Cambium Networks

cnPilot Enterprise AP Professional installation Guide

System Release 2.5

- Product Description
- Configuration
- Operation and Troubleshooting

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Safety and Regulatory Information

This section describes important safety and regulatory guidelines that must be observed by personnel installing or operating cnPilot Enterprise AP equipment.

Important Safety Information

⚠️Warning

To prevent loss of life or physical injury, observe the safety guidelines in this section.

Power lines

Exercise extreme care when working near power lines.

Working at heights

Exercise extreme care when working at heights.

Grounding and protective earth

cnPilot Enterprise AP devices must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with national regulations. In the USA, follow Section 810 of the *National Electric Code, ANSI/NFPA No.70-1984* (USA). In Canada, follow Section 54 of the *Canadian Electrical Code*. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. Other regulations may apply in different countries and therefore it is recommended that installation be contracted to a professional installer.

Powering down before servicing

Always power down and unplug the equipment before servicing.

Primary disconnect device

The cnPilot Enterprise AP power supply is the primary disconnect device.

RF exposure near the antenna

Strong radio frequency (RF) fields will be present close to the antenna when the transmitter is on. Always turn off the power to the cnPilot Enterprise AP device before undertaking maintenance activities in front of the antenna.

Important Regulatory Information

The cnPilot Enterprise AP product is certified as an unlicensed device in frequency bands where it is not allowed to cause interference to licensed services (called primary users of the bands).

Radar avoidance

In countries where radar systems are the primary band users, the regulators have mandated special requirements to protect these systems from interference caused by unlicensed devices. Unlicensed devices must detect and avoid co-channel operation with radar systems.

The cnPilot Enterprise AP detects and avoids functionality for countries and frequency bands requiring protection for radar systems. The cnPilot Enterprise AP is qualified for ETSI/FCC DFS certification for radar detection and avoidance as per the law.

Installers and users must meet all local regulatory requirements for radar detection. To meet these requirements, users must set the correct country code during commissioning of the cnPilot Enterprise AP equipment. If this is not done, installers and users may be liable to civil and criminal penalties.

Contact the Cambium helpdesk if more guidance is required.

USA and Canada Specific Information

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

⚠️Caution
Any changes or modifications not expressly approved by the party
responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

This device and it's antennas(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

Note

FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **26 cm** between the radiator & your body.

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. *L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.
Pour les produits disponibles aux États-Unis / Canada du marché, seul le canal 1 à 11 peuvent être exploités. Sélection d'autres canaux n'est pas possible.

This device and it's antennas(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with IC multi-transmitter product procedures.
Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.
les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

CE Statement:

This equipment complies with EU radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Specific expertise and training required for professional installers

To ensure that the cnPilot Enterprise AP is installed and configured in compliance with the requirements of Industry Canada and the FCC, installers must have the radio engineering skills and training described in this section. This is particularly important when installing and configuring an cnPilot Enterprise AP system for operation in the 5 GHz band (5150 – 5250 MHz – FCC only, 5250 – 5350 MHz, 5470 – 5725 MHz and 5725 – 5850 MHz).

Avoidance of weather radars

The installer must be familiar with the requirements in FCC KDB 443999. Essentially, the installer must be able to:

- Access the FCC database of weather radar location and channel frequencies.
- Use this information to correctly configure the product (using the GUI) to avoid operation on channels that must be avoided according to the guidelines that are contained in the KDB and explained in detail in this user guide.

In ETSI regions, the band 5600 MHz to 5650 MHz is reserved for the use of weather radars.

External antennas

When using a connectorized version of the product (as compared to the version with an integrated antenna), the conducted transmit power must be reduced to ensure the regulatory limit on transmitter EIRP is not exceeded. The installer must have an understanding of how to compute the effective antenna gain from the actual antenna gain and the antenna cable losses.

The product GUI automatically applies the correct conducted power limit to ensure that it is not possible for the installation to exceed the EIRP limit, when the appropriate values for antenna gain are entered into the GUI.

Ethernet networking skills

The installer must have the ability to configure IP addressing on a PC and to set up and control products using a web browser interface.

Lightning protection

To protect outdoor radio installations from the impact of lightning strikes, the installer must be familiar with the normal procedures for site selection, bonding and grounding.

Training

The installer needs to have basic competence in radio and IP network installation. The specific requirements applicable to the cnPilot Enterprise AP must be gained by reading this user guide and by performing sample setups at base workshop before live deployments.

Contents

About this User Guide

This User Guide describes the features supported by cnPilot Enterprise AP and provides detailed instructions for setting up and configuring cnPilot Enterprise AP.

Intended Audience

This guide is intended for use by the system designer, system installer and system administrator.

Contacting Cambium Networks

Support website:	http://www.cambiumnetworks.com/support
Main website:	http://www.cambiumnetworks.com
Community:	http://community.cambiumnetworks.com
Sales enquiries:	solutions@cambiumnetworks.com
Support enquiries:	support@cambiumnetworks.com
Telephone number list:	http://www.cambiumnetworks.com/support/contact-support/
Address:	Cambium Networks Limited,
	3800 Golf Road, Suite 360
	Rolling Meadows, IL 60008

Purpose

Cambium Networks cnPilot Enterprise AP documents are intended to instruct and assist personnel in the operation, installation and maintenance of the Cambium cnPilot Enterprise AP equipment and ancillary devices. It is recommended that all personnel engaged in such activities be properly trained.

Cambium disclaims all liability whatsoever, implied or expressed, for any risk of damage, loss or reduction in system performance arising directly or indirectly out of the failure of the customer, or anyone acting on the customer's behalf, to abide by the instructions, system parameters, or recommendations made in this document.

Cross References

References to external publications are shown in *italics*. Other cross references, emphasized in **green text** in electronic versions, are active links to the references.

Feedback

We appreciate feedback from the users of our documents. This includes feedback on the structure, content, accuracy, or completeness of our documents.

For feedback, e-mail to **support@cambiumnetworks.com**.

Problems and Warranty

Reporting Problems

If any problems are encountered when installing or operating this equipment, follow this procedure to investigate and report:

  1   Search this document and the software release notes of supported releases.

  2   Visit the support website:
          http://www.cambiumnetworks.com/support

  3   Ask for assistance from the Cambium product supplier.

  4   Gather information from affected units, such as any available diagnostic downloads.

  5   Escalate the problem by emailing or telephoning support:
          http://www.cambiumnetworks.com/support/contact-support

Repair and Service

If unit failure is suspected, obtain details of the Return Material Authorization (RMA) process from the support website.

Warranty

Cambium's standard hardware warranty is for one (1) year from date of shipment from Cambium or a Cambium distributor. Cambium warrants that hardware will conform to the relevant published specifications and will be free from material defects in material and workmanship under normal use and service. Cambium shall within this time, at its own option, either repair or replace the defective product within thirty (30) days of receipt of the defective product. Repaired or replaced product will be subject to the original warranty period but not less than thirty (30) days.

To register PMP products or activate warranties, visit the support website.

For warranty assistance, contact the reseller or distributor.

⚠️Caution

Do not open the radio housing for repair or diagnostics; there are no serviceable parts within the housing.

Portions of Cambium equipment may be damaged from exposure to electrostatic discharge. Use precautions to prevent damage.

Security Advice

Cambium Networks systems and equipment provide security parameters that can be configured by the operator based on their particular operating environment. Cambium recommends setting and using these parameters following industry recognized security practices. Security aspects to be considered are protecting the confidentiality, integrity, and availability of information and assets. Assets include the ability to communicate, information about the nature of the communications, and information about the parties involved.

In certain instances Cambium makes specific recommendations regarding security practices, however the implementation of these recommendations and final responsibility for the security of the system lies with the operator of the system.

Cambium Networks cnPilot Enterprise AP equipment is shipped with default web management interface login credentials. It is highly recommended that the following default username and password should to be modified prior to system deployment.

Username: admin

Password: admin

Warnings, Cautions, and Notes

The following describes how warnings and cautions are used in this document and in all documents of the Cambium Networks document set.

Warning

Warnings precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:

⚠️Warning

Warning text and consequence for not following the instructions in the warning.

Caution

Cautions precede instructions and are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. A caution has the following format:

⚠️Caution

Caution text and consequence for not following the instructions in the caution.

Note

A note means that there is a possibility of an undesirable situation or provides additional information to help the reader understand a topic or concept. A note has the following format:

 Note

Note text.

Caring for the Environment

The following information describes national or regional requirements for the disposal of Cambium Networks supplied equipment and for the approved disposal of surplus packaging.

In EU Countries

The following information is provided to enable regulatory compliance with the European Union (EU) directives identified and any amendments made to these directives when using Cambium equipment in EU countries.

Disposal of Cambium Equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of Cambium equipment in landfill sites. For disposal instructions, see
http://www.cambiumnetworks.com/support

Disposal of Surplus Packaging

Do not dispose of surplus packaging in landfill sites. In the EU, it is the individual recipient's responsibility to ensure that packaging materials are collected and recycled according to the requirements of EU environmental law.

In non-EU Countries

In non-EU countries, dispose of Cambium equipment and all surplus packaging in accordance with national and regional regulations.

Product Description

This chapter provides a high level description of the cnPilot Enterprise AP product. It describes the function of the product and the main hardware components.

The major topics described in this document are:

- Overview of cnPilot Enterprise AP
- System configuration
- Radio configuration
- WLAN Configuration
- Network Configuration
- Guest Access
- Firewall and ACL
- Firmware Management
- Troubleshooting

Overview of cnPilot Enterprise AP

This section introduces the key features, typical use cases, product variants and components of the cnPilot Enterprise AP.

