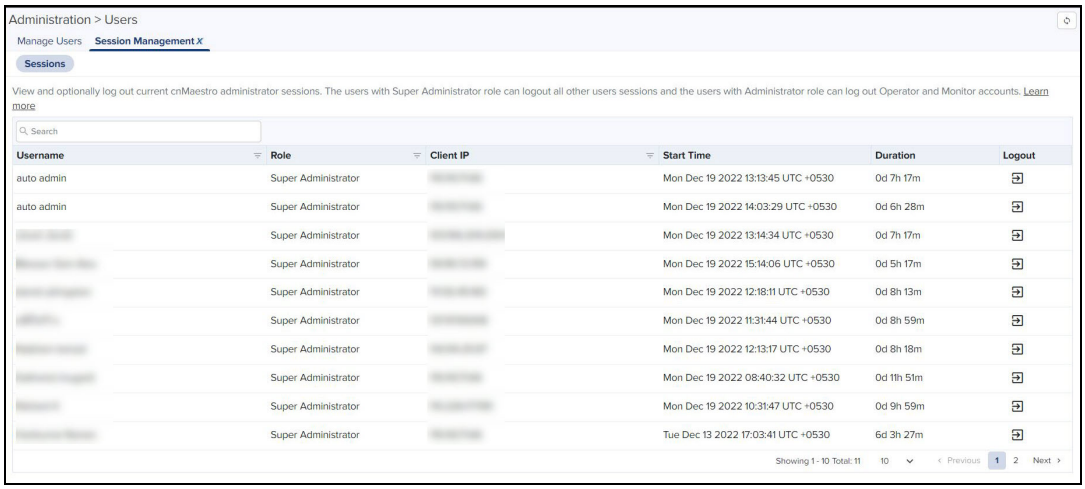


3. Enter the ID in the **Email** text box.
4. Click **Send** button to add this user.

To delete click the Delete icon against the user in the **Administration > Users** page.

Session Management

View and optionally log out current cnMaestro administrator sessions. The users with Super Administrator role can logout all other users sessions and the users with Administrator role can log out Operator and Monitor accounts.



Network Services

Network Services provide the following details:

- CBRS
- Organization

CBRS

Citizens Broadband Radio Service subscription for the CBRS-compliant devices in 3.6 GHz band (3550 MHz to 3700 MHz).

For further information, refer to CBRS.

Organization

An Organization allows multiple accounts to share CBRS billing and SAS ID. The Primary account owns this configuration, and the Secondary account can optionally share it. Both accounts must authorize the sharing.

For further information, refer to Organization.

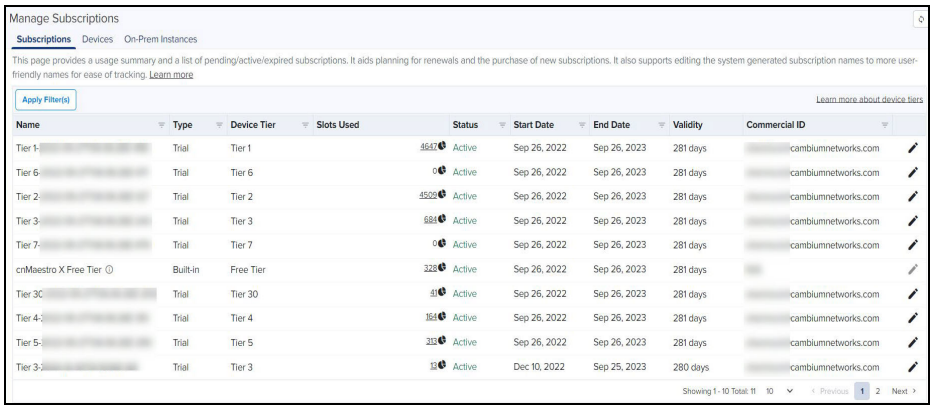
Manage Subscriptions

Manage Subscriptions provide the following details:

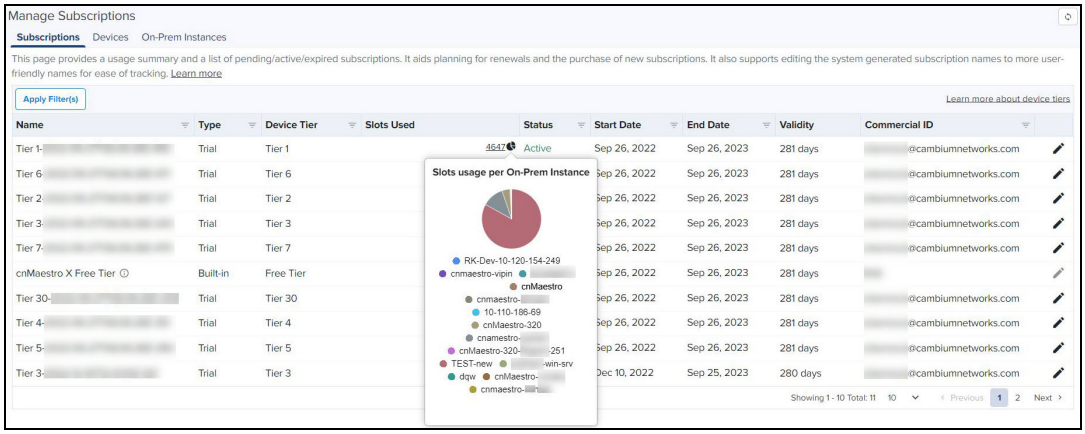
- Subscriptions
- Devices
- On-Premises Instances

Subscriptions

Subscriptions page describes about the usage summary and a list of pending, active, and expired subscriptions. It aids planning for renewals and the purchase of new subscriptions.



By clicking the Slot icon , you can view the Slot usage per On-Premises Instance as shown below:



It also supports editing the system generated subscription names to more user-friendly names for ease of tracking.

To edit the **Subscriptions** perform the following steps:

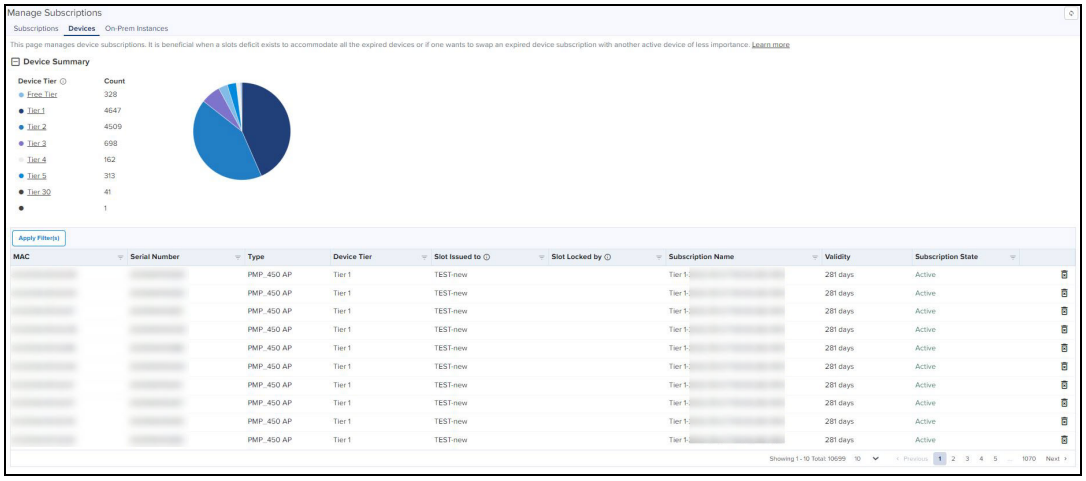
1. click edit icon.

   Edit window pops up as shown below.

2. Enter **Name** and **Description**.
3. Click **Save**.

Devices

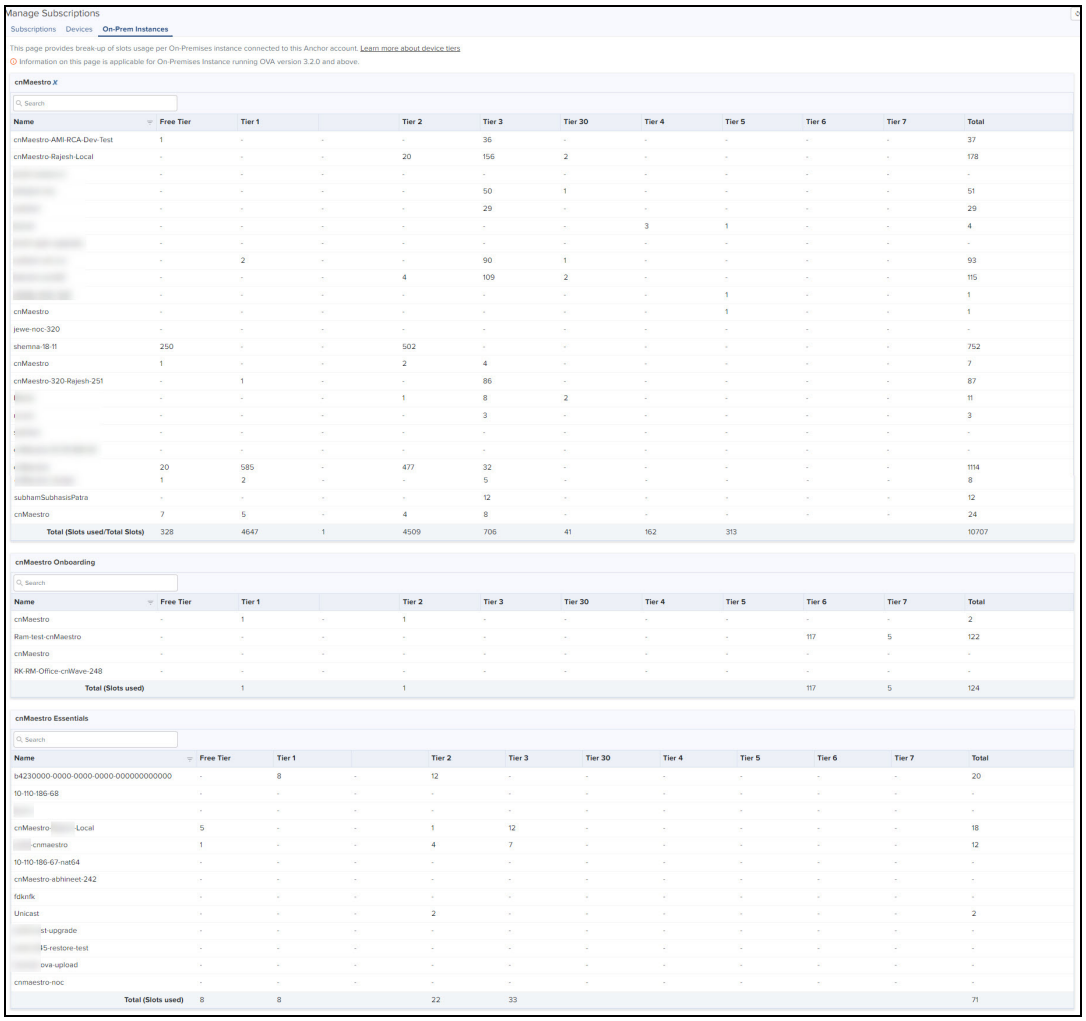
Devices page manages device subscriptions. It is beneficial when a slots deficit exists to accommodate all the expired devices or if one wants to swap an expired device subscription with another active device of less importance. For more info refer to Subscription Management.



