ZYXEL
Your Networking Ally

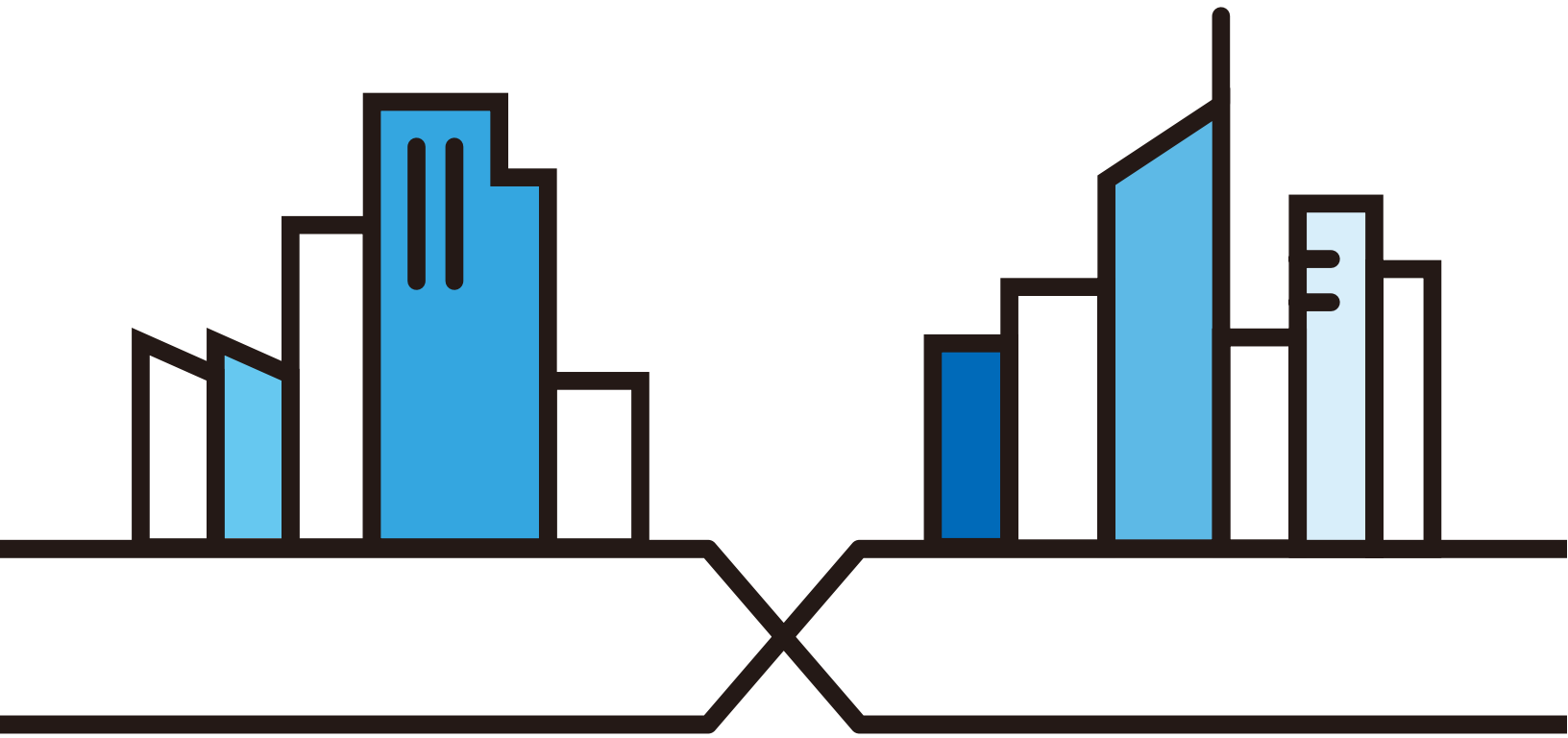
User's Guide

NXC Series

Wireless LAN Controller

Default Login Details	
LAN IP Address	https://192.168.1.1
User Name	admin
Password	1234

Version 6.0 Edition 1, 10/2019



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IMPORTANT!

READ CAREFULLY BEFORE USE.

KEEP THIS GUIDE FOR FUTURE REFERENCE.

This is a User's Guide for a series of products. Not all products support all firmware features. Screenshots and graphics in this book may differ slightly from your product due to differences in your product firmware or your computer operating system. Every effort has been made to ensure that the information in this manual is accurate.