PURPOSE

cnPilot Enterprise AP is 802.11ac dual band radio Wi-Fi Access point. It is a 2x2:2 (2 spatial streams) device and supports over 1Gbps of data rate. It has one Gigabit Ethernet port that also provides Power over Ethernet.

KEY FEATURES

This section describes the key features of cnPilot Enterprise AP:

- Capacity of cnPilot E400/E500:
    - WLANs: 16
    - Clients: 128 for 11ac radio and 256 for 11n radio
- Capacity of ePMP 1000 Hotspot:
    - WLANs: 8
    - Clients: 128
- Can be managed via Cambium Networks cnMaestro cloud-based network manager.
- Supports device configuration by using CLI or UI.
- Can be monitored via SNMP versions v2 and v3.
- A Client traffic can be controlled through rate-limiting policies, configured per-WLAN or per-client.
- Supports Captive Portal redirection (Guest Access) with WISPr functionality
- Supports L3 services such as NAT, port forwarding, DHCP server, and DNS proxy

- Access to the network can be controlled based on traffic type and MAC address using features such as WLAN and Port Access Control (ACL), DNS based whitelist and blacklist, and DoS attack prevention
- Provides several troubleshooting tools such as Packet Capture, WiFi Analyzer, and Connectivity Tests.
- Supports single hop mesh.
- Supports roaming protocols such as 802.11r (cnPilot E400/E500 only), OKC and Pre-auth
- Supports Protected Management Frame for cnPilot E400/E500 only (802.11w).
- Support Band Steering feature which enables improvement in capacity and throughput.

DEFAULT SETTINGS

The E400/E500 Access Point is setup to obtain its IP address from a DHCP server. A default IP address of 192.168.0.1 will be used if an IP address is not obtained from DHCP. The default username and password for CLI as well as GUI (http/https) access are admin / admin.

 Note

The default IP address for ePMP 1000 Hotspot is 192.168.0.2.

LED STATUS

The E400/E500 Access Point has two dual color LEDs. The power LED will glow Orange as the AP boots up, and turn Green once it has booted up successfully. The network/status LED will glow Orange if the connection to cnMaestro controller/manager is down, and Green once the AP is connected successfully to cnMaestro.

Table 1: ePMP 1000 Hotspot LED Status

LED	Color	Description
Power	Green	Powered up
Eth1	Green	Link up
	Blinking	Link Activity
Eth2	Green	Link up
	Blinking	Link Activity

Table 1: E400/E500 LED Status

LED	Icon	Color	Description
System		Orange	System is starting up.
		Green	Started up successfully and operational.
Network		Orange	Not connected to cnMaestro.
		Green	Connected and Managed by cnMaestro.

Command Line Interface (CLI)

Overview

The cnPilot Enterprise AP supports a powerful and structured Command Line Interface (CLI) that can be used for managing the device over SSH or Telnet.
The CLI can be used to configure any system parameter, to view the system status and statistics, and for actions such as reloading the device, or importing and exporting configuration from it. Several troubleshooting tools such as packet-capture and ping are also supported in the CLI.

The CLI is hierarchical, in addition to a global mode for system-wide commands, there are separate modes for Wireless LAN, Radio, Etherent, VLAN, and DHCP server configuration. These specific modes are entered by specifying the instance of the mode.

Use the following CLI to configure wireless LAN 1 parameters:

```
•       cnWest-5ghz(config)#
•       cnWest-5ghz(config)# wireless wlan 1
•       cnWest-5ghz(config-wlan-1)#
```

Use the following CLI to exit from a mode back to the global context type *exit* command:

```
•       cnWest-5ghz(config-wlan-1)# exit
•       cnWest-5ghz(config)#
```

The default login and password for the CLI are **admin**. The password can be changed using the *management user admin password* command.

- Entering **?** displays the command menu and any context specific help.
- Pressing **<TAB>** completes a partially typed CLI command wherever possible.
- Commands to view system status and statistics begin with *show*.
- Commands to default or negate a configuration begin with *no*.

Example

Some of the commonly used CLI commands are:

Show config — Displays system configuration
Save — Used to apply and save any configuration changes
Show version — Displays the basic device information and firmware version

System Configuration

This section describes the System, Management, Time Settings, and Event Logging functionalities of cnPilot Enterprise AP.

System

The following table lists the fields that are displayed in the **Configuration > System** page:

Table 1: Configuration: **System** parameters

Parameter	Description	Default Value
Name	Hostname of the device. The maximum length of name is 64 characters.	—
Location	The location where the device is placed. The maximum length of location is 64 characters.	—
Contact	Contact information for the device.	—
Country-Code	To be set by the administrator to the country-of-operation of the device. The allowed operating channels and the transmit power levels on those channels depends on the country of operation. Radios remain disabled unless this is set. The list of countries supported depends on the SKU of the device (FCC, ROW etc).	—
PoE Output (Only for ePMP 1000 Hotspot)	Enable to make the AP provide power an auxiliary device connected to its ETH2 interface. Note that the Eth2 interface provides Cambium PoE (not standard 802.3af) and only supported Cambium devices should be plugged into that port, when POE-Out is enabled (devices such as other ePMPs, PMP450-SM).	—
LED	Select the LED checkbox for the device LEDs to be **ON** during operation.	—

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configuration > System** tab. The following fields are displayed in **System**:
a. Enter the hostname of the device in the **Name** text box.
b. Enter the location where this device is placed in the **Location** text box.
c. Enter the contact details of the device is placed in the **Contact** text box.
d. Select the appropriate country code for the regulatory configuration from the **Country-Code** text box.

e.   Select the LED checkbox for the device LEDs to be **ON** during operation.

2.   Click **Save**.

Figure 1: Configuration: **System** page

In the CLI

To change the hostname:

(cnPilot Enterprise AP) (configure)# hostname <name>

To change the location:

(cnPilot Enterprise AP) (configure)# location

To change the country-code:

(cnPilot Enterprise AP) (configure)# country-code

To view the list of all country-codes:

(cnPilot Enterprise AP) # show country-code

Management

The following table lists the fields that are displayed in the **Configuration > System > Management** page:

Table 2: Configuration: **System > Management** parameters

Parameter	Description	Default Value
Admin Password	Password for authentication of UI and CLI sessions.	admin
Telnet	Enable Telnet access to the device CLI.	Disabled
SSH	Enable SSH access to the device CLI.	Enabled
HTTP	Enable HTTP access to the device UI.	Enabled
HTTPS	Enable HTTPS access to the device UI.	Enabled
Cambium Remote Mgmt	Enable support for Cambium Remote Management of this device.	Disabled

Cambium ID	Cambium-ID used for provisioning cnMaestro (Cambium Remote Management) of this device.	—
Cambium Password	Password used for onboarding the device to cnMaestro.	—
SNMP		
V2 RO Community	SNMP v2c read-only community string	—
V2 RW Community	SNMP v2c read-write community string	—
V3 Username	SNMP v3 username	—
V3 Password	SNMP v3 password	—
Auth	Choose MD5 or sha	MD5
Access	Choose RO or RW	RO
Encryption	Choose ON or OFF	ON

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configuration > System** tab. The following fields are displayed in **Management**:
a. Enter the admin password of the device in the **Admin Password** text box.
b. Enable the **Telnet** checkbox to enable telnet access to the device CLI.
c. Enable the **SSH** checkbox to enable ssh access to the device CLI.
d. Enable the **HTTP** checkbox to enable HTTP access to the device UI.
e. Enable the **HTTPS** checkbox to enable HTTPS access to the device UI.
f. Under cnMaestro, enable **Remote Management** to support for Cambium Remote Management of this device.
g. Enter the URL for cnMaestro in the **cnMaestro URL** text box.
h. Enter the Cambium ID of the user in the **Cambium ID** text box.
i. Enter the Onboarding Key in the **Onboarding Key** text box.
j. Enter the SNMP v2c read-only community string in the **V2 RO community** text box.
k. Enter the SNMP v2c read-write community string in the **V2 RW community** text box.
l. Enter the SNMP V3 username in the V3 Username text box.
m. Enter the SNMP V3 password in the V3 Password text box.
n. Choose **MD5** or **SHA** from the **Auth** drop-down list.
o. Choose **RO** or **RW** from the **Access** drop-down list.
p. Choose **ON** or **OFF** from the **Encryption** drop-down list.
2. Click **Save**.

Figure 2: Configuration: **Management** page

In the CLI

To configure management:

(cnPilot Enterprise AP) (configure)# management {telnet, ssh, http. https}

To configure Cambium-ID:

(cnPilot Enterprise AP) (configure)# cambium-id CAMBIUM-ID PASSWORD

Time Settings

The user can configure upto 2 NTP servers. These are used by the AP to set its internal clock to UTC/GMT time. Note that the AP does not have a battery backup, and on power-cycle its clock will reset to default and needs to sync time again. The servers can be specified as IP addresses or as hostname (Eg: pool.ntp.org).

The following table lists the fields that are displayed in the Configuration > System > Time Settings page:

Table 3: Configuration: **System > Time Settings** parameters

Parameter	Description	Default Value
NTP Server 1	Name or IP address of a Network Time Protocol server 1.	—
NTP Server 2	Name or IP address of a Network Time Protocol server 2.	—

| Timezone | Timezone can be set according to the location where the AP is installed. By selecting the appropriate timezone from the drop-down list, ensures that the device clock is synced with the wall clock time. | — |
| | **Note:** Accurate time on the AP is critical for features such as WLAN Scheduled Access, Syslogs etc | |

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configuration > System** tab. The following fields are displayed in **Time Settings**:
   a. Enter the name or IP address of the NTP server 1 in the **NTP Server 1** text box.
   b. Enter the name or IP address of the NTP server 2 in the **NTP Server 2** text box.
   c. Select the time zone settings for the AP from the **Timezone** drop-down list.
2. Click **Save**.