On-Prem Instances

	Note: **On-Premises Instance** page is applicable for On-Premises Instance running OVA version 3.2.0 and above.

On-Prem Instances page provides break-up of slots usage per On-Premises instance connected to this Anchor account such as cnMaestro X, Onboarding, and Essentials.



cnMaestro X - lists the devices that are subscribed and upgraded to cnMaestro X.

Onboarding - lists the devices that are upgraded from On-Premises 3.1.0 and in cnMaestro Trial period.

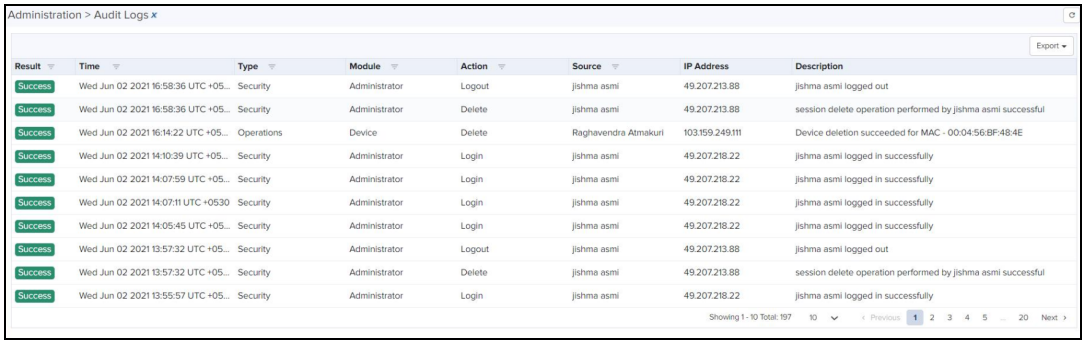
Essentials - lists the devices that are in the Essentials.

Audit Logs

	Note: Audit Logs are supported only for the cnMaestro X features.

Audit Logs record administration activities through both the Web UI and the RESTful API. Audit Log entries usually include destination and source addresses, a timestamp and user login information. User can access Audit Logs in the **Administration** > **Audit Logs** page.

Figure 413 Audit Logs



The following table describes the Audit Logs parameters and their descriptions.

Table 135: Audit Log Parameters

Parameter	Description
Action	Displays the action performed by the user (create, delete, download, etc).
Description	Textual description of the task.
Export	Enable export as CSV or PDF.
IP Address	IP address of the Web browser or API application.
Module	Module generating entry (AAA, administrator, alarm).
Result	The result of the audit log as **Success** or **Failed**.
Source	Administrator or API client name.
Source Type	Entity making the update: administrator or API client.
Time	The time when the action was performed.
Type	Type of the log entry (configuration, operation, onboarding, security).

Log Action

An action log contains a set of transactions. Each transaction contains one or more Actions. Each Action has a name and input parameters. Some Actions have output parameters.

The following Actions will be supported for individual Audit Log entries. Each activity performed in the server is detailed in this table.

Table 136: Log Action Parameters

Parameter	Description
Claim	Claim a device in the network operator.
Cloud-Connect	Provides the status of the On-Premises to Cloud account connection.
Create	Create an object in the network device.

Table 136: Log Action Parameters

Parameter	Description
Delete	Delete an object in the network device.
Download	Download a file.
Edit	Edit an existing device detail.
Link Test	Perform a Link Test.
Login	Login to a device.
Logout	Logout from a device.
Mail	Mail ID of a device.
Move	Move a device from the server.
Reboot	Reboot a device.
Reset	To reset a device
Upload	Upload a file on the server.

Audit Modules

Auditing activity is mapped to individual modules within cnMaestro. A breakdown of the available modules is listed below.

Module	Type (s)	Description
ACL	provisioning	Adding Editing Removing the ACL Entries.
administrator	provisioning operations security	User Management: Login, Users, Roles, Email, etc.
alarm	provisioning	Alarms and Alarm History.
api	provisioning	API Management: API Clients and Webhooks.
auditing	provisioning	Auditing Infrastructure.
auto-provision	provisioning	Auto-Provisioning.
CBRS	Services	CBRS.
Cloud- Sync	Services	Synchronizing the Cloud to On-Premises Instances.
data-tunnel	provisioning	Data Tunneling.
device	provisioning	Device management.

Module	Type (s)	Description
	operations	
Email-Notifications	operations	Add or edit Email notification.
guest-portal	provisioning	Guest Portal.
infrastructure	provisioning	Site, Network, Tower Management.
jobs	provisioning operations	Jobs Infrastructure.
license	licensing	Update license details.
MSP	operations	Operations covering Managed Services and Managed Account.
onboard	provisioning operations	Onboarding Queue.
report	provisioning operations	Data Reports.
Profile	provisioning	Create or update a profile.
SIM	provisioning	SIM claim and delete.
system	provisioning operations security	System Services: VM management, change log level, system upgrade, system monitoring, software images, system settings.
template	provisioning	Template-Based Configuration.
tools	provisioning operations	Technical support dump, networking operations, etc.
webhooks	provisioning	Webhooks configuration and management.
Wi-Fi	provisioning operations security	AP Groups, WLANs: edit W-Fi configuration objects.

Settings

Email Notifications

The Email Notifications feature allows the Super Administrator and the Administrator users to add subscribers (Email IDs) for receiving different types of alerts by means of Emails.

	NOTE: • Only 2 email recipients can be added per cnMaestro Essentials account. • Up to 10 email recipients can be added per MSP, Base Infra, and system level scope. For example, if there is 1 MSP, you can create 10 recipients at MSP, 10 at Base Infra, and 10 at system level (All accounts scope).

The severity of alerts are classified as follows:

- Critical
- Major
- Minor

The content of the email alert will be in JSON or HTML format. The subscriber will get email alert only when the global setting is enabled.

Figure 414 Email notifications when MSP is disabled

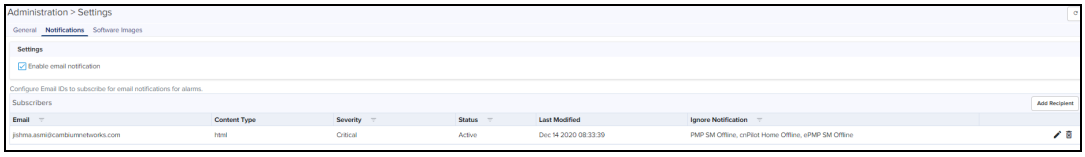
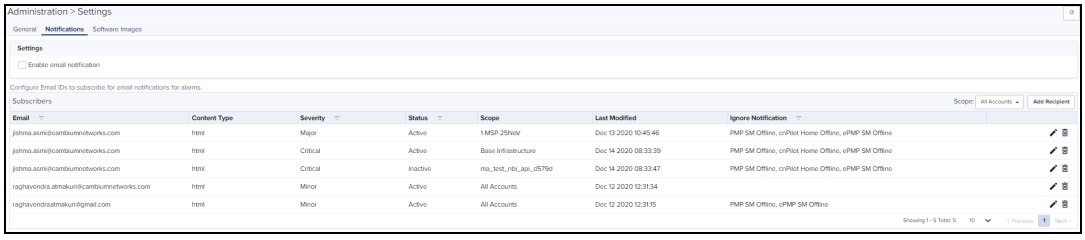


Figure 415 Email notifications when MSP is enabled



user can use the filter option for the following fields:

- Email
- Severity
- Status
- Ignore Notification

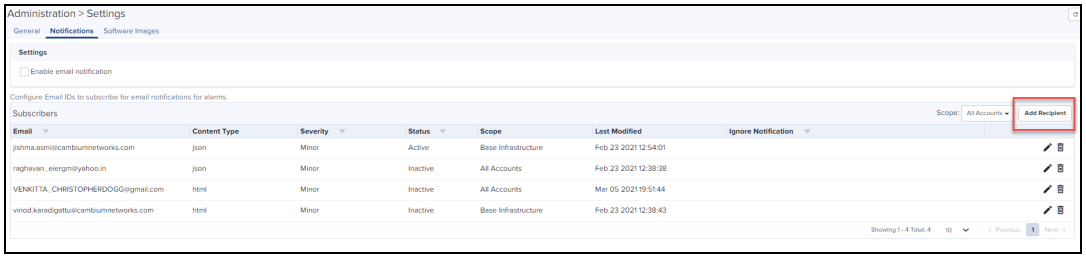
User can use the sorting option for the following fields:

- Content Type
- Last Modified Date

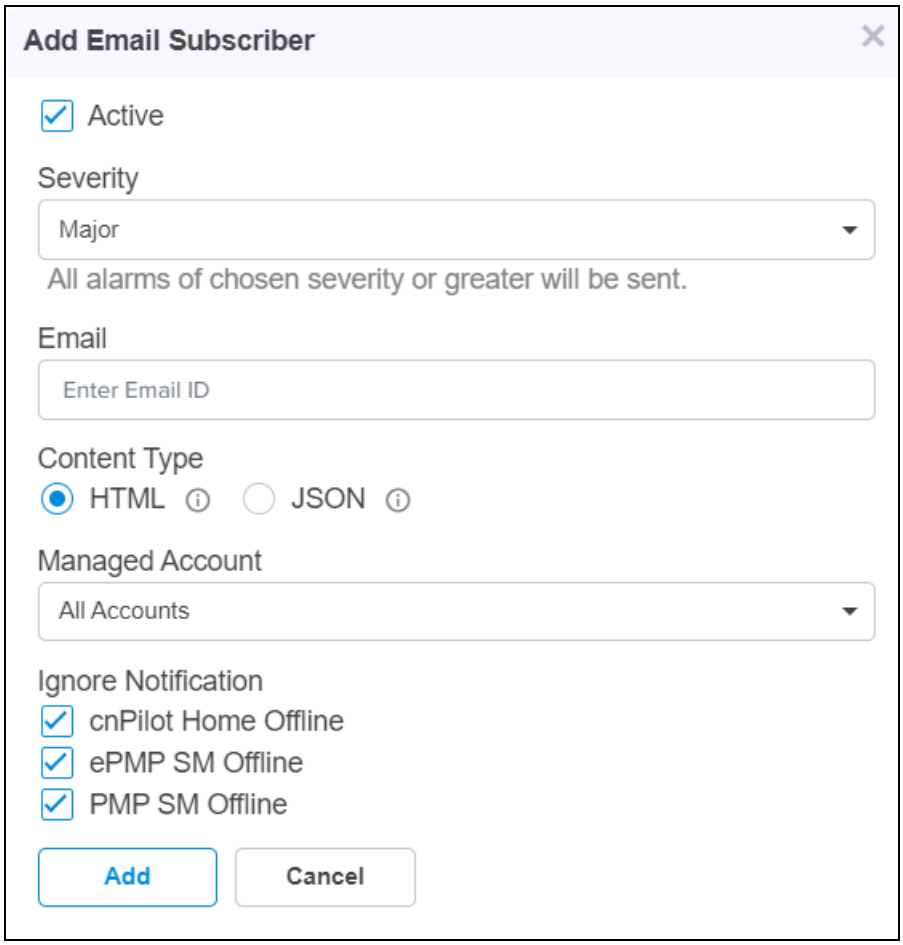
Adding Recipient to Subscriber Table

1. Navigate to **Administration > Settings > Notifications** page and click **Add Recipient** button.

Figure 416 Adding Subscribers



The following window is displayed:

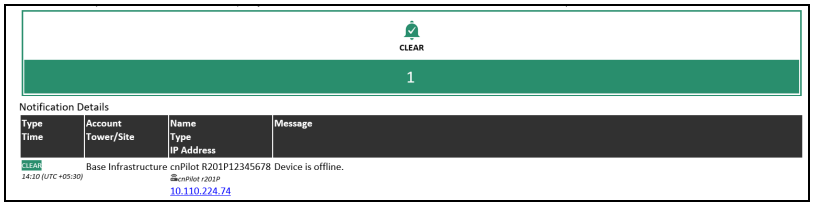


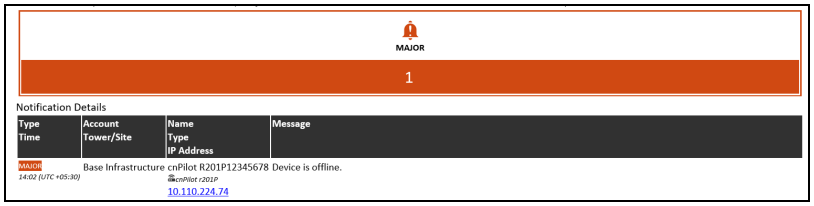
2. Enter the Email ID of the subscriber in the **Email** textbox.
3. Select the severity level from the **Severity** list.
4. Select the Managed Account type from the **Managed Account** list.
5. Choose **HTML** or **JSON** radio button for the **Content Type**.
6. Select the appropriate option (s) for **Ignore Notification.**
7. Click **Add** and the entry reflects in the subscriber table.

All alarms of chosen severity and above are sent through email as explained below:

- If severity **Critical** is selected, then we receive only critical alarms.
- If severity **Major** is selected, then we receive critical and major alarms.
- If severity **Minor** is selected, then we receive critical, major, and minor alarms.

HTML Email Example





JSON Email Example

Account Type

cnMaestro supports three separate account types, based upon the composition of devices installed. The type is set when the account is created initially, but it can be changed later through the **Administration > Settings** page.

For more information, please refer Navigating the cnMaestro UI.

Managing Device software images under Automatically Update Device Software section

cnMaestro cloud allows one to update the device software during onboarding and for managed devices.

Adding update device software is a manual process as follows:

1. Navigate to **Administration > Settings > Software Images** > **Automatically Update Device Software** tab.

2. Select the version file and then click **onboarding/Managed Devices** check Box.

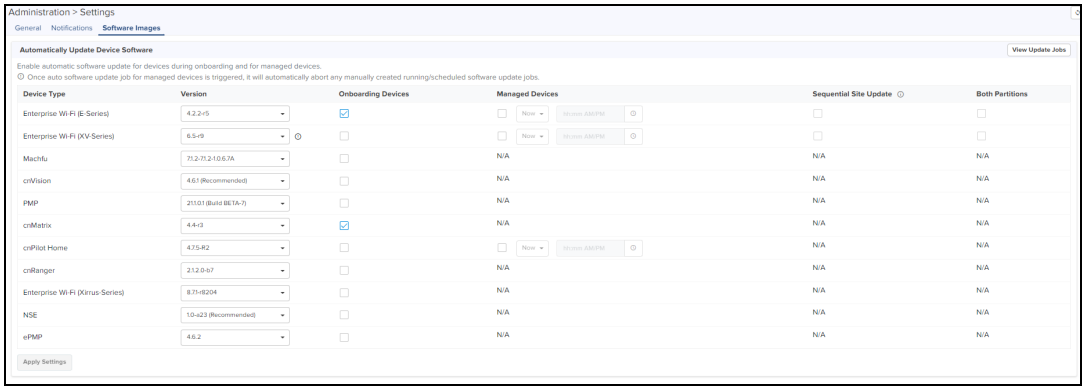
	NOTE: Enable the onboarding check box, in order to avoid the failure of onboarding devices with minimum supported version rather than the recommended version.

3. Enable the checkbox as follows:
   - Enable **Managed Devices** flag only for wifi devices (E-Series, R-Series and XV-Series).
   - Enable **Sequential Site Update** and **Both Partitions** flag only for only E-Series and XV-Series devices.

4. click **Apply Settings.**

	NOTE: Once auto software update job for managed devices is triggered, it will automatically abort any manually created running/scheduled software update jobs. In order to avoid failures in onboarding devices having minimum supported version other than recommended version enable the onboarding check.

Figure 417 Software Images



Appendix

This section includes the following topics:

Network Port Requirements

Network Port Requirements for Outbound

The following table provides information about network port requirements for outbound:

Table 137: Outbound Port Details

Port Number	Port Type	Purpose
443	TCP	HTTPS Web Access and Device communication

XMS-Enterprise to cnMaestro X

This section describes the process of migration from XMS-Enterprise (XMS-E) to cnMaestro X.

Before you begin migration, upgrade the following to the latest version:

- XMS-E to version 8.4.0
- Xirrus APs to version 8.7.0

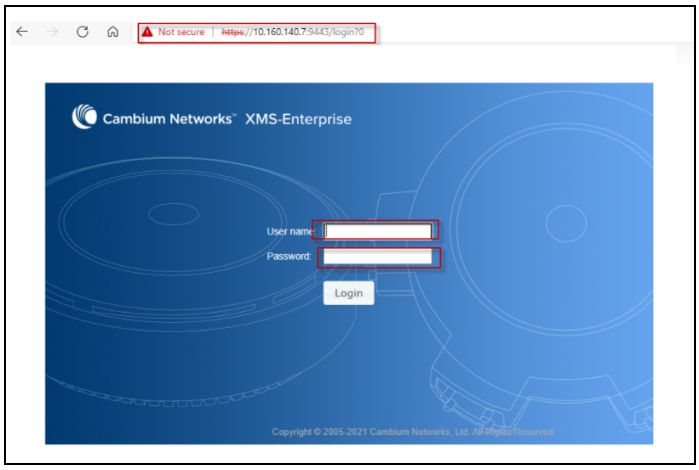
Perform the following steps for migration:

1. In XMS-E do the following:
   - Export Golden Configuration
   - Migrate to cnMaestro X
2. In cnMaestro X do the following:
   - Create Wi-Fi AP Group
   - Approve APs into Wi-Fi AP Group
   - Import and Apply AP configuration

XMS-E system

To login to XMS-E, complete the following steps:

1. Launch the Web login page.
2. Enter the username and password.
3. Click **Login**.

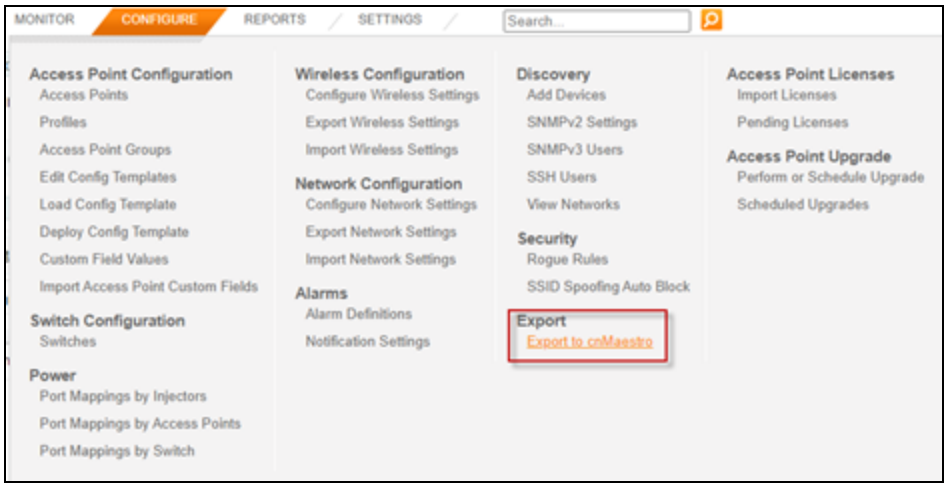


Export Golden Configuration

Export Golden Configuration for one of the APs. It is saved as a zipped file in the local file system.