Related Documentation

- Quick Start Guide

  The Quick Start Guide is designed to show you how to make the NXC hardware connections and access the Web Configurator.

- CLI Reference Guide

  The CLI Reference Guide explains how to use the Command-Line Interface (CLI) and CLI commands to configure the NXC.

Note: It is recommended you use the Web Configurator to configure the NXC.

- NWA/WAC User's Guide

  See this user's guide to know which access points can be managed by the NXC. It also lists the features of the NXC-managed access points.

- Web Configurator Online Help

  Click the help icon in any screen for help in configuring that screen and supplementary information.

- More Information

  Go to **support.zyxel.com** to find other information on the NXC.

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this guide.

Warnings tell you about things that could harm you or your device.

Note: Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- All models in this series may be referred to as the "NXC" in this guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Configuration > Network > Interface** means you first click **Configuration** in the navigation panel, then the **Network** sub menu and finally the **Interface** tab to get to that screen.

Icons Used in Figures

Figures in this guide may use the following generic icons. The NXC icon is not an exact representation of your device.

NXC 	AP 	Router 	Switch 
Internet 	Server 	Desktop 	Laptop 

Contents Overview

Table of Contents

PART I
User's Guide

CHAPTER 1
Introduction

1.1 Overview

This User's Guide covers the following models: NXC2500 and NXC5500.

Table 1 NXC Series Comparison Table

FEATURES	NXC2500	NXC5500
Link Aggregation Group (LAG) Support	No	Yes
Two USB Ports	Yes	Yes
Console Port (Serial Port)	DB-9 Connector	RJ-45 Connector
Max. no, of managed APs	8; can be upgraded up to 64	64; can be upgraded up to 1024

The NXC is a comprehensive wireless LAN controller. Its flexible configuration helps network administrators set up wireless LAN networks and efficiently enforce security policies over them. In addition, the NXC provides excellent throughput, making it an ideal solution for reliable, secure service.

The NXC's security features include firewall and certificates. It also provides captive portal configuration, NAT, port forwarding, policy routing, DHCP server, extensive wireless AP control options, and many other powerful features. Flexible configuration helps you set up the network and enforce security policies efficiently.

The front panel physical Gigabit Ethernet ports (labeled **P1**, **P2**, **P3**, and so on) are mapped to Gigabit Ethernet (ge) interfaces. By default **P1** is mapped to **ge1**, **P2** is mapped to **ge2** and so on.

- The default LAN IP address is 192.168.1.1.
- The default administrator login user name and password are "admin" and "1234" respectively.

1.2 Zones, Interfaces, and Physical Ports

Here is an overview of zones, interfaces, and physical ports in the NXC.

Table 2 Zones, Interfaces, and Physical Ethernet Ports

Zones (LAN)	A zone is a group of interfaces. Use zones to apply security settings such as firewall.
Interfaces (Ethernet, VLAN)	Interfaces are logical entities that (layer-3) packets pass through. Use interfaces in configuring zones, policy routes, static routes, and NAT. Port combine physical ports into interfaces.
Physical Ethernet Ports (P1, P2, P3, and so on)	The physical port is where you connect a cable.

1.2.1 Interface Types

There are two types of interfaces in the NXC. In addition to being used in various features, interfaces also describe the network that is directly connected to it.

- **Ethernet interfaces** are the foundation for defining other interfaces and network policies.
- **VLAN interfaces** recognize tagged frames. The NXC automatically adds or removes the tags as needed. Each VLAN can only be associated with one Ethernet interface.

Note: By default, all Ethernet interfaces are placed into vlan0, allowing the NXC to function as a bridge device.

1.2.2 Interface and Zone Configuration

This section introduces the NXC's default zone member physical interfaces and the default configuration of those interfaces. This section uses the NXC5500 drawings as an example.