Figure 3: Configuration: **Time settings** page

Time Settings

NTP Server 1	pool.ntp.org	Name or IP address of a Network Time Protocol server
NTP Server 2	ntpserver1	
Timezone	Asia/New Delhi ▼	

Current System Time Mon 17 Aug 2015 06:24:07 UTC

In the CLI

To configure NTP server:

(cnPilot Enterprise AP) (configure)# ntp <server>

To configure Timezone:

(cnPilot Enterprise APv) (configure)# timezone

To view the current system time:

(cnPilot Enterprise AP) # show clock

Event Logging

The user can configure upto 2 Syslog servers on the device. All important events regarding device operation will be logged into these servers as standard RFC5424 complaint syslog messages.

Each message has a mnemonic indicating the type of message, a severity from 0-7 (see the syslog wikipedia page for details of this. 0-emergency, 7-debugging etc), as well as a text indicating details of the event.

Table 4: Configuration: System > Event logging parameters

Parameter	Description	Default Value
Syslog Server 1	IP address of syslog server 1.	—
Syslog Server 2	IP address of syslog server 2.	—

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configuration > System** tab. The following fields are displayed in **Event Logging**:
   a. Enter the IP address of the syslog server 1 in the **Syslog Server 1** text box.
   b. Enter the IP address of the NTP server 2 in the **Syslog Server 2** text box.
2. Click **Save**.

Figure 4: Configuration: Event logging page

In the CLI

To configure Event Logging:

(cnPilot Enterprise AP) (configure)# logging host <ipaddr>

To delete a previous entry of the event logging:

(cnPilot Enterprise AP) (configure)# no logging host <ipaddr>

To view a previous entry of the event logging:

(cnPilot Enterprise AP) # show logging

Onboarding to cnMaestro

Overview

cnMaestro is Cambium's next generation network management platform based on Cloud technologies. It will eventually replace the entire lineup of Network Management Tools. The initial release will include support for ePMP and cnPilot family of devices. Subsequent releases will add the remaining devices in the Cambium portfolio. The legacy and 3rd party devices will be supported by a proxy application.

In addition to the Cloud deployment, the solution will also be able to be deployed as a standalone, redundant server solution for deployments where access to the Internet is restricted or forbidden.

Onboarding Steps

You can onboard cnPilot Enterprise AP to cnMaestro using the following steps:

1. To enable Cambium Remote Management:

   (cnPIlot Enterprise AP) # management cambium-remote

2. If the device does not have a unique Serial Number (MSN), then set the cambium-id/password obtained from Cambium Support:

3. If the device is claimed and is able to reach the cnMaestro, it will get on-boarded. The cnMaestro connection status can be seen under "Cambium Remote Management Status".

To view the connection status:

(cnPIlot Enterprise AP) # cambium-id <cambium-id> <password>
(cnPIlot Enterprise AP # management cambium-remote
url https://cloud.cambiumnetworks.com

(cnPIlot Enterprise AP) # apply
(cnPIlot Enterprise AP) # save
(cnPIlot Enterprise AP) # show management

Remote Management

Config : Enabled
URL   : https://cloud.cambiumnetworks.com
Status: Not Connected

Wireless Configuration

The wireless settings are divided into the following:

- Radio configuration
- WLAN configuration

Radio Configuration

cnPilot Enterprise AP is a dual band radio solution which operates on 5GHz and 2.4GHz bands concurrently. The dashboard menu in the UI displays the channel and band from the CLI, **show wireless radios** displays the details of the radio.

The following table lists the fields that are displayed in the **Configure > Radio** page and select **Radio 1(2.4GHz)** or **Radio 2(5GHz)** from the drop-down list.

Table 5: Configure: **Radio** parameters

Parameter	Description	Default Value
Enable	Enables operation of this radio.	—
Channel	Primary operating channel.	Auto
Channel Width	Operating width of the channel.	20MHz for 2.4GHz and 80MHz for 5GHz
Transmit Power	Radio transmit power in dBm (1 to 30)	—(*)
Beacon interval	Beacon interval in ms (100 to 3400)	100
Multicast Data Rate	Multicast in highest-basic, lowest-basic and highest-supported.	Highest Basic for 2.4GHz and Lowest Basic for 5GHz

 Note:
Due to FCC restrictions on the maximum EIRP for elevation angles greater than 30deg above the horizon the professional installer must manually set the maximum power.
IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE FCC REQUIREMENTS DESCRIBED ABOVE ARE MET
Application: Outdoor operation in the 5150-5250MHz band.
Country code: United States of America
The EIRP for all outdoor antennas used in the 5.15 - 5.25 GHz band should Not exceed a maximum 125 mW ERIP (21dBm) at any elevation angle above 30 degrees (21dBm).
(*)E.g
E502s antenna gain: 17 dBi
The frequency band 5150 – 5250 MHz when antenna above 30 degrees from the horizon power must be reduced.
Transmit power can only choose 1 in UI.

The default channel configuration is set to auto, with this the AP sets the radio to best available channel based on the interference and Noise Floor.

The country-code set in **System** page effects channel selection. Only the channels that are allowed in the country code should be selected.

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > Radio** tab and select **Radio 1(2.4GHz)** or **Radio 2(5GHz)** from the drop-down list. The following fields are displayed in **Radio**:
   a. Select the **Enable** checkbox to enable the operations of this radio.
   b. Select the primary operating channel from the **Channel** drop-down list.

    c. Select the operating width (20 MHz, 40 MHz, or 80 MHz) of the channel from the **Channel Width** drop-down list for 5 GHz only. We do not support 40 MHz and 80 MHz in 2.4 GHz.

    d. Enter the radio transmit power in the **Transmit Power** text box.

    e. Enter the antenna gain of connected antenna in the **Antenna Gain** text box.

2. Enter the beacon interval in the **Beacon Interval** text box.

3. Select **Highest Basic** or **Lowest Basic** or **Highest Supported** from the **Multicast data rate** drop-down list.

4. Click **Save**.

Figure 5: Configure: **Radio** page

You can configure the radio parameters through the UI or CLI.

In the CLI

To configure radio:

(cnPilot Enterprise AP) (configure)# wireless radio 1

Advanced Radio Settings

You can configure the following advanced radio settings on cnPilot Enterprise AP:

- **Scheduled ACS (Auto Channel Select**) - When Scheduled ACS is configured, the radio scans all the channels available in the frequency band and selects the best available channel. Scheduled ACS can be configured to scan on-startup or periodic. (Run channel selection on specified days at specified time).

Table 6: Configure: **Radio > Auto Channel Select** parameters

Parameter	Description	Default Value
Candidate Channels	Select available channel.	—
Periodic	Run channel selection on specified days at specified time.	—

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > Radio** tab. The following fields are displayed:
   a. Select the **Channel** as **Auto**.
   b. Select **No Clients** radio button if clients are not connected.
2. Click **Save**.

Figure 6: Configure: **Auto Channel Select** page

In the CLI

To configure Auto Channel Select:

(cnPilot Enterprise AP) (configure)# wireless radio 1

(cnPilot Enterprise AP) (config-radio-1)# channel-list

(cnPilot Enterprise AP) (config-radio-1)# auto-channel-select

- **Enhanced Roaming** - When enhanced roaming is enabled, the clients are forced to roam when the SNR is below the configured value. This is useful when clients are connected to the AP that is far away and stick to that AP. With enhanced roaming, the AP disconnects the client is the SNR is less than the configured which makes client to find the better AP and roam to it. This is useful in a dense environment and multi-AP setup. It is disabled by default and user should understand his deployment topology and then only enable this,

user should enable only if he is sure what they want and the threshold should to be set accordingly.

The following table lists the fields that are displayed in the **Configure > Radio > Enhanced Roaming** page:

Table 7: Configure: **Radio > Enhanced Roaming** parameters

Parameter	Description	Default Value
Enable	Enable active disconnection of clients with weak signal.	Disabled
Roam SNR Threshold	SNR below which clients will be forced to roam (1-100 dB).	—

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > Enhanced Roaming** tab. The following fields are displayed:
   a. Select the **Enable** checkbox to enable active disconnection of clients with weak signal.
   b. Enter **Roam SNR Threshold** value between 1-100.
2. Click **Save**.

Figure 7: Configure: **Radio > Enhanced Roaming** tab

In the CLI

To configure Enhanced Roaming:

(cnPilot Enterprise AP) (configure)# wireless radio 1

(cnPilot Enterprise AP) (config-radio-1)# enhanced-roaming

(cnPilot Enterprise AP) (config-radio-1)# enhanced-roaming threshold

WLAN Configuration

This section provides details on configuring WLAN Configuration parameters.