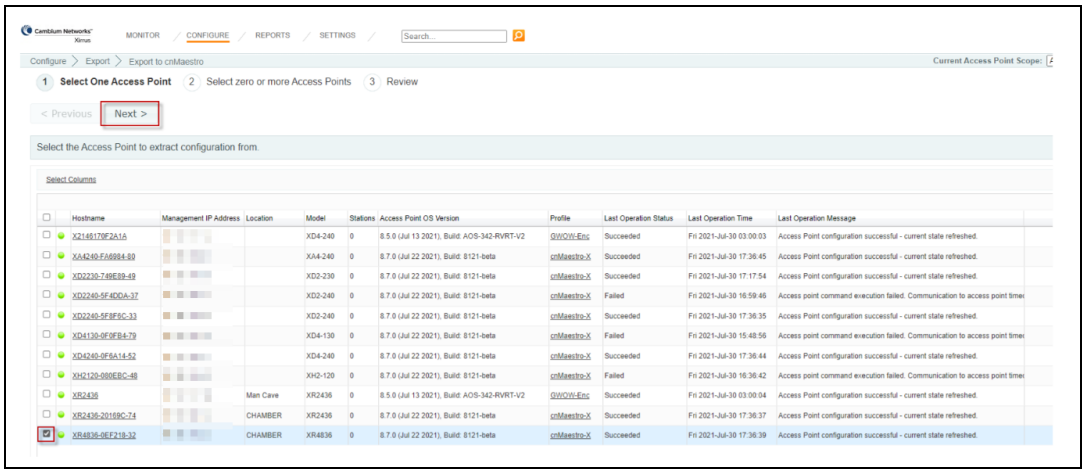
To start export golden configuration in XMS-E, navigate to **Configure** tab > **Export**.

1. Select **Export to cnMaestro**.

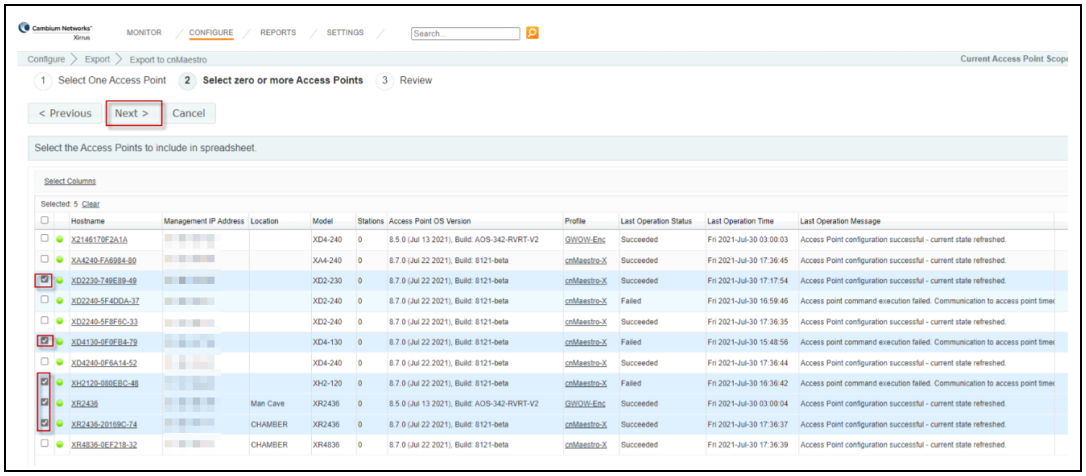


2. Select the AP to create the golden configuration for a group of APs and click **Next**.

	NOTE: • Select the AP with the maximum radios and the highest capability. • During the migration of an AP from XMS-E to cnMaestro, the AP configurations are not modified.



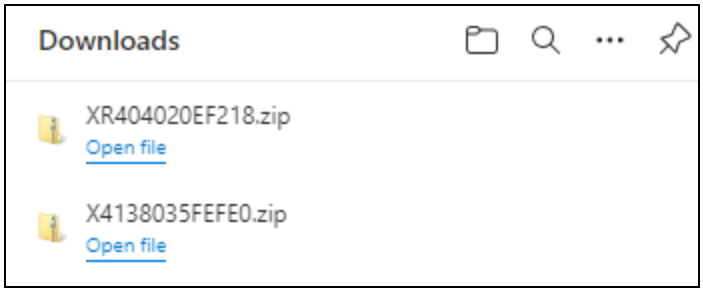
4. Select group of APs to be added to the spreadsheet and click **Next**.



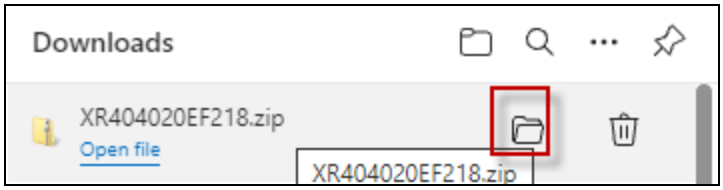
5. Click **Export**.

In Local System unzip the directory and files to local directory.

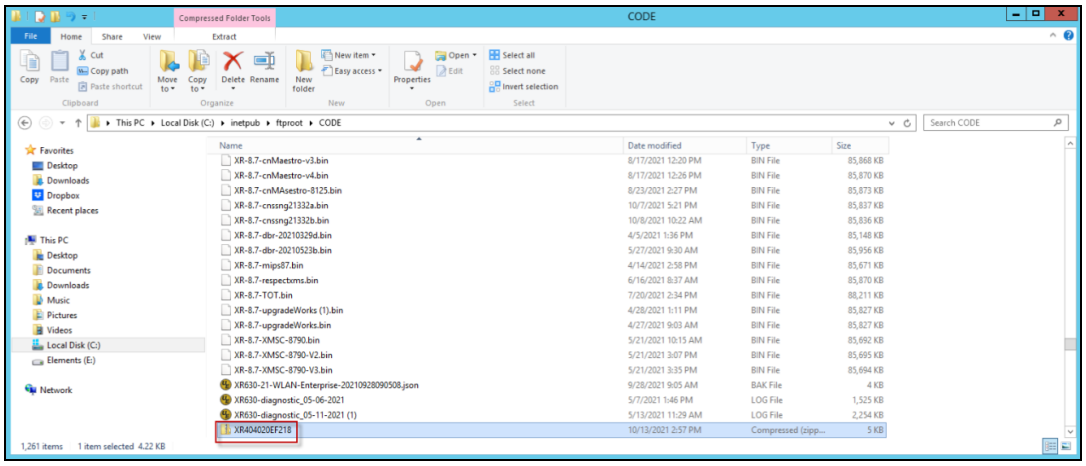
6. Download the zip files from the browser window.



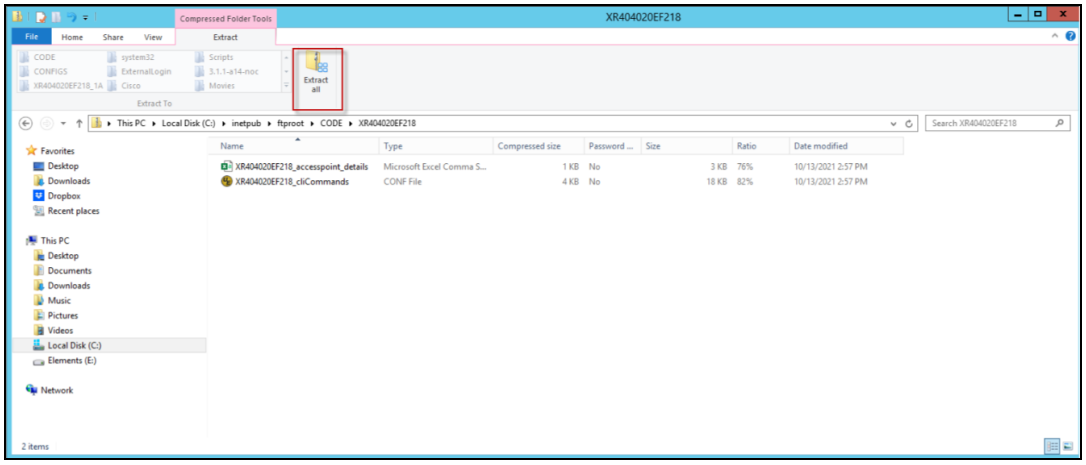
7. Go to the folder where the zipped files are saved and extract the contents to a folder.