Figure 1 Default Network Topology

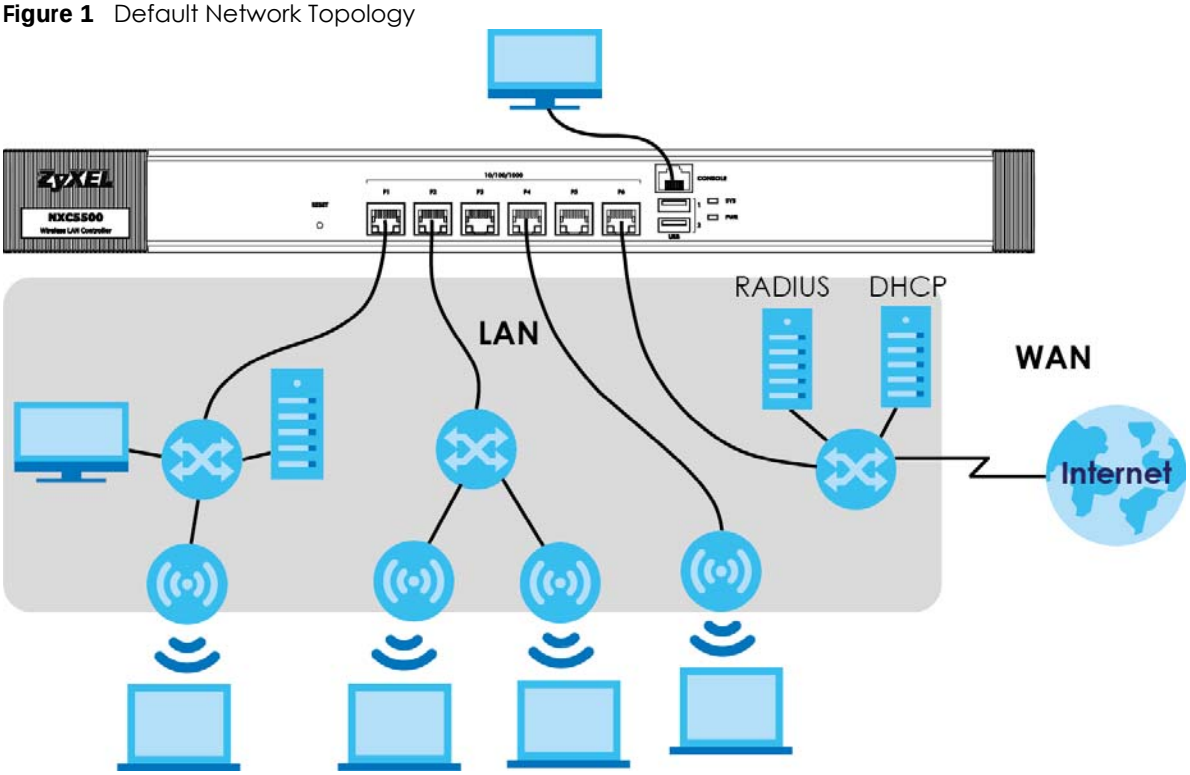


Table 3 Default Interfaces Configuration

PORT	INTERFACE	ZONE	IP ADDRESS AND DHCP SETTINGS	SUGGESTED USE WITH DEFAULT SETTINGS
P1~P6	ge1~ge6	LAN (vlan0)	192.168.1.1, DHCP server disabled	Dedicated LAN connections
CONSOLE	N/A	None	None	Local management

- The **LAN** zone contains the **ge1~ ge6** interfaces (physical ports P1~P6). By default, all LAN interfaces are put in vlan0.
- The **console** port is not in a zone and can be directly accessed by a computer attached to it using a special console-to-Ethernet adapter.