The following table lists the fields that are displayed in the **Configure > WLAN** page:

Table 8: Configure: **WLAN Configuration** parameters

Parameter	Description	Default Value
Enable	To enable a particular WLAN.	Disabled
SSID	The SSID of this WLAN (Upto 32 characters).	—
VLAN	Default VLAN assigned to clients on this WLAN. (1-4094).	—
Security	Displays the security type • Open • WPA2 Pre-shared Keys • WPA2 Enterprise	—
Passphrase	WPA2 Pre-shared Security passphrase or key.	—
Radios	Defines radio types (2.4GHz, 5GHz) on which this WLAN should be supported.	—
Max Clients	Max Client assigned to this WLAN. (0-255)	127
Client Isolation	Prevents wireless clients from communicating with each other. The client devices does not connect with each other.	—
Hide SSID	Prevents broadcasting SSID in beacons.	Disabled
Proxy ARP	Responds to ARP requests automatically on behalf of clients	—
UAPSD	To enable or disable U-APSD	Disable
QBSS	To enable or disable QBSS	Disable
DTIM interval	Configure DTIM interval	1
Band Steering	Steer dual band capable clients towards 5GHz radio.	—
Fast-Roaming Protocol	One of the important aspect to support voice applications on Wi-Fi network (apart from QoS) is how quickly a client can move its connection from one access point to another. This should be less than 150 msec to avoid any call drop. This is easily achievable when WPA2-PSK security mechanism is in use. However, in enterprise environments there is a need for more robust security (the one provided by WPA2-Enterprise). With WPA2-Enterprise, the client exchanges multiple frames with AAA server and hence	—

	depending on the location of AAA server the roaming-time will be above 700 msec. Select any one of the following: • Pre-authentication: This roaming method was proposed in 802.11i standard. Access points supporting this method indicates their capability using pre-authentication flag in RSN capabilities element of the RSN-IE • OKC: This roaming method is a proprietary solution to bring scalability to the roaming problem. This method avoids the need to authenticate with AAA server every time a client moves to new access point. • 802.11r: This is the IEEE standard for fast roaming, introduces a new concept of roaming where the initial handshake with the new AP is done even before the client roams to the target AP, which is called Fast Transition (FT).	
802.11 w State	802.11 w, also termed as Protected Management Frames (PMF) Service, defines encryption for management frames. Unencrypted management frames makes wireless connection vulnerable to DoS Attacks as well as they cannot protect important information exchanged using management frames from eavesdroppers. Select any one of the following: • Disable • Optional • Mandatory	—

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > WLAN** tab. The following fields are displayed:
   a. Select the **Enable** checkbox to enable a particular WLAN.

      b.   Enter the SSID name for this WLAN in the **SSID** textbox.

      c.   Enter the default VLAN assigned to the clients on this WLAN in the **VLAN** textbox.

      d.   Select the security type as Open, WPA2 Pre-shared Keys, or WPA2 Enterprise from the **Security** drop-down list.

      e.   Select the **Client Isolation** checkbox to prevent wireless clients from connecting to each other.

      f.   Select the **Hide SSID** checkbox for not broadcast SSID in beacons.

      g.   Select **Proxy ARP** checkbox for responding to ARP requests automatically on behalf of clients.

      h.   Select the **UAPSD** checkbox to enable UAPSD.

      i.   Select the **QBSS** checkbox to enable QBSS.

      j.   Enter the value in the **DTIM interval** text box to configure DTIM interval.

      k.   To enable band steering feature, select **Band Steering** checkbox.

      l.   Select the type of Fast-Roaming Protocol as **Pre-authentication**, **OKC,** or **802.11r**.

      m.   Select **802.11w State** as **Disable**, **Optional**, or **Mandatory**.

2.   Click **Save**.

Figure 8: Configure: WLAN Configuration page

In the CLI

To configure wlan:

(cnPilot Enterprise AP) (configure)# wireless wlan 1

To configure SSID:

(cnPilot Enterprise AP) (config-wlan-1)# ssid<name>

To configure security:

(cnPilot Enterprise AP) (config-wlan-1)# security wpa2-psk

(cnPilot Enterprise AP) (config-wlan-1)# passphrase <string>

To view the client status:

(cnPilot Enterprise AP) (config)#show wireless clients

To view the client statistics

(cnPilot Enterprise AP) (config)#show wireless clients statistics

To configure 802.11w:

(cnPilot Enterprise AP) (config)# protected-mgmt-frames sa-query-retry-time msecs

(cnPilot Enterprise AP) (config)# protected-mgmt-frames association-comeback secs

(cnPilot Enterprise AP) (config)# [no] protected-mgmt-frames state optional | mandatory

To configure Fast Roaming Protocol:

(cnPilot Enterprise AP) (config)# *fast-roaming pre-authentication*

(cnPilot Enterprise AP) (config)# *fast-roaming okc*

(cnPilot Enterprise AP) (config)# *fast-roaming 802.11r*

(cnPilot Enterprise AP) (config)# *fast-roaming 802.11r over-the-ds*

(cnPilot Enterprise AP) (config)# *fast-roaming 802.11r reassociation-timeout x # Reassociation time out in secs*

Configuring RADIUS Servers

RADIUS accounting allows user activity and statistics to be reported from the device to RADIUS servers.

This section provides details on configuring parameters for RADIUS Servers.

The following table lists the fields that are displayed in the **Configure > WLAN > RADIUS Servers** page:

Table 9: Configure: **RADIUS Servers** parameters

Parameter	Description	Default Value
Authentication Server	IP address of the host for the authentication server.	—
Timeout	Timeout in seconds of each request attempt.	—
Attempts	Number of attempts before a request is given up.	—
Accounting Server	IP address of the host for the accounting server.	—
Timeout	Timeout in seconds of each request attempt.	—

Attempts	Number of attempts before a request is given up.	—
Accounting Mode	**start-stop:** **Start-interim-stop:** **None:**	
Server Pool Mode	**Load Balance:** Load balance requests equally among configured servers. **Failover:** Move down server list when earlier servers are unreachable.	—
NAS Identifier	NAS-Identifier attribute to use in request packets. Defaults to system name.	—
Interim Update Interval	Interval for accounting interim stats update (60-65535).	120

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > WLAN > RADIUS Servers** tab. The following fields are displayed:
   a. Enter the IP address of the host for the authentication server in the **host** textbox.
   b. Enter the shared key for this host in the **Shared** textbox.
   c. Enter the Port in the **Port** textbox.
   d. Enter the time in seconds of each request attempt in **Timeout** textbox.
   e. Enter the number of attempts before a request is given up in the **Attempts** textbox.
   f. Enter the IP address of the host for the accounting server in the **host** textbox.
   g. Enter the shared key for this host in the **Shared** textbox.
   h. Enter the Port in the **Port** textbox.
   i. Enter the time in seconds of each request attempt in **Timeout** textbox.
   j. Enter the number of attempts before a request is given up in the **Attempts** textbox.
   k. Select any one of the Server Pool Mode:
   • Load Balance
   • Failover
   l. Enter the interval for accounting interim stats update (60-65535) in the **Interim Update Interval** textbox.
   m. Enter the NAS identifier in the **NAS Identifier** textbox.
   n. Select the **Dynamic Auth** checkbox to configure dynamic authorizationfor wireless clients.
2. Click **Save**.

Figure 9: Configure: **RADIUS Servers** page

In the CLI

To configure RADIUS server:

(cnPilot Enterprise AP) (configure)# wireless wlan 1

(cnPilot Enterprise AP) (config)#wireless wlan <WLAN_IDX>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication host <1-3> <HOSTIP>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication port <1-3>
<1-65535>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication secret <1-3> <WORD>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication realm <1-3> <WORD>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication timeout <1-30>
(cnPilot Enterprise AP) (config-wlan)#radius-server authentication attempts <1-3>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting host <1-3> <HOST-IP>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting port <1-3> <1-65535>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting secret <1-3> <WORD>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting realm <1-3> <WORD>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting timeout <1-30>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting attempts <1-3>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting interim-update-interval
<60-65535>
(cnPilot Enterprise AP) (config-wlan)#radius-server accounting mode <start-stop|startinterim-
stop|none>

Wireless Mesh

Overview

With System release 2.0, cnPilot access points as well as the ePMP1000 Hotpot support mesh connections between radios. A single mesh hop is supported in release 2.0 with experimental support for multiple mesh hops. Mesh links can form between radios of the same band of operation (2.4GHz or 5GHz), but the two peers of the mesh link don't have to be of the same AP-type: a link between an ePMP1000 Hotspot and cnPilot E400/E500 is supported. Given the larger set of available channels and typically cleaner RF environment we recommend using the 5GHz radio for mesh backhaul if the AP is 5GHz-capable, such as the E400/E500.

A mesh link can be created between two radios by configuring one of them as a BASE and the other as a CLIENT on the first WLAN of the AP. Typically the access point which has wired connectivity would be configured as a mesh base. The radio setup for mesh base will select a channel and start transmitting beacons as soon as the AP comes up. The radio setup for mesh client will scan all available channels, looking for a mesh base radio to connect with. The SSID in the mesh WLAN is how the client and base radios of a mesh link identify each other, the same SSID should be configured on the mesh BASE WLAN as well as the mesh CLIENT WLAN.

In addition to a simple topology between a base and a client, a "star" or "hub-and-spoke" mesh topology is also supported: a mesh radio can service upto 5 mesh clients connected to it. When a radio is configured with a mesh WLAN, on that WLAN other clients are not allowed to connect, however the radio can service clients on other WLANs mapped to it. Note that a client radio will start rescanning all available channels as soon as it loses connectivity to the base. During this scan period other WLANs mapped to it will not be operational.

The mesh link can be also be secured with WPA2-Preshared-Keys. The same passphrase should be configured on both the mesh BASE as well as the mesh CLIENT. Standard 802.11 security handshakes and AES-CCM encryption are then used on the mesh link."