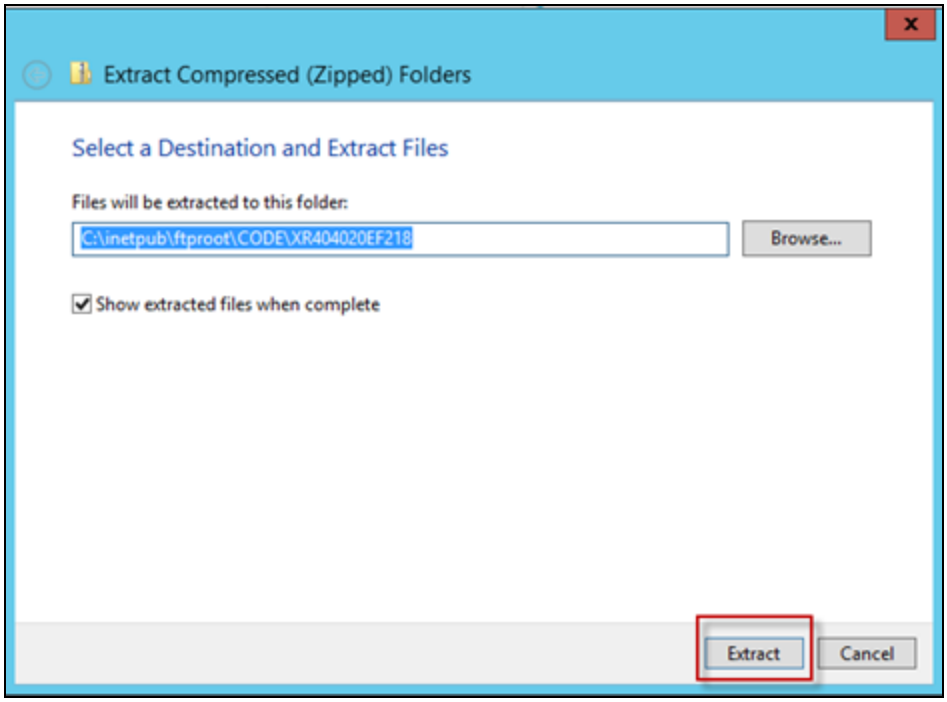
8. Open the directory path where the file has been stored and double-click on the zipped file.



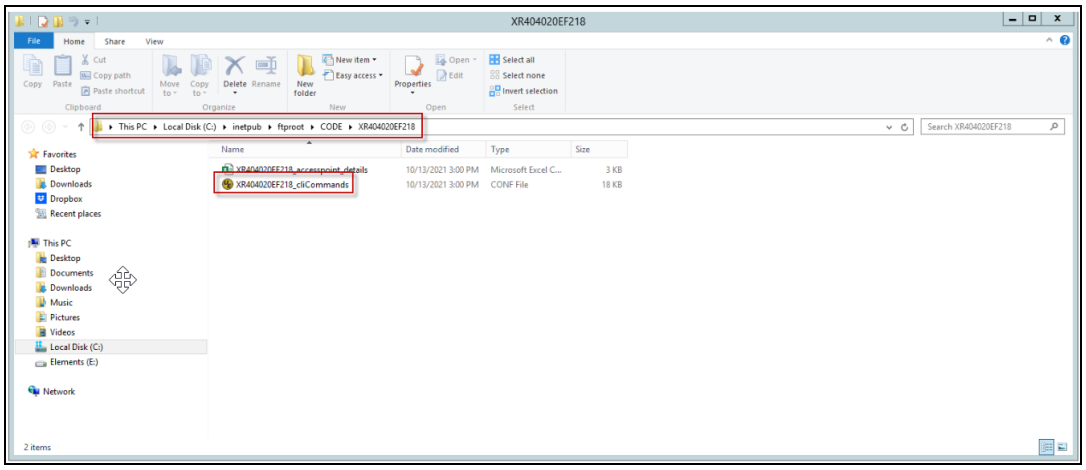
9. Click **Extract all**.



10. Extract the folder to the path.



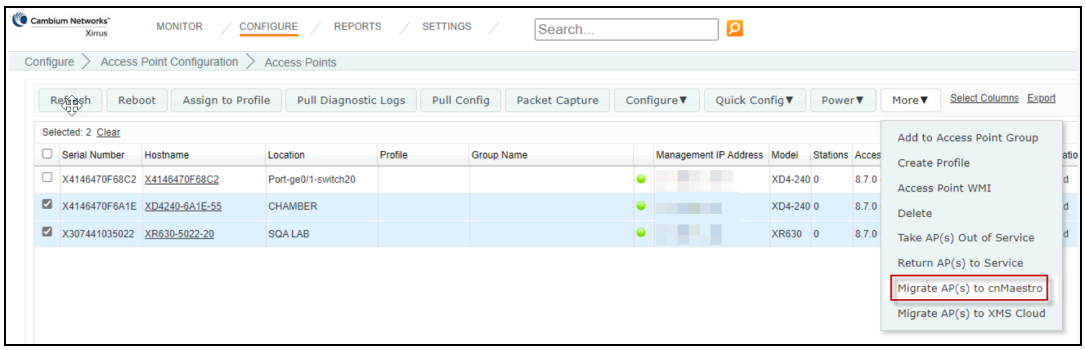
11. Make a note of the folder or file location as you will require this file later.



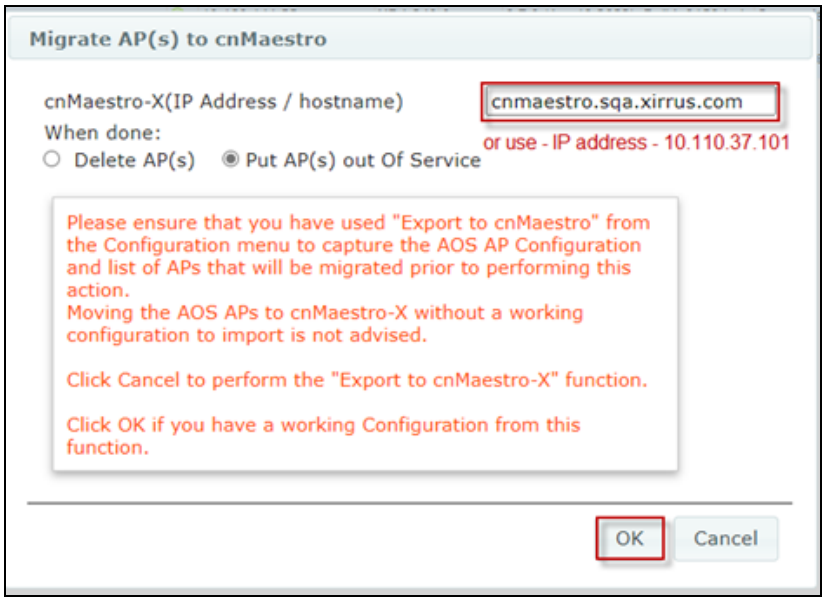
Migrate to cnMaestro X

Select APs to migrate to cnMaestro X. Perform the following steps:

1. Navigate to the **More** menu > select **Migrate APs to cnMaestro.**



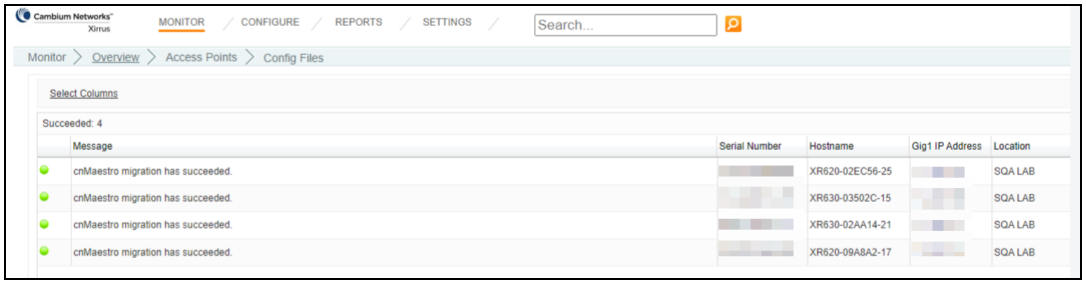
2. Enter the IP address or Hostname mapped in DNS for cnMaestro X.
3. Select **Delete AP** or **Put AP(s) out of Service** and click **OK.**



NOTE:

- Out of service APs are not removed from XMS-E, so if there is an issue, select the **Return APs to Service** option and they will return to XMS-E.
  - You must reset using the `snmp trap host 1 Xirrus-XMS` AP CLI command on the AP for the return to service to work.
- If you select **Delete APs**, they will be removed and you must rediscover them on the network to return them to XMS-E.
  - You should also remove the Device Network from the Device discovery section to clean up XMS-E.

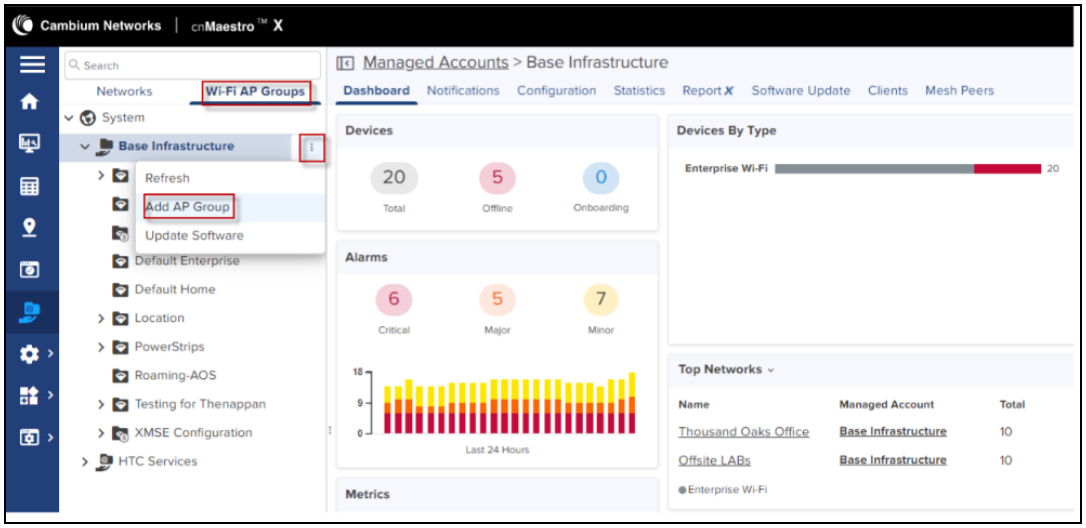
A success message from XMS-E for each of the APs migrated to cnMaestro X is displayed.