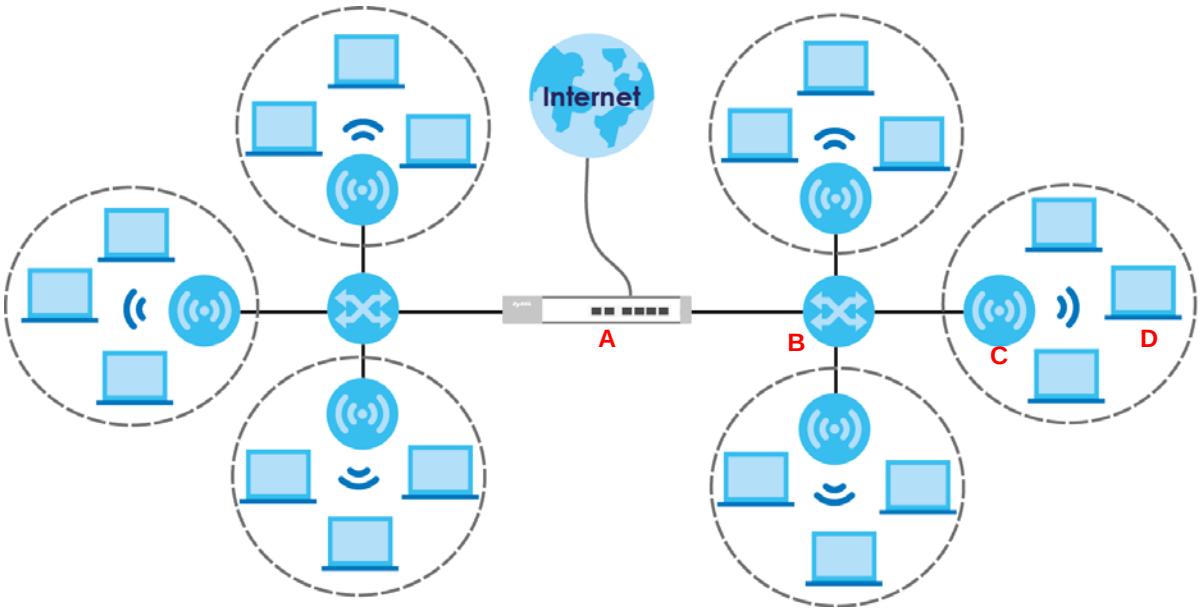
1.3 Applications

These are some example applications for your NXC.

1.3.1 AP Management

Manage multiple separate Access Points (APs) from a single, persistent location. APs can also be configured to monitor for rogue APs.

Figure 2 AP Management Example



Here, the NXC (**A**) connects to a number of Power over Ethernet (**PoE**) devices (**B**). They connect to the managed Access Points (**C**), such as NWA5123-NI, which in turn provide access to the network for the wireless clients (**D**) within their broadcast radius.

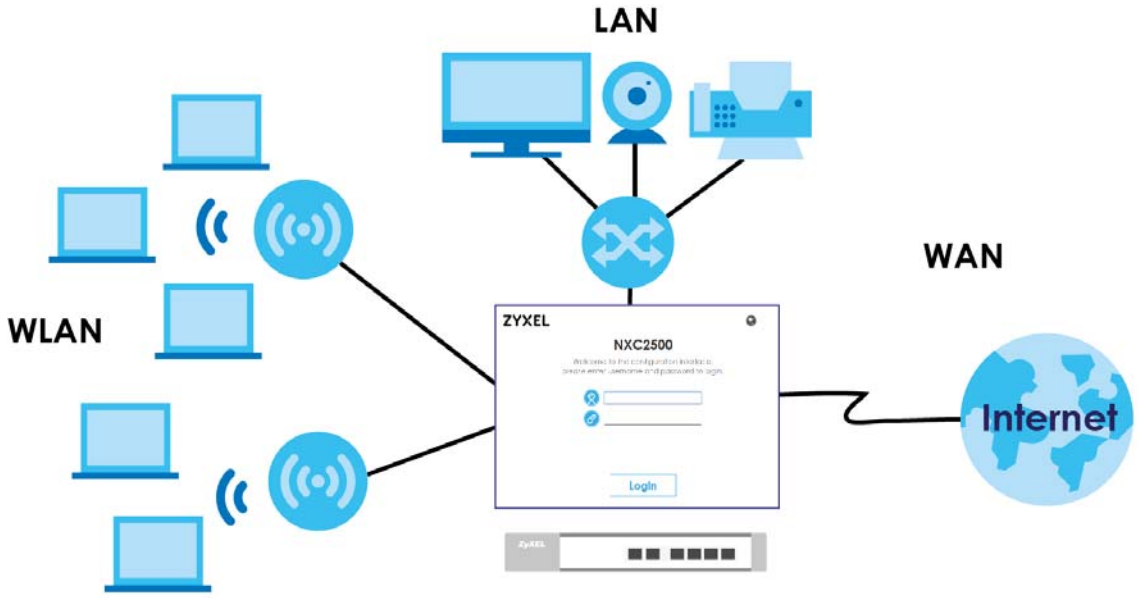
1.3.2 Wireless Security

Keep the connections between wireless clients and your APs secure with the NXC's comprehensive wireless security tools. APs can be configured to require WEP and WPA encryption from all wireless clients attempting to associate with them. Furthermore, you can protect your network by monitoring for rogue APs. Rogue APs are wireless access points operating in a network's coverage area that are not under the control of the network's administrators, and can potentially open up critical holes in a network's security policy.

1.3.3 Captive Portal

The NXC can be configured with a captive portal, which intercepts all network traffic, regardless of address or port, until a connecting user authenticates his or her session, through a designated login Web page.

Figure 3 Applications: Captive Portal



The captive portal page only appears once per authentication session. Unless a session times out or a user closes the connection, he or she generally will not see it again during the same session.

1.3.4 Load Balancing

With load balancing you can easily distribute wireless traffic across multiple APs to relieve strain on your network. When a station becomes overloaded, it can automatically delay a connection until the client associates with another network, or it can alternatively disassociate idle clients or those clients with weak connections from the network.