Deployment

The following diagram illustrates the working scenario of wireless mesh network:
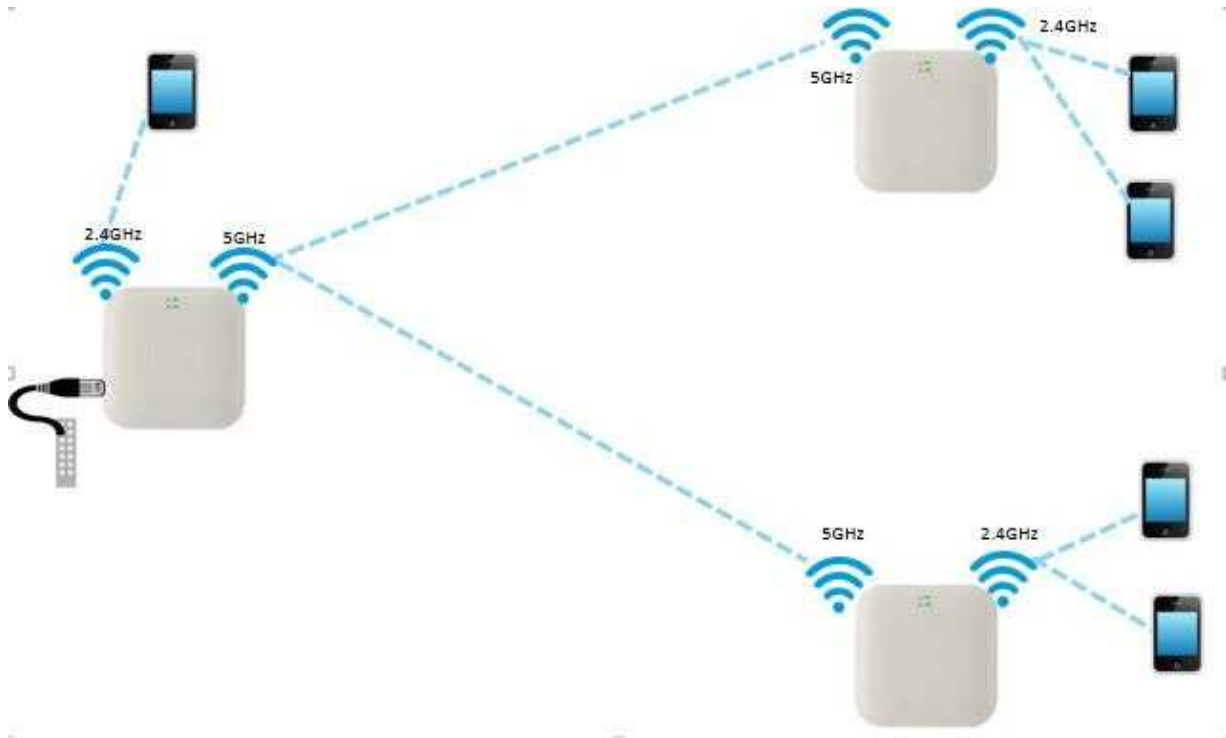
The following diagram shows the list of connected mesh peers in the dashboard:

Figure 10: Mesh Peers

Typical Use-Cases

- WiFi access in areas with no cable run
- Small retail location with one AP near an Ethernet outlet, another in the middle of lobby that has no easy cablerun.

- Extend range outdoors
- An ePMP1000 Hotspot in a parking lot outside a building, with E400/E500 providing WiFi within the building
- Plug coverage holes
- Add an AP indoor/outdoor for the areas that are difficult to reach

Configuring Wireless Mesh

The following table lists the fields that are displayed in the **Configure > WLAN > Basic** page:

Table 10: Configure: **WLAN > Basic** parameters

Parameter	Description	Default Value
Mesh	Configures the Mesh feature. Select Base, Client or Off from the Mesh list.	—
SSID	The WLAN name that is seen by the wireless clients.	—
VLAN	The VLAN ID to be used for this WLAN.	1
Security	Select the security type for this client.	—
Passphrase	The WPA2 pre-shared security passphrase or key.	—
Radios	The RADIO type on which this WLAN should be supported.	—
Hide SSID	Select this option for not broadcasting the SSID in beacons.	—

The wireless Mesh can be configured by using the UI or the CLI.

To configure the Mesh Client or Mesh Base:

In the UI

1. Navigate to the **Configure > WLAN > Basics** tab. The following fields are displayed:
a. Select **Enable** checkbox.
b. Choose **Base**, **Client** or **Off** from the **Mesh** drop-down list.
c. Enter the name of the **WLAN** in the SSID textbox.
d. Select the security type for this client as **open** or **WPA2 Pre-Shared Keys** from the **Security** drop-down list.
e. Enter the WPA2 pre-shared passphrase or key in the **Passphrase** textbox.
f. Choose the RADIO type (5GHz or 2.4GHz) on which the WLAN should be supported from the **Radios** drop-down list.
g. Select the **Hide SSID** checkbox for not broadcasting the SSID.
2. Click **Save**.

Figure 11: Configure: **WLAN > Basic** page

In the CLI

To configure Mesh:

(cnPilot Enterprise AP) (configure)# wireless wlan 1

(cnPilot Enterprise AP) (config-wlan-1)# {base,client}

Notes

1. In SW release 2.0, a single mesh hop is supported, multiple hops can be configured but support is experimental.
2. There is a large throughput drop when using a radio for client access as well as mesh link (over 50%) since each packet would traverse the air twice, once from the client to the AP, then from the AP to its mesh peer.
3. Access Points have to be configured independently for mesh, a new AP will not connect out-of-the-box with an existing mesh network. Mesh mode (client/base), the SSID and the security configuration has to be done from the device GUI or CLI.

Usage Limit

Usage Limit is a WLAN feature that allows to configure the maximum threshold value of bandwidth allowed either per client or per WLAN in both downlink and uplink traffic directions.

| Basic | Radius Server | Guest Access | Usage Limits | Scheduled Access | Access |

Rate Limit per client   Upstream: [0]   Kbps

Downstream: [0]   Kbps

Rate Limit for WLAN   Upstream: [0]   Kbps

Downstream: [0]   Kbps

[Save]   [Cancel]

Guest Access

Guest access feature is used to provide a web-based network access control process where a client is redirected to a login page to gain network access. The clients can have a simple click-through login process or a RADIUS authentication based access mode. Without a login no network traffic is allowed from the client apart from DHCP and DNS packets. Traffic to specific IP addresses can be allowed using the whitelist configuration for the un-authenticated clients.

Configuring Guest Access

Administrator can configure a set of whitelist IP address which guest access clients can access without doing a login. This configuration also becomes handy when an external web portal is being used for providing the login/welcome pages. Administrator can give a secured http connection for the login where the communication between the access point and the client will be secured. Administrator can also configure the page title and welcome message as per his own requirements.

The following table lists the fields that are displayed in the **Configure > WLAN > Guest Access** page:

Table 11: Configure: **Guest Access** parameters

Parameter	Description	Default Value
Enable	Enables the Guest Access feature.	Disable
Access Policy	There are two types of access types provided for the end user, click-through and another being the RADIUS authentication mode. The click-through can also be combined with additional terms and condition content which can tell end users the terms of the network usage.	—
Redirect Mode	You can use http or https URLs for redirection.	—
Splash Page	Select **On Device** or **URL** radio button.	—
Title	Title text in splash page.	—
Contents	Main contents of the splash page.	—
Terms	The admin can configure his own text for the terms and condition in the CLI/UI or he can load terms and condition content file from CLI using a service command. If a terms and condition content file is loaded then it will be common across all WLAN configuration if guest access is enabled on them.	—
Success Action	Select any one of the following: • Internal Logout Page	—

	• Redirect User to External URL • Redirect user to Original URL	
Success message	The message to be displayed in the login page after successful authentication.	—
Session Timeout	Administrator can configure a limited session time for each session after which a re-login will be enforced.	—
Inactivity Timeout	Administrator can also configure an inactivity time for deleting those clients which went away without doing a proper guest access logout and free up the consumed resources by that client. Such a configuration is very helpful for public hotspots where free network is provided and clients go away without doing a logout.	—

The RADIUS server configuration is used for RADIUS access type guest access and one can also enable RADIUS accounting for the guest access clients.

You can configure the above parameters through the UI or CLI.

In the UI

1. Navigate to the **Configure > WLAN > Guest Access** tab. The following fields are displayed:
   a. Select **Enable** checkbox to enable guest access feature.
   b. Choose the Access Policy as **Click through** or **Radius.**
   c. Choose the Redirect Mode as **HTTP** or **HTTPS**.
   d. Choose the login page to be on device login page or an external URL.
   e. Enter the title to appear in the splash page in the **Title** textbox.
   f. Enter the content to appear in the splash page in the **Contents** textbox.
   g. Enter the terms and conditions to appear in the splash page in the **Terms** textbox.
   h. Enter the success message to appear in the **Success Message** textbox.
   i. Enter the session timeout in seconds in the **Session Timeout** textbox.
   j. Enter the inactivity timeout in seconds in the **Inactivity Timeout** textbox.
2. Click **Save**.

To configure the whitelist parameter:

1. Enter the IP address or the domain name of the permitted domain in the IP Address or Domain Name textbox.
2. Click Save.

Figure 12: Configure: **Guest Access** page

In the CLI

To configure Guest Access:

(cnPilot Enterprise AP) (configure)# wireless wlan 1
(cnPilot Enterprise AP) (config)#wireless wlan <WLAN_IDX>
(cnPilot Enterprise AP) (config-wlan)#guest-access access-type <click-through|radius>
(cnPilot Enterprise AP) (config-wlan)#guest-access connection-mode <http|https>
(cnPilot Enterprise AP) (config-wlan)#guest-access splash-page terms-message <TEXT>
(cnPilot Enterprise AP) (config-wlan)#guest-access splash-page text <TEXT>
(cnPilot Enterprise AP) (config-wlan)#guest-access splash-page title <TITLE>
(cnPilot Enterprise AP) (config-wlan)#guest-access splash-page URL <URL>
(cnPilot Enterprise AP) (config-wlan)#guest-access success-action <redirect-url|
logout-page>
(cnPilot Enterprise AP) (config-wlan)#guest-access success-action logout-page text
<TEXT>
(cnPilot Enterprise AP) (config-wlan)#guest-access session-time <60-86400>
(cnPilot Enterprise AP) (config-wlan)#guest-access inactivity-time <60-28800>

(cnPilot Enterprise AP) (config-wlan)#guest-access whitelist <IP_ADDRESS>

Network Configuration

This section introduces the configuration of various network elements such as Ethernet ports, SVIs, DHCP servers, DNS proxy, management VLAN access, NAT, and port forwarding. Depending of the use case, the required elements can be configured.