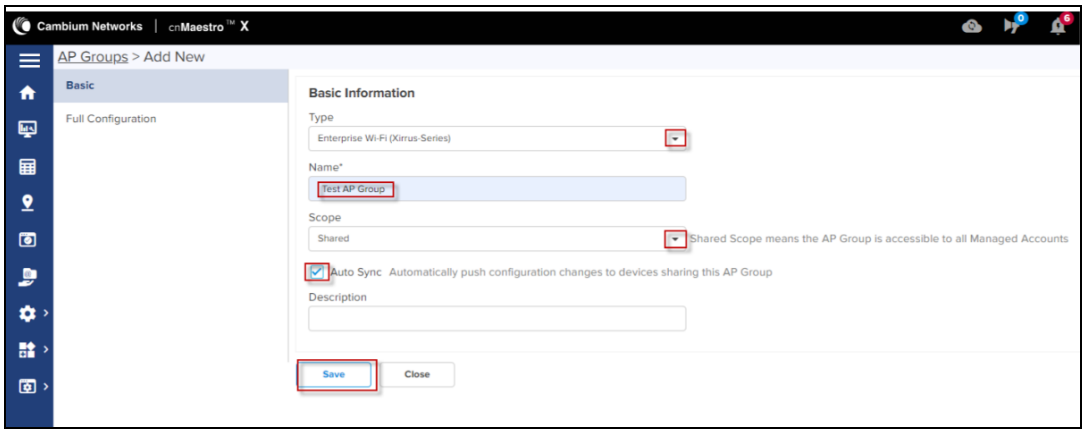
Create Wi-Fi AP Group

Create Wi-Fi AP Group and Import CLI command file from exported directory.

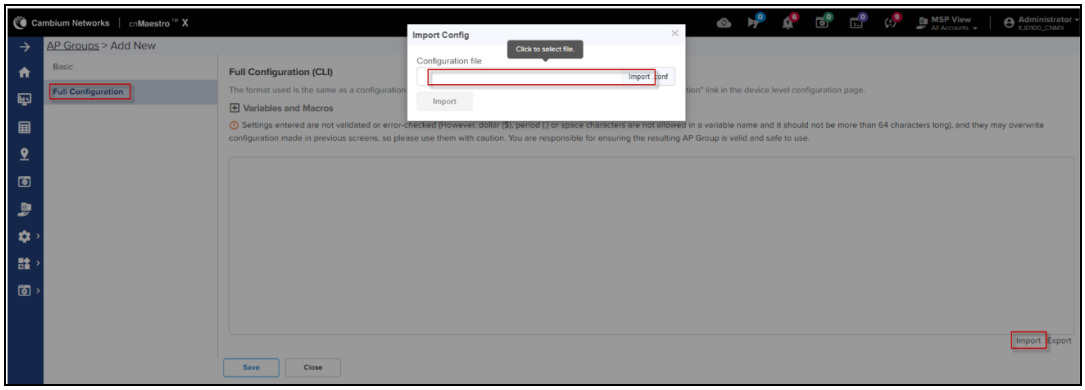
1. Navigate to **Wi-Fi AP Group** > **Base Infrastructure** > click action (⋮) icon to add **Add AP Group**.



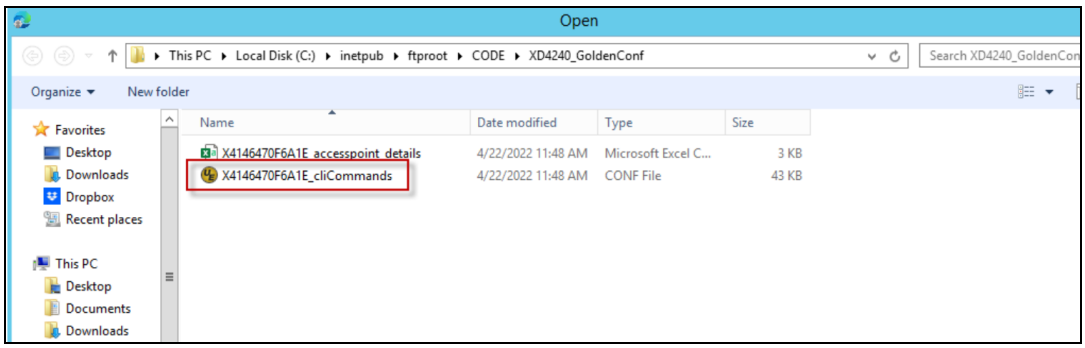
2. In the **Basic Information** page, select Type as **Enterprise Wi-Fi (Xirrus-Series)** from the drop-down.
3. Select the **Auto-Sync.**
4. Click **Save.**



3. In the **Full Configuration** page, click the **Import** option.

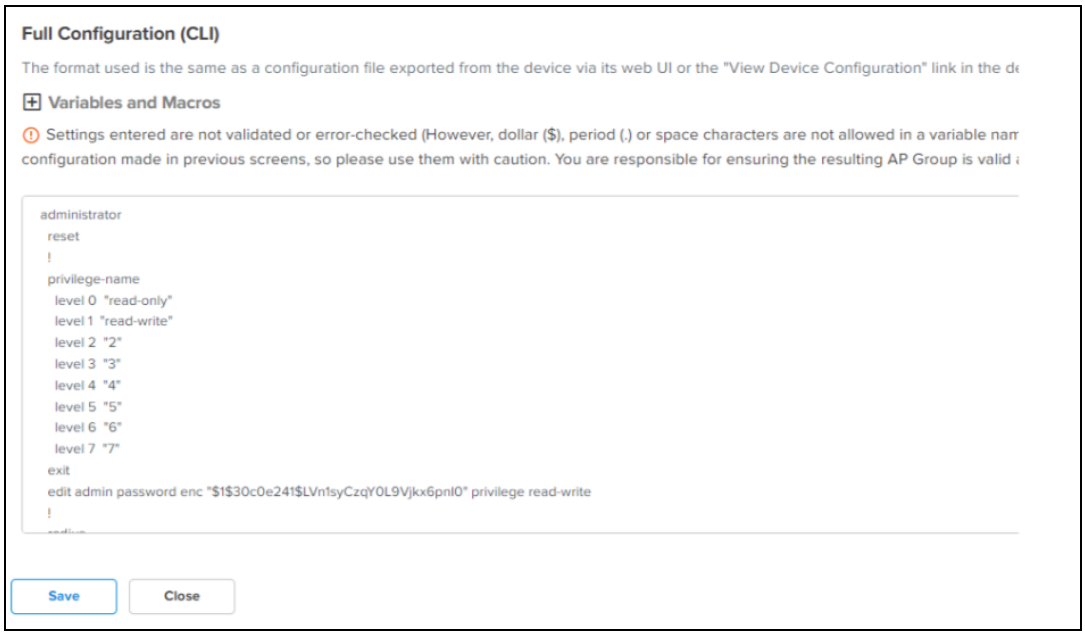


5. Select the CLI command file from the unzipped directory.



5. Click **Import**.

The configuration file is displayed.



6. Click **Save**.

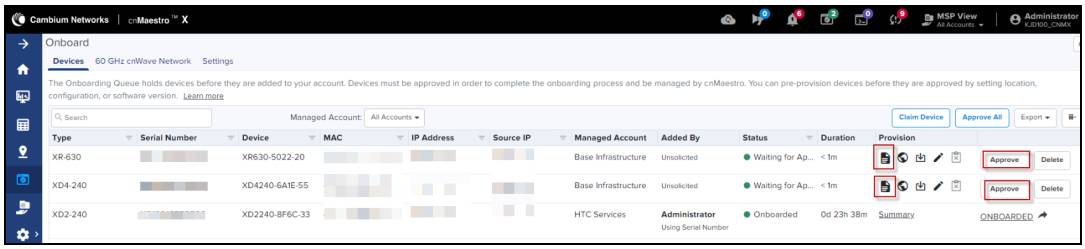
Approve APs into Wi-Fi AP Group

APs pending for approval in cnMaestro X based on the **Migrate APs to cnMaestro X** steps as described above.

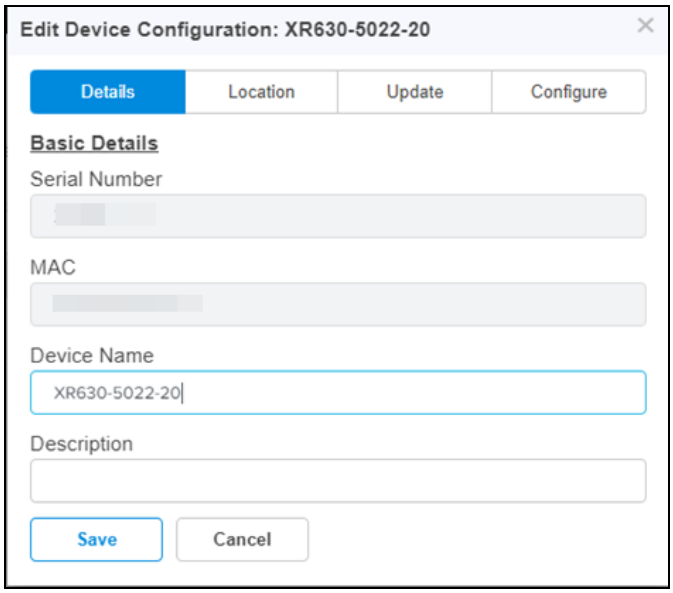
You can claim APs to approve from the **Onboard** > **Devices** page.

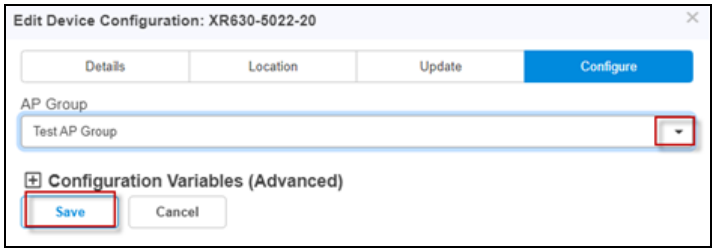
Perform the following steps to approve APs from the **Onboard** > **Devices** page.