1.3.5 Dynamic Channel Selection

The NXC can automatically select the radio channel upon which its APs broadcast by scanning the area around those APs and determining what channels are currently being used by other devices not connected to the network.

1.3.6 User-Aware Access Control

Set up security policies that restrict access to sensitive information and shared resources based on the user who is trying to access it.

1.4 Management Overview

You can use the following ways to manage the NXC.

Web Configurator

The Web Configurator allows easy NXC setup and management using an Internet browser. This User's Guide provides information about the Web Configurator.

Command-Line Interface (CLI)

The CLI allows you to use text-based commands to configure the NXC. You can access it using remote management (for example, SSH or Telnet) or via the physical or Web Configurator console port. See the Command Reference Guide for CLI details. The default settings for the console port are as follows:

Table 4 Console Port Default Settings

SETTING	VALUE
Speed	115200 bps
Data Bits	8
Parity	None
Stop Bit	1
Flow Control	Off

1.5 Object-based Configuration

The NXC stores information or settings as objects. You use these objects to configure many of the NXC's features and settings. Once you configure an object, you can reuse it in configuring other features.

When you change an object's settings, the NXC automatically updates all the settings or rules that use the object.

You can create address objects based on an interface's IP address, subnet, or gateway. The NXC automatically updates every rule or setting that uses these objects whenever the interface's IP address settings change. For example, if you change an Ethernet interface's IP address, the NXC automatically updates the rules or settings that use the interface-based, LAN subnet address object.

You can use the **Configuration > Object** screens to create objects before you configure features that use them. If you are in a screen that uses objects, you can also usually select **Create new Object** to be able to configure a new object.

Use the **Object Reference** screen to see what objects are configured and which configuration settings reference specific objects.

1.6 Starting and Stopping the NXC

Here are some of the ways to start and stop the NXC.

Always use Maintenance > Shutdown or the `shutdown` command before you turn off the NXC or remove the power. Not doing so can cause the firmware to become corrupt.

Table 5 Starting and Stopping the NXC

METHOD	DESCRIPTION
Turning on the power	A cold start occurs when you turn on the power to the NXC. The NXC powers up, checks the hardware, and starts the system processes.
Rebooting the NXC	A warm start (without powering down and powering up again) occurs when you use the **Reboot** button in the **Reboot** screen or when you use the `reboot` command. The NXC writes all cached data to the local storage, stops the system processes, and then does a warm start.
Using the RESET button	If you press the **RESET** button, the NXC sets the configuration to its default values and then reboots.
Clicking **Maintenance > Shutdown > Shutdown** or using the `shutdown` command	Clicking **Maintenance > Shutdown > Shutdown** or using the `shutdown` command writes all cached data to the local storage and stops the system processes. Wait for the device to shut down and then manually turn off or remove the power. It does not turn off the power.
Disconnecting the power	Power off occurs when you turn off the power to the NXC. The NXC simply turns off. It does not stop the system processes or write cached data to local storage.

The NXC does not stop or start the system processes when you apply configuration files or run shell scripts although you may temporarily lose access to network resources.

CHAPTER 2
Hardware Installation and Connection

2.1 Overview

This chapter shows different installation scenarios of the NXC. It also shows the NXC's front and rear panel connections.

Make sure you connect the NXC's power cord to a socket-outlet with an earthing connection or its equivalent.

Note: Leave 10 cm of clearance at the sides and 20 cm in the rear when installing the NXC.

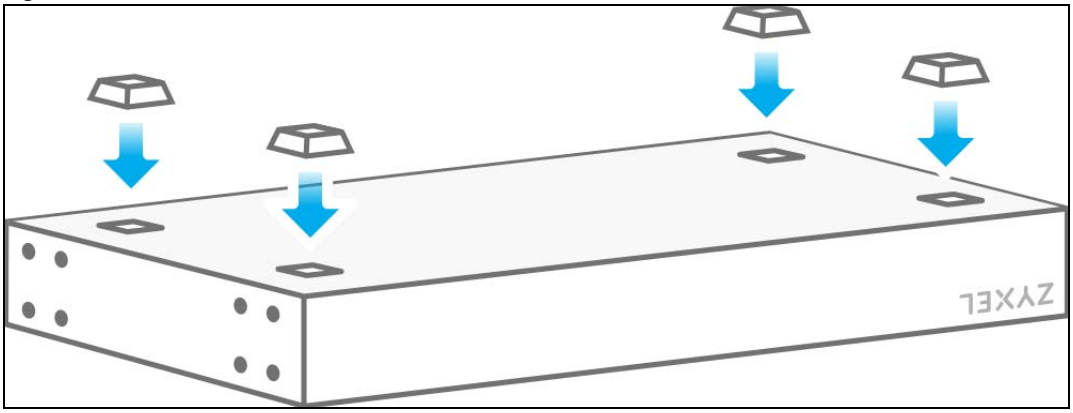
Note: Failure to use the proper screws may damage the unit.