Ethernet Ports

The following table describes the parameters displayed in the **Network Configuration > Ethernet Configuration** page.

Table 12: Configure: **Ethernet Ports** parameters

Parameter	Description	Values
Mode	Configure Ethernet port in either trunk or access mode. **Trunk Mode**: Allows traffic with different user defined VLANs (refer allowed VLANs list) to egress & ingress. One of these VLANs can be defined as native VLAN. Traffic with native VLAN will map to untagged traffic based on whether native VLAN is tagged or untagged. **Access Mode**: Allows traffic with specific user defined VLAN (called access VLAN) to egress as untagged and allowed only untagged traffic to ingress and map to access VLAN.	trunk/access Default mode for Eth1 and Eth2 is access.
Access VLAN*	Untagged traffic on access port will map to the access VLAN inside the device.	1 - 4094
Allowed VLANs^	List of all VLANs which are allowed to ingress and egress from the trunk port and are separated by commas. E.g. 1,14,100,200-567	VLAN List
Native VLAN^	Marks one of the VLANs from allowed VLAN list as native VLAN.	1-4094
Native Tagged^	Maps native VLAN traffic of device to untagged traffic on Ethernet (when enabled) otherwise keep it tagged on Ethernet side.	Enable/Disable
*: valid only in access mode ^: valid only in trunk mode		

Figure 13: Configure: **Network Configuration** page
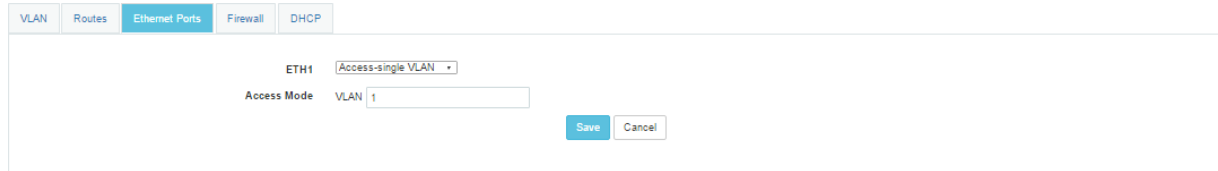
In the CLI

To switch from configuration context to interface context:
(cnPilot Enterprise AP) (configure)# interface eth port-num

To configure port mode (default is trunk mode):
(cnPilot Enterprise AP) (configure)# switchport mode *access/trunk*

To configure default VLAN of access port (default 1):
(cnPilot Enterprise AP) (configure)# switchport access vlan *vlan-id*

To configure allowed VLAN range for trunk port (defaults 1 to 4094):
(cnPilot Enterprise AP) (configure)# switchport trunk allowed vlan *vlan-range*

To specify native VLAN for the trunk port (default 1):
(cnPilot Enterprise AP) (configure)# switchport trunk native vlan *vlan-id*

To enable native VLAN tagging:
(cnPilot Enterprise AP) (configure)# switchport trunk native tagged

To disable native VLAN tagging:
(cnPilot Enterprise AP) (configure)# no switchport trunk native tagged

To display L2 parameters of the ports:
(cnPilot Enterprise AP) (configure)# show interface brief

Switched Virtual Interface (SVI)

SVI represents virtual interfaces each mapped to a specific VLAN. Each SVI can have static IP or assigned from external DHCP server.

Table 13: Configure: **SVI** parameters

Parameter	Description	Values
IP Mode / Address	Configures either IP mode to DHCP or static IP to the SVI. Note: Each SVI should have IP in unique subnet.	dhcp or ip-addr/mask

zeroconf	Creates additional zeroconf IP (169.254.x.y) on the interface alias. Only valid for SVI with VLAN 1.	Enable/Disable

You can configure the above parameters through the CLI.

In the CLI

To switch from configuration context to SVI context:
(cnPilot Enterprise AP) (configure)# interface vlan *vlan-id*

To configure IP address mode to DHCP client:
(cnPilot Enterprise AP) (configure)# ip address dhcp

To configures static IP address with a network mask of x bits:
(cnPilot Enterprise AP) (configure)# ip address *a.b.c.d* /x

To configures zeroconf (169.254.x.y) IP on SVI:
(cnPilot Enterprise AP) (configure)# ip address zeroconf

To disable zeroconf IP on an interface:
(cnPilot Enterprise AP) (configure)# no ip address zeroconf

To display all the created SVIs along with their VLAN and IP address information:
(cnPilot Enterprise AP) (configure)# show ip interface brief

Figure 14: Configure: **Network > VLAN** page
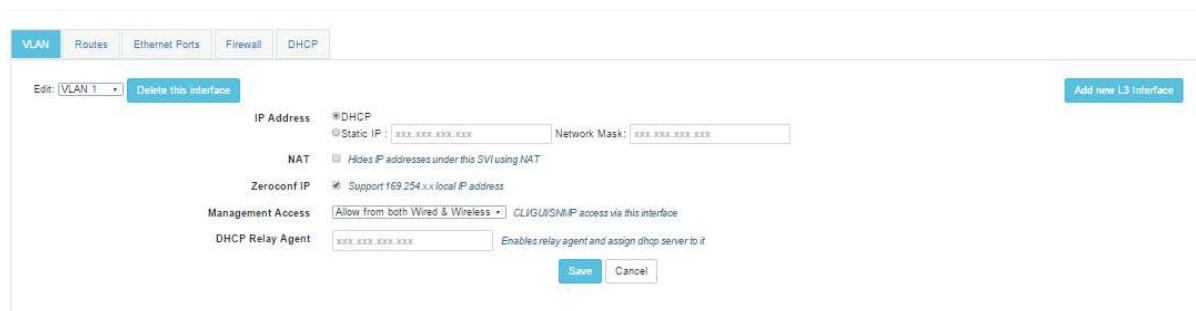
DHCP Server

Configures on board DHCP server on a particular SVI. User can configure different DHCP servers on up to 16 SVIs. Mapping between DHCP server and SVI is done through SVI IP address & network parameter of DHCP server configuration.

Table 14: Configure: **DHCP Server** parameters

Parameter	Description	Values
IP Address Range	Specifies the range of IP address to be used for assigning to the clients.	start-ip-address to end-ip-address

Default Router IP	Specifies IP address of the default gateway to be assigned to the clients	ip-addr
Primary & Secondary DNS Server IP	Specifies IP address of the domain name servers. Default values: 8.8.8.8 & 8.8.4.4 (when dns proxy is configured at device) SVI IP & none (when dns proxy is not configured on device)	ip-addr1 ip-addr2 (optional)
Domain Name	Specifies the domain name to be assigned to clients.	string
Lease Time	Specifies the lease time.	days – hours - minutes
network	Specifies subnet of SVI to which this DHCP server should attach.	ip-addr/mask
MAC-IP Bindings	Specifies specific binding between MAC address and IP address.	mac-addr ip-addr

You can configure the above parameters through the CLI.

In the CLI

To switch from configuration context to DHCP pool context:
(cnPilot Enterprise AP) (configure)# ip dhcp pool *pool-num*

To configure IP address range to be assigned to the clients:
(cnPilot Enterprise AP) (configure)# address-range *a.b.c.d A.B.C.D*

To configure default router IP to be assigned to clients. Default router, if present in address range is excluded.
(cnPilot Enterprise AP) (configure)# default-router *a.b.c.d*

To configure primary and secondary DNS server IP to be assigned to clients. Default Value: 8.8.8.8 for primary & 208.67.222.222 for secondary:
(cnPilot Enterprise AP) (configure)# dns-server *primary-server-ip secondary-server-ip*

To configure domain name to be assigned to clients:
(cnPilot Enterprise AP) (configure)# domain-name

To configure lease time:
(cnPilot Enterprise AP) (configure)# lease *days hrs min*

To specify subnet (SVI) to attach with DHCP server:
(cnPilot Enterprise AP) (configure)# network *a.b.c.d /x*

To bind IP address with MAC address. Up to 32 bindings can be specified:
(cnPilot Enterprise AP) (configure)# bind *xx:xx:xx:xx:xx:xx a.b.c.d*

To destroy the specified DHCP pool:
(cnPilot Enterprise AP) (configure)# *no ip dhcp pool pool-num*

To display the pool status, SVI on which DHCP pool is attached & assigned leases to all client from this pool:
(cnPilot Enterprise AP) (configure)# show dhcp-pool *pool-num*

Figure 15: Configure: **Network > DHCP** page

DHCP Relay

DHCP relay allows DHCP server in one subnet to be shared by clients in other subnet by relaying DHCP requests. Relay agent configuration is specific to SVI. i.e. any SVI / subnet looking for DHCP server in different subnet needs to have relay agent configured for it.

Table 15: Configure: **DHCP Relay** parameters

Parameter	Description	Value
DHCP Server IP	Specifies the IP address of the DHCP server which should be used of the given subnet. **Note:** It automatically enables relay w/o any additional command.	ip-address

You can configure the above parameters through the CLI.

In the CLI

To switch from configuration context to SVI context.
(cnPilot Enterprise AP) (configure)# interface vlan *vlan-id*

To configure DHCP relay for the SVI with *a.b.c.d* as the DHCP server IP address.
(cnPilot Enterprise AP) (configure)# ip dhcp relay server *a.b.c.d*

To display relay:
(cnPilot Enterprise AP) (configure)# no ip dhcp relay

DNS Proxy

DNS proxy enables local caching of DNS entries from all the interfaces configured on the device. For the queries which cannot be answered from the local cache, external servers are referred.