1. Navigate to the **Onboard** > **Devices** page and click **Approve All** (to approve all devices at once) or **Approve** (to approve devices individually.)



2. Enter the required details, provision the device for location, and assign to an AP Group.

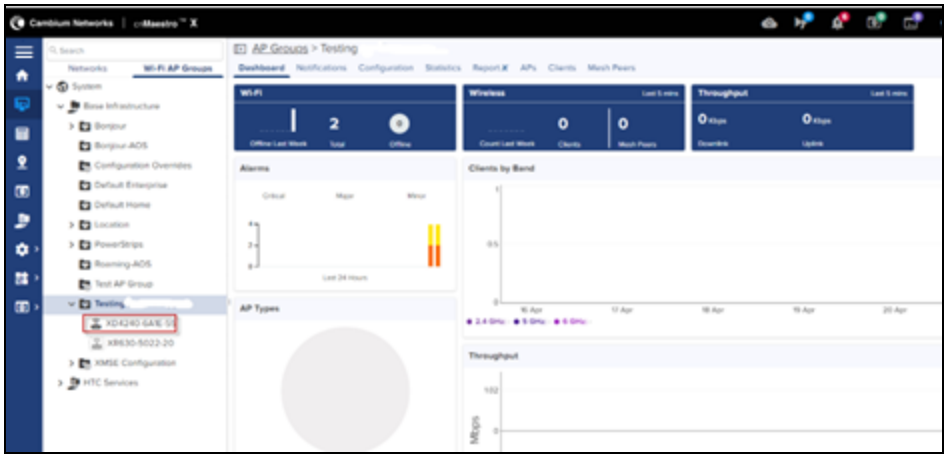




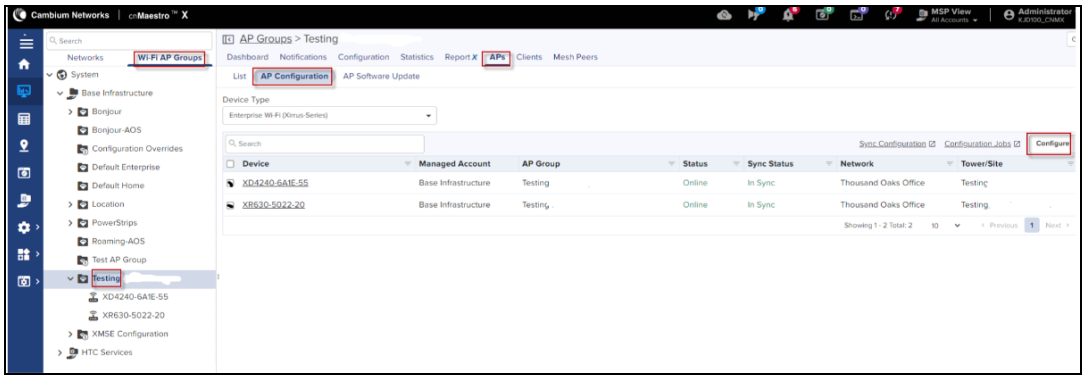
7. Click **Save.**
8. In the **Onboard** > **Devices** page, select **Approval All** (to approve all devices at once) or **Approve** (to approve devices individually.)

Import and Apply AP configuration

APs imported are ready for basic configuration. Import AP configuration using the CSV file from the exported directory.

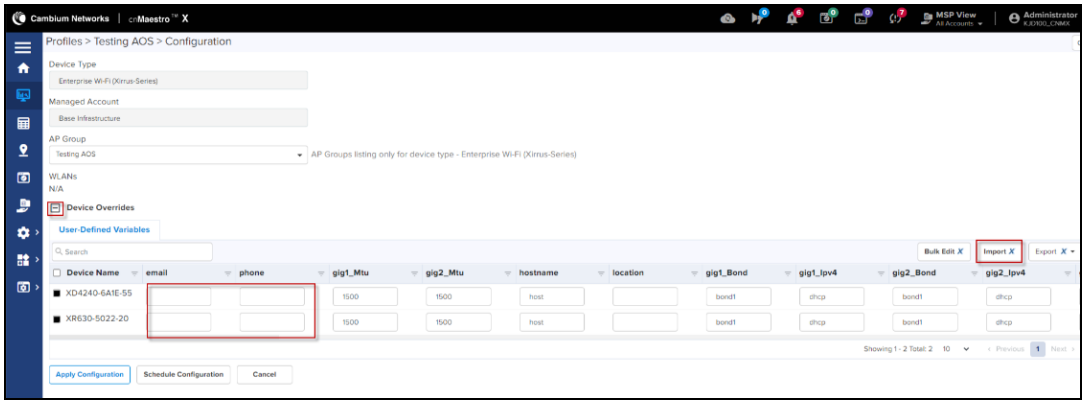


1. Navigate to **Wi-Fi AP Group** > select **AP Group** > **AP Configuration**.
2. Select all APs to configure, click **Configure.**

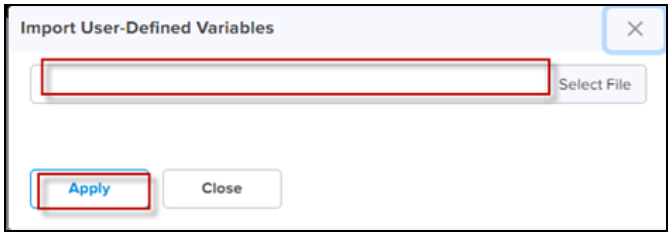


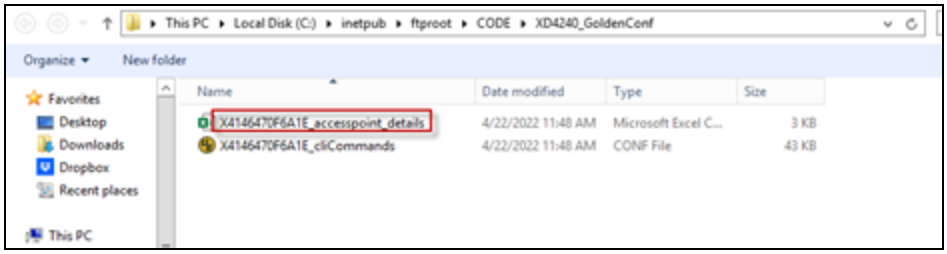
3. In Device Override table, verify AP details and click **Import.**

	NOTE: Email and Phone fields are auto populated from the .csv file.

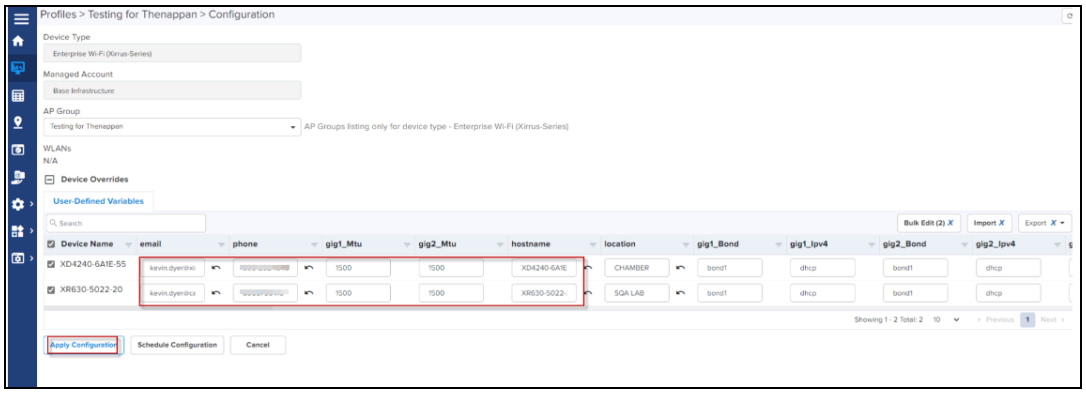


4. Select the .csv import file from the unzipped directory folder and click **Apply**.

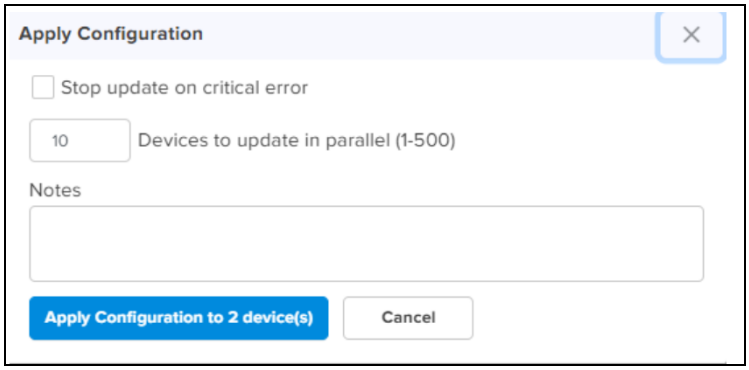




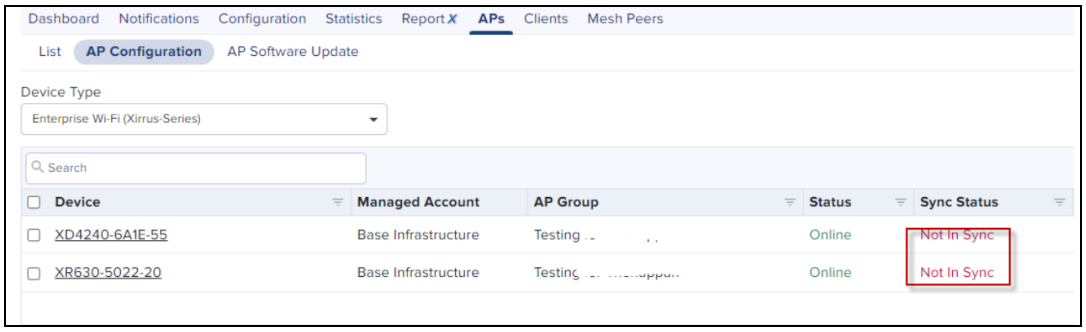
All the configuration values from the CSV file are populated for each AP. The data is auto populated to the **User Defined Variables** tab. The APs receive complete configurations including all IAP settings.