2.2 Desktop Installation Procedure

1. Make sure the NXC is clean and dry.
2. Attach the rubber feet as shown if they are not already attached - see Figure 4 on page 26.
3. Set the NXC on a smooth, level surface strong enough to support the weight of the NXC and the connected cables. Make sure there is a power outlet nearby.
4. Make sure there is enough space around the NXC to allow the attachment of cables and the power cord and allow sufficient air circulation.

   Note: Make sure you are using the correct type of Ethernet cable (Category 5e, 6UTP/STP, or better Ethernet cable).

Figure 4 Attach Rubber Feet



2.3 Rack-mounted Installation

The NXC can be mounted on an EIA standard size, 19-inch rack or in a wiring closet with other equipment. Follow the steps below to mount your NXC on a standard EIA rack using a rack-mounting kit. Make sure the rack will safely support the combined weight of all the equipment it contains and that the position of the NXC does not make the rack unstable or top-heavy. Take all necessary precautions to anchor the rack securely before installing the unit.

Note: Zyxel provides a sliding rail accessory for your use with your device. Please contact your local vendor for details.

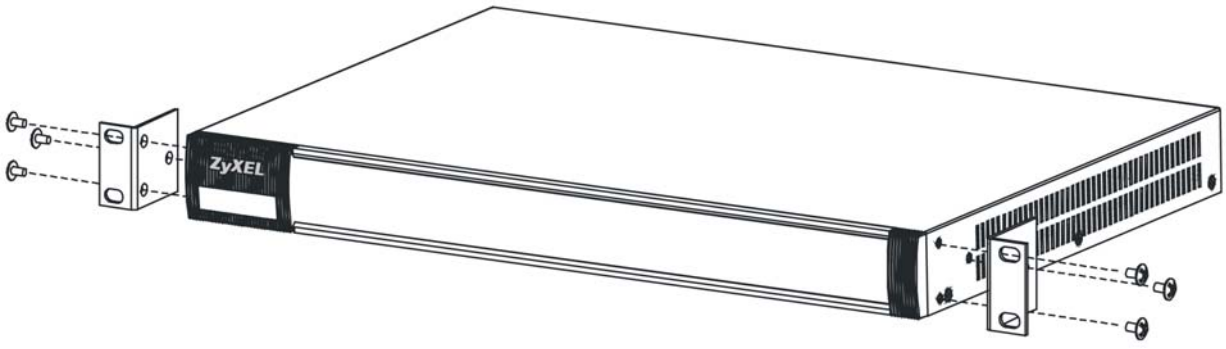
Use a #2 Phillips screwdriver to install the screws.

2.3.1 Rack-Mounted Installation Procedure

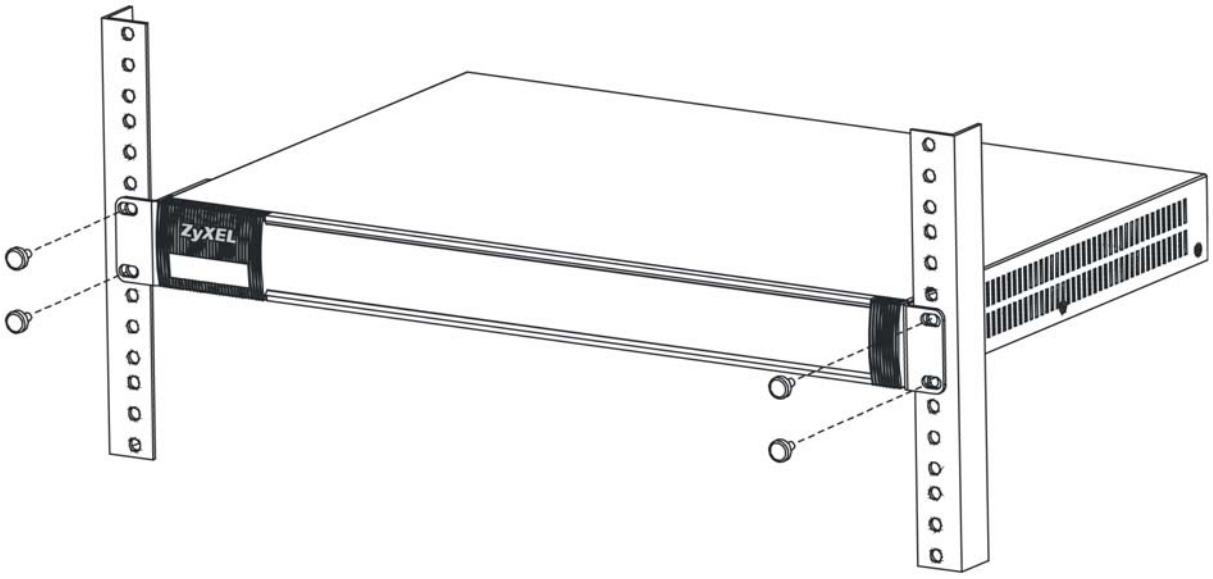
This section uses the NXC5500 drawings as an example.