Table 16: Configure: **DNS Proxy** Parameters

Parameter	Description	Value
State	Configures the state of DNS proxy on the device.	Enable/Disable
External name server	IP address of external name server to be referred by DNS proxy. Up to two name server can be defined. Additionally, any name servers passed by external DHCP servers will also be used as external DHCP server.	Ip-address

You can configure the above parameters through CLI.

In the CLI

To enable DNS server / proxy:
(cnPilot Enterprise AP) (configure)# ip dns server

To disable DNS server / proxy:
(cnPilot Enterprise AP) (configure)# no ip dns server

To configure single external name server:
(cnPilot Enterprise AP) (configure)# ip name-server *a.b.c.d*

Figure 16: Configure: **Network > VLAN** page

Management VLAN Access

The management VLAN access allows to restrict device access using a given set (one or more) VLANs. Additionally, access using a given VLAN can be allowed only from wired connection.

Table 17: Configure: **Management VLAN Access** Parameters

Parameter	Description	Values
state	Management VLAN access is per SVI configuration.	Disable / allow-from-wired / allow-

	Disabled: No access of device using this SVI's VLAN Allow-from-wired: Access of device is allowed from wired side using this SVI's VLAN Allow-from-both-wired-wireless: Access of device is allowed from both wired & wireless side using this SVI's VLAN	from-both-wired-wireless

You can configure the above parameters through the CLI.

In the CLI

To switch from configuration context to SVI context:
(cnPilot Enterprise AP) (configure)# interface vlan *vlan-id*

To enable management access through given SVI. Access from both wired and wireless is allowed:
(cnPilot Enterprise AP) (configure)# management-access all

To enable management access through given SVI. Access from only wired side is permitted:
(cnPilot Enterprise AP) (configure)# management-access wired

To disable management access through given SVI:
(cnPilot Enterprise AP) (configure)# no management-access

NAT and Port Forwarding

NAT allows to hide IP addresses of a subnet while accessing IP addresses in another subnet. Each SVI / Subnet needs to be individually configured for NAT.

You can configure NAT using the UI and CLI:

In the UI

Figure 17: Configure: **NAT**
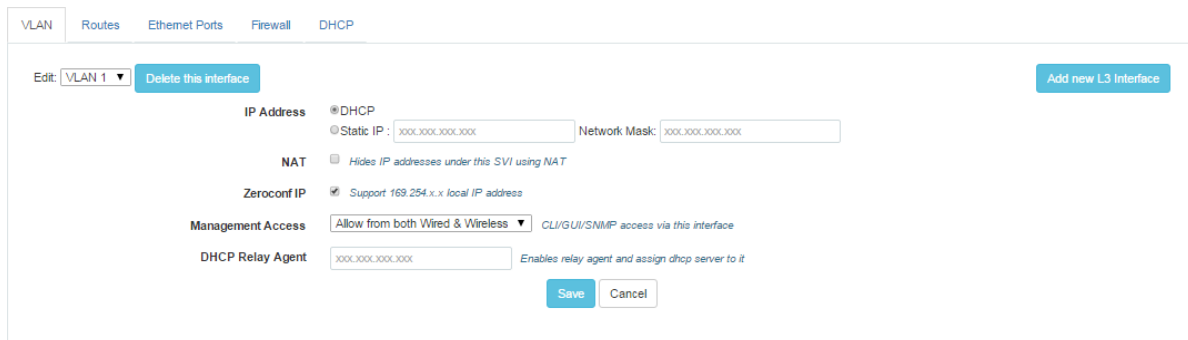
In the CLI

To switch from configuration context to SVI context:

(cnPilot Enterprise AP) (configure)# interface vlan *vlan-id*

To enable NAT for the SVI:
(cnPilot Enterprise AP) (configure)# ip nat inside

To disable NAT for the SVI:
(cnPilot Enterprise AP) (configure)# no ip nat

Port Forwarding allows to forward traffic with specific TCP / UDP ports to specific server in NAT enabled subnet. As oppose to NAT which is SVI specific, port forwarding is a global configuration.

You can configure NAT using UI and the CLI:

In the UI

1.   Navigate to the **Configure > Network > Routes** tab. The following fields are displayed:

   a.   Enter the port number in the **Port** textbox.
   b.   Enter the IP address in the **IP Address** textbox.
   c.   Select the type as TCP or UDP from the **Type** drop-down list.

2.   Click **Save**.

Figure 18: Configure: **Network > Port Forwarding** page

In the CLI

To forward TCP port-num to a.b.c.d server:
(cnPilot Enterprise AP) (configure)# ip port-forward tcp *port-num a.b.c.d*

To forward UDP port-num to a.b.c.d server:
(cnPilot Enterprise AP) (configure)# ip port-forward udp *port-num a.b.c.d*

To disable forwarding of TCP port-num to a.b.c.d server:
(cnPilot Enterprise AP) (configure)# no ip port-forward tcp *port-num a.b.c.d*

To disable forwarding of UDP port-num to a.b.c.d server
(cnPilot Enterprise AP) (configure)# no ip port-forward udp *port-num a.b.c.d*

Firewall

Firewall options are used to configure options to protect form denial of service (DoS) attacks. By configuring these options AP prevents attacks on its Ethernet and wireless interface so that it does not enter in DoS state for its wireless clients.

Configuring Firewall

You can configure Firewall using the UI or CLI:

In the UI

1. Navigate to the **Configure > Network** tab. The following fields are displayed:

a. To enable IP spoof, select **IP Spoof** checkbox.
b. To enable smurf attack protection, select **Smurf Attack** checkbox.
c. To enable IP spoof log, select **IP Spoof Log** checkbox.
d. To enable fragmented ping attack protection, select **ICMP Fragment** checkbox.

2. Click **Save**.

Figure 19: Configure: **Network > Firewall** page
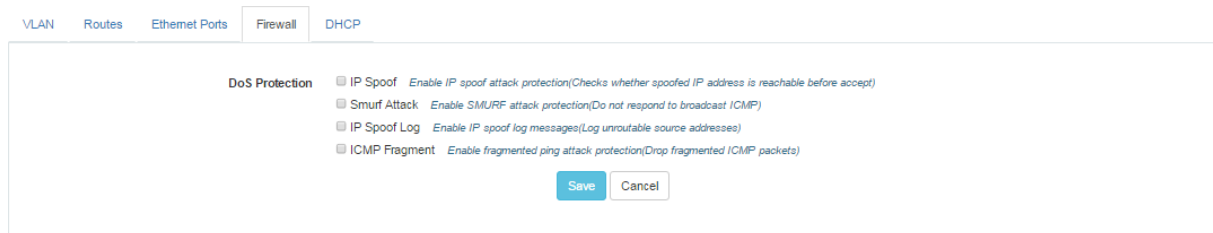
In the CLI

(cnPilot Enterprise AP) (configure)# firewall dos-protection {icmp-frag, ip-spoof, ip-spoof-log, smurf-atttack}

ACL

ACL provides basic traffic filtering capabilities based on selected type of ACL, for example if user configures an IP ACL then from A.B.C.D. IP address to M.N.O.P IP address traffic will be dropped. The AP examines each packet to determine whether to forward or drop the packet, on the basis of the criteria such as:

*   Allow or Deny criterion

*   Source or Destination IP address of the traffic

*   Source or Destination MAC address of the traffic

*   Upper-layer protocol types

- Source or destination port information.

A maximum of 256 rules per network interface and rules are processed in the order of precedence (1=high; 256=low).

Configuring ACL

You can configure ACL using the UI and the CLI.

In the UI

1. Navigate to the Configure > WLAN > Access tab. The following fields are displayed:
   a. Select preference from the Preference drop-down list.
   b. Select type of policy from Policy drop-down list.
   c. Select direction from the Direction drop-down list.
   d. Select type from the Type drop-down list.
   e. Enter IP address of source in the Source IP text box.
   f. Enter IP address of destination in the Destination IP text box.
2. Click Save.

Figure 20: Configure: **Network > ACL** page

In the CLI

(cnPilot Enterprise AP) (config-wlan-1# acl {deny, permit}

(cnPilot Enterprise AP) (config-wlan-1# acl deny {ip, mac, proto}

(cnPilot Enterprise AP) (config-wlan-1)# acl permit ip

  acl permit ip PRECEDENCE (SOURCE-IP{/{mask|prefix-length}}|any) (DESTINATION-IP{/{mask|/prefix-length}}|any) (in|out|any)

 Example: acl permit ip 255 any any any

(cnPilot Enterprise AP) (config-wlan-1)# acl permit proto

acl permit proto PRECEDENCE (tcp|udp|icmp|any) (SOURCE-IP{/{mask|prefix-length}}|any) (SOURCE-PORT|any) (DESTINATION-IP{/{mask|prefix-length}}|any) (DESTINATION-PORT|any) (in|out|any) #Please ignore port for ie

Example: acl permit proto 30 tcp any any any 10000 out

 Note

If ACL rules are configured and there is no matching rule exist then by default packets will be dropped. So it is advised to add default rule with lower priority to allow or deny un-matched traffic.

DNS ACL

DNS ACL gives URL filtering based on the domain name in DNS Requests. User can configure allow or deny list based on the requirements. If a domain has been configured as **allow** then the wireless clients can load that URL. If a domain has been kept as **deny** then those URLs will be blocked by AP Wildcards as domain names are supported (Eg: *.google.com). You can configure upto 256 entries per WLAN.

Configuring DNS ACL

You can configure DNS ACL using the UI or CLI:

In the UI

3. Navigate to the Configure > WLAN > Access tab. The following fields are displayed:

    a. Select preference from the Preference drop-down list.
    b. Select type of action from Action drop-down list.
    c. Enter domain name in the Domain text box.