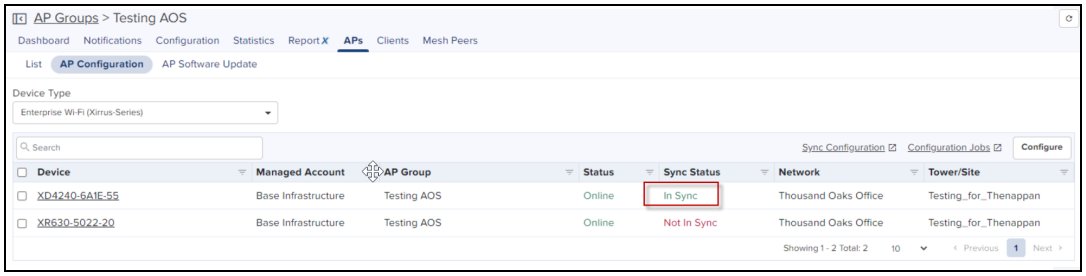
5. Click **Apply Configuration.**



When the APs are completely configured, **Sync Status** is displayed as **In Sync**.



You have to refresh the page to view the updated **Sync Status.**



Converting Tier 2 Unused Slots

Cambium Networks has introduced new product family-based cnMaestro X SKUs and pricing for devices such as Fixed Wireless Broadband APs, cnRanger, cnReach, cnVision, PMP, ePMP, and PTP. Earlier, the Tier 2 subscription was used to control these devices (pricing). To simplify the purchase and onboarding for these devices, Cambium Networks has decided to remove the Tier 2 subscription and introduce new four tiers (Tier 21, Tier 22, Tier 23, and Tier 24).

The Tier 2 subscription is no longer valid now. Due to Tier 2 subscription removal, there can be unused Tier 2 slots in your account (purchased during the Tier 2 subscription). As a solution, Cambium Networks provides an option to convert these unused Tier 2 slots into new tiers based on the device family and requirements. You can manually convert the unused Tier 2 slots to Tier 21, Tier 22, Tier 23, and Tier 24 using the ⓘ icon located on the **Manage Subscriptions** page (cnMaestro UI). This solution helps in better mapping and device management.

NOTE:

The Convert Tier 2 option is effective from March 1, 2024 for Fixed Wireless Broadband APs, cnRanger, cnReach, cnVision, and PTP devices. You must convert the unused Tier 2 slots in your account to the new Tier 2x slots before onboarding the devices.

When you convert the unused Tier 2 slots into new tiers, you cannot change the new tiers back to Tier 2.

You can convert the unused Tier 2 slots to new tiers, for example, as described in Table 138.

Table 138: Example of converting unused Tier 2 slots

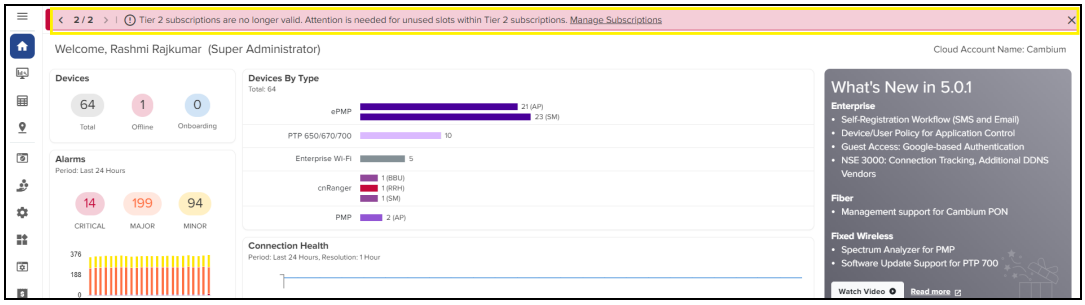
New Tier	Device Family and Type	
Tier 21	cnVision	FLEXr, HUB360
	ePMP	All AP Models
Tier 22	PMP	All AP Models except 450m and 450mv
Tier 23	PMP	450m
Tier 24	cnRanger	All BBU Models
	cnReach	All cnReach Models
	PTP	All PTP Models

To manually convert the unused Tier 2 slots for a device family, complete the following steps:

1. Log in to your respective cnMaestro UI account.

   The **Home** page appears with a banner, as shown in Figure 418.

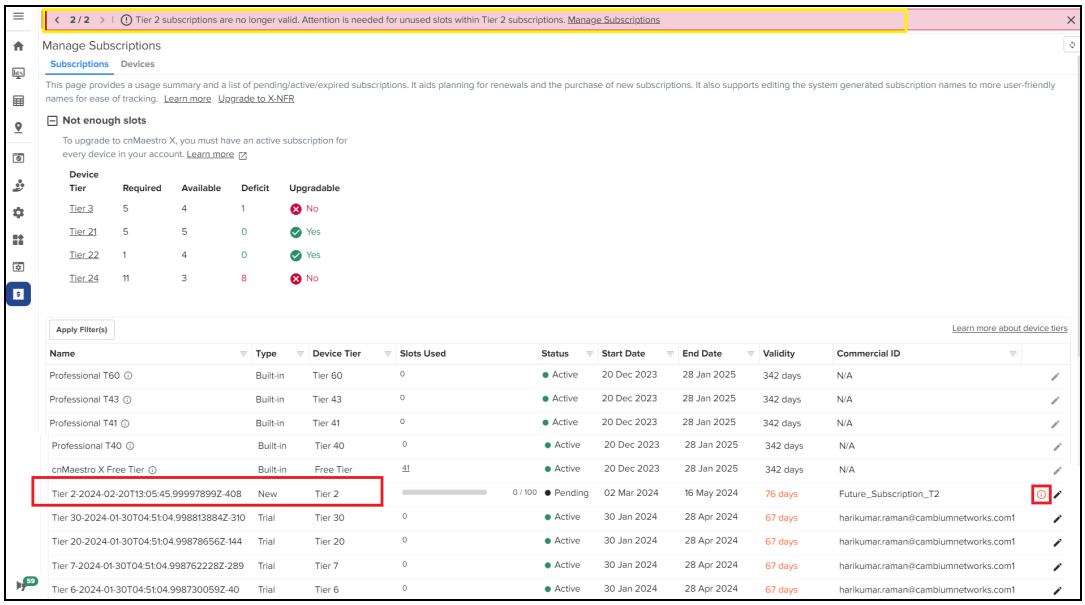
Figure 418 The Tier 2 conversion-specific banner



2. From the home page, navigate to the **Manage Subscriptions** page.

   The **Manage Subscriptions** page appears (as shown in Figure 419), displaying the same banner and details of tiers.

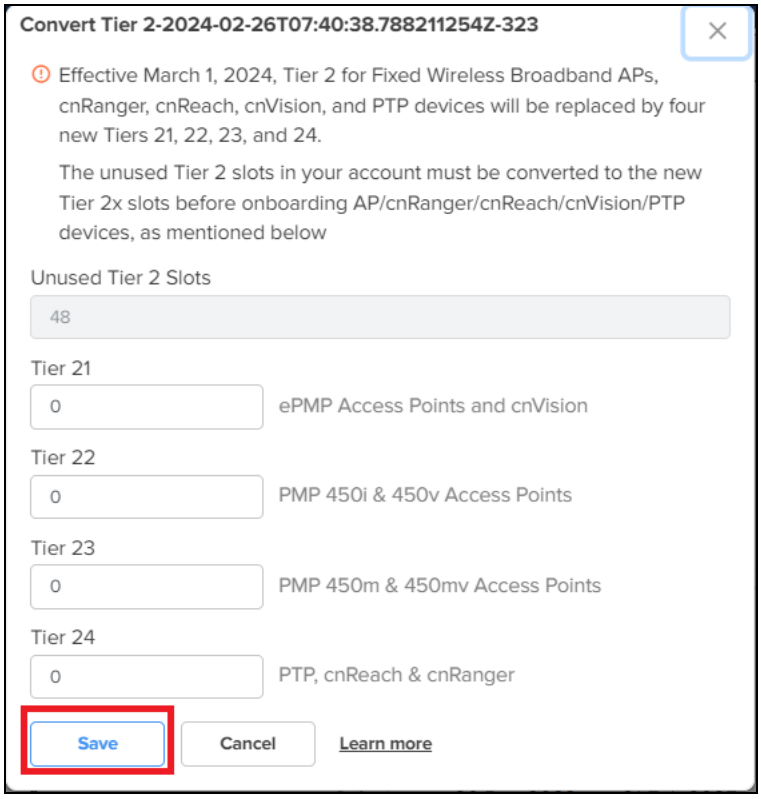
Figure 419 The Manage Subscriptions page with tier information



3. Select the Tier 2 subscription and click the corresponding ⓘ icon (as shown in Figure 419).

   The Tier 2 subscription window appears with details of unused slots and options to convert to new tiers (Tier 21, Tier 22, Tier 23, and Tier 24).

Figure 420 The Convert Tier 2 window



4. Check the unused slot count and enter a valid value (in integers) in Tier 21, Tier 22, Tier 23, or Tier 24 text boxes (based on your requirements).
5. Click the **Save** button (as shown in Figure 420) to apply the changes.

Contacting Cambium Networks

Support Website	https://support.cambiumnetworks.com/
Main Website	http://www.cambiumnetworks.com
cnMaestro Community	http://community.cambiumnetworks.com/t5/cnMaestro/bd-p/cnMaestro
Sales Enquiries	solutions@cambiumnetworks.com
Support Enquiries	support@cambiumnetworks.com
Telephone Number List	http://www.cambiumnetworks.com/support/contact-support
Address	Cambium Networks Limited, Linhay Business Park, Eastern Road, Ashburton, Devon, TQ13 7UP United Kingdom