1 Align one bracket with the holes on one side of the NXC and secure it with the included bracket screws (smaller than the rack-mounting screws).

2 Attach the other bracket in a similar fashion.



3 After attaching both mounting brackets, position the NXC in the rack by lining up the holes in the brackets with the appropriate holes on the rack. Secure the NXC to the rack with the rack-mounting screws.



2.4 Wall-mounting

Do the following to mount your NXC on a wall.

1 Drill two holes a distance D = 206 mm apart into a wall - see Figure 5 on page 28.

2 Place two screw anchors in the holes. Screw two screws into the screw anchors. Do not screw the screws all the way in to the wall; leave a small gap between the head of the screw and the wall.

3 The gap must be big enough for the screw heads to slide into the screw slots and the power cord to run down the back of the NXC.

Note: Make sure the screws are securely fixed to the wall and strong enough to hold the weight of the NXC with the connection cables.

4 Use the mounting holes on the NXC to hang the NXC on the screws.

Wall-mount the NXC with the Ethernet ports facing down and the ventilation holes on the side.

Figure 5 Wall Mounting

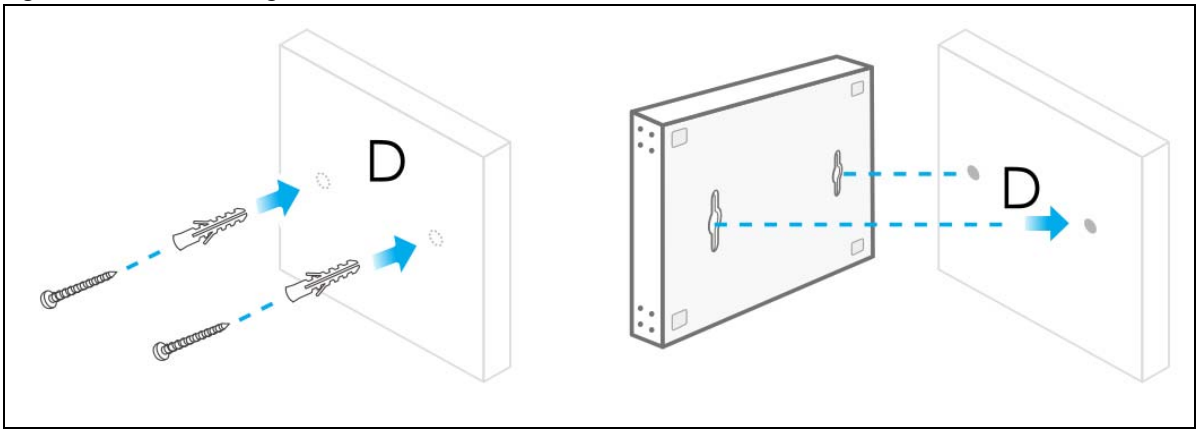
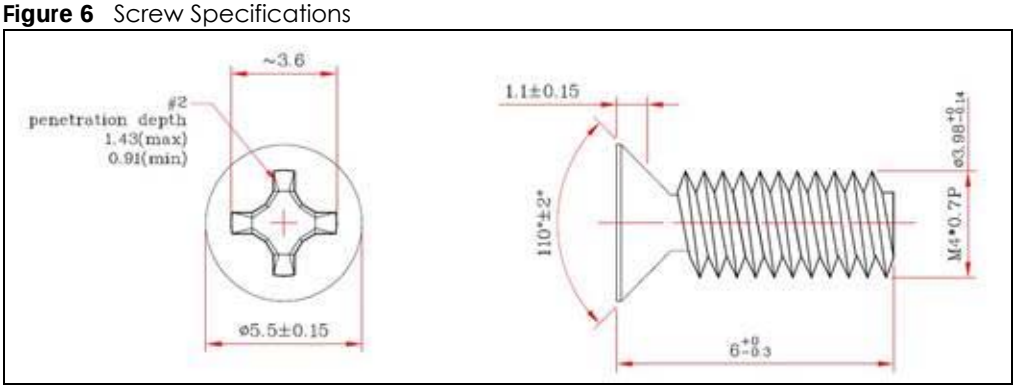


Figure 6 Screw Specifications



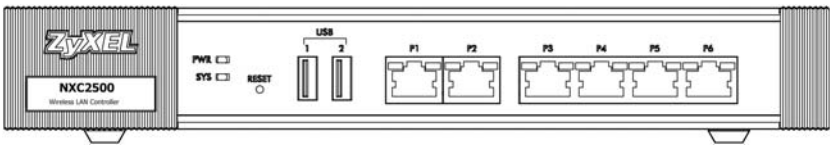
2.5 Front Panel

This section gives you an overview of the front panel.

2.5.1 NXC2500

There are LEDs, one reset button, two USB ports and six Ethernet ports on the NXC2500 front panel.

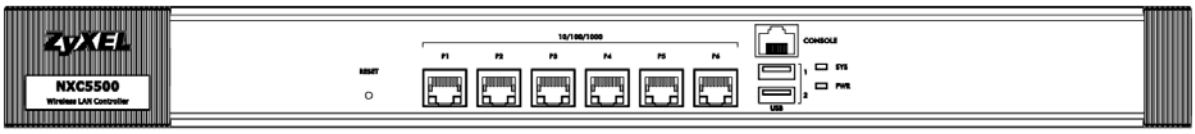
Figure 7 Front Panel: NXC2500



2.5.2 NXC5500

There are one reset button, six Ethernet ports, one console port, two USB ports and LEDs on the NXC5500 front panel.

Figure 8 Front Panel: NXC5500



Ethernet Ports

The auto-negotiating, auto-crossover Ethernet ports support 10/100/1000 Mbps Gigabit Ethernet so the speed can be 10 Mbps, 100 Mbps or 1000 Mbps. The duplex mode can be both half or full duplex at 10/100 Mbps and full duplex only at 1000 Mbps. An auto-negotiating port can detect and adjust to the optimum Ethernet speed and duplex mode of the connected device.

An auto-crossover (auto-MDI/MDI-X) port automatically works with a straight-through or crossover Ethernet cable.

Default Ethernet Settings

The factory default negotiation settings for the Ethernet ports on the NXC are:

- Speed: Auto
- Duplex: Auto
- Flow control: On (you cannot configure the flow control setting, but the NXC can negotiate with the peer and turn it off if needed)

Console Port (NXC5500 Only)

Connect this port to your computer (using an RJ-45-to-DB-9 console cable) if you want to configure the NXC using the command line interface (CLI) via the console port.

For local management, you can use a computer with terminal emulation software configured to the following parameters:

- VT100 terminal emulation
- 115200 bps
- No parity, 8 data bits, 1 stop bit
- No flow control

Connect the RJ-45 connector of the console cable to the console port of the NXC. Connect the female 9-pin end of the console cable to a serial port (COM1, COM2 or other COM port) of your computer.

The following table shows you the wire color codes and pin assignment for the console cable.

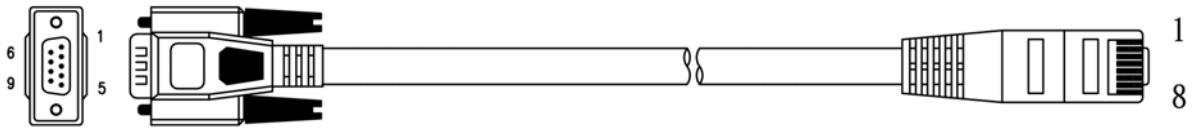


Table 6 RJ-45-to-DB-9 Console Cable Color Codes

DB-9 SIGNAL	DB-9 PIN#	WIRE COLOR	RJ45 PIN#
CTS	8	White/Orange	1
DSR/DCD	6+1	Orange	2
RD	2	White/Green	