4. Click Save.

Figure 21: Configure: Network > DNS-ACL page

In the CLI

(cnPilot Enterprise AP) (config-wlan-1# dns-acl {deny, permit}

Firmware Management

The running software on the cnPilot Enterprise AP can be upgraded to newer firmware from either the CLI or the UI. When upgrading from the CLI the user must specify a TFTP or FTP server from where the firmware file would be downloaded by the Access Point. When upgrading from the UI the user can upload the firmware file from the browser. The same process can be followed to downgrade the Access Point to a previous firmware version if required. Configuration is maintained across the firmware upgrade process.

> **Note**
> Once a firmware upgrade has been initiated, the Access Point should not be rebooted or power cycled until the process completes, as this might leave the Access Point inoperable.

You can configure the above parameters through the UI or CLI.

In the UI

5. Navigate to the **Operations > Firmware Upgrade** tab. The following fields are displayed:
6. To upgrade the firmware manually:
   Click **Browse** and select the downloaded image file.
7. To upgrade the firmware automatically:
   Click Upgrade Firmware.
8. You can view the status of upgrade in the **Upgrade Status** field.
9. Click **Save**.

Figure 22: Operations: Firmware Upgrade page

In the CLI

To upgrade firmware:

(cnPilot Enterprise AP) (configure)# upgrade

System

You can reboot the device, download tech support from the device, and disconnect all the wireless clients under the **Operations > System** page of the UI.

Figure 23: Configure: **Operations> Systems** page
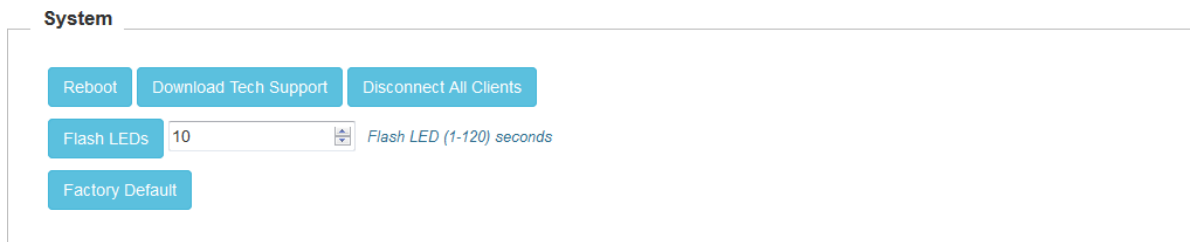
Troubleshooting

The following types of troubleshooting tools are supported:

1. **Packet Capture**: Allows the administrator to capture all packets on a specified interface. A decode of the packet indicating the network addresses, protocol types etc is displayed. The administrator can filter the packets being captured by specifying a particular MAC address, IP address, port number etc. The number of packets that are captured can also be capped, so the console or system is not overwhelmed. Packets captured on the ETH interfaces are packets that are being transmitted or received on the physical interface of the device. Packets captures on the WLAN interfaces are data packets on a particular WLAN as they are bridged on the radio interface of the device.

Figure 24: Troubleshooting> Packet Capture page

Troubleshoot / Packet Capture

Interface : Ethernet ▾ Ex : 1
Count : Ex : 100
Filter : Ex : icmp[icmptype] == 8
NOTE: Packet capture is aborted after 60 seconds, if the count has not reached. Summary will not be available when aborted.

Start Capture

Packet Capture Result

2. **Logs and Events**: The system generates event-messages for any notable activity on the device from client associations and authentications to system configuration changes. These logs are:
   1. Forwarded to cnMaestro for later viewing and filtering
   2. Buffered on the device and can be viewed using 'show logging' in the CLI
   3. Transmitted to any configured syslog servers.

Figure 25: Logs page
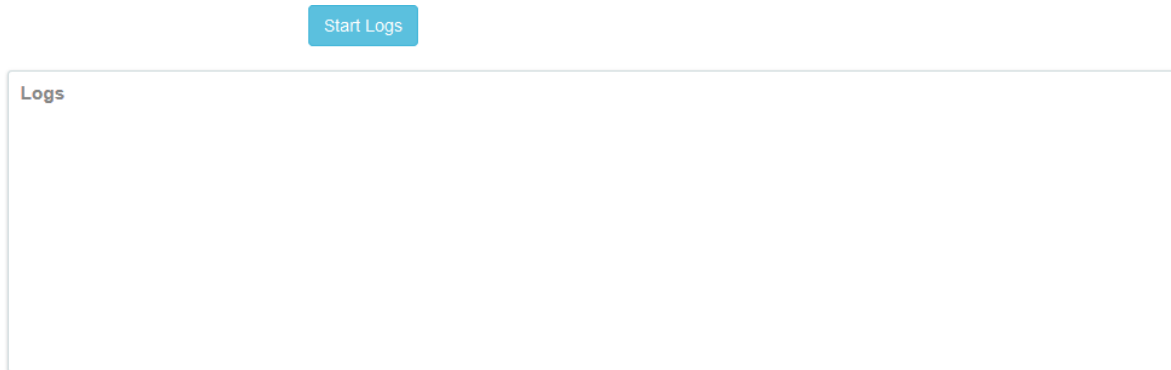
3. **Configuration Import, Export, Delete**: The device configuration can either be exported from the device as a text file of CLI commands, or imported into the device from a previous backup. The delete configuration option will factory-reset the device. All configuration, configured onboarding parameters are reset to default when the configuration is deleted and the device rebooted. Note that when a configuration file is imported onto the device, a reboot is necessary to activate that new configuration.

Figure 26: Import/Export Configuration
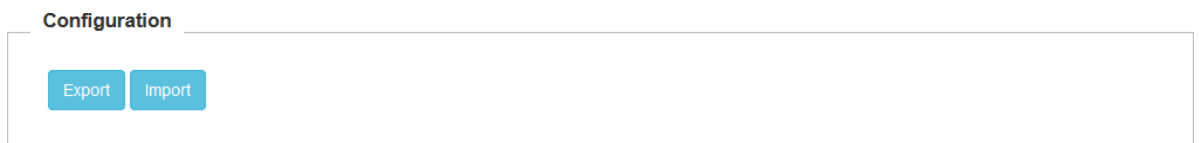
4. **Factory Default**: There are two ways a device can be reset back to factory default:
   1. Using the 'Factory Default' option in the Operations panel of the GUI or by using the 'delete config' CLI command.

Figure 27: Factory Default
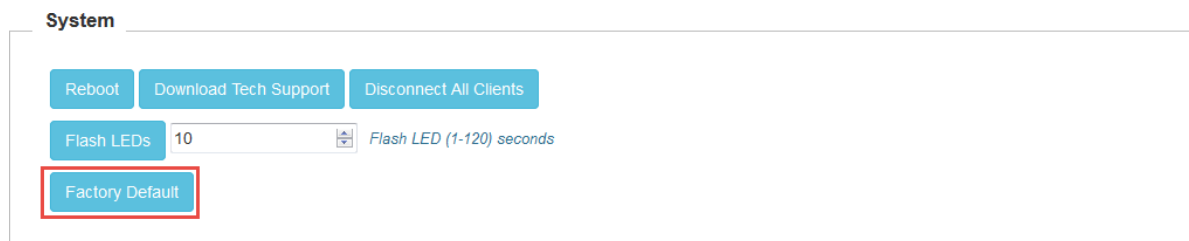
   2. By pressing down the reset tab on the Access Point for about 10 seconds until the AP reboots (indicated by the power LED changing color from Green to Orange).
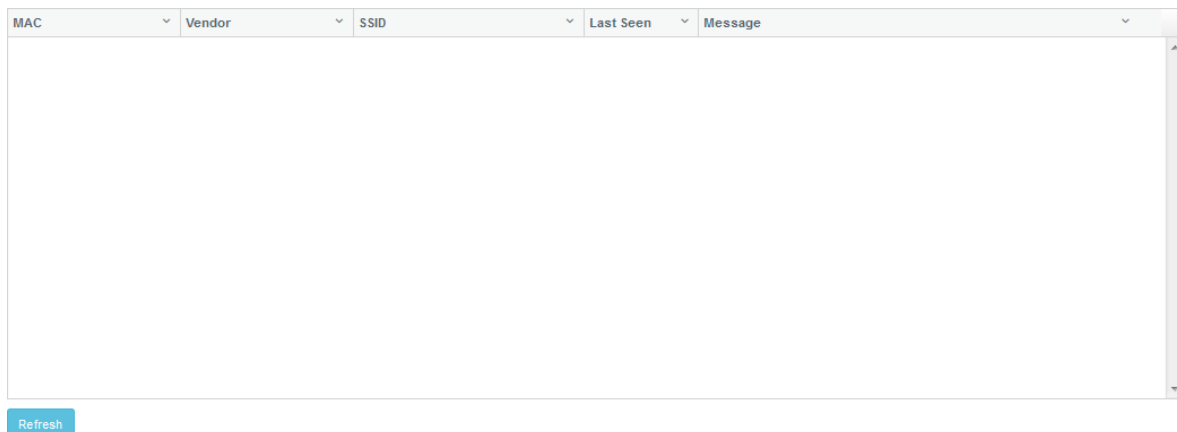
5. **Unconnected Clients**: Unconnected clients provides a list of clients that could not connect properly due to various reasons, with the access points. Currently the following failures are tracked:

- Invalid pre-shared key
- EAP authentication failure
- Denied due to MAC ACL
- Radius server not reachable
- No radius server found
- Client disconnected by enhanced-roaming
- Denied association by enhanced-roaming

Use the following CLI to display the list of wireless clients unconnected:

(cnPilot Enterprise AP) (config# show wireless unconnected clients

Figure 28: Unconnected Clients

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loginrec.h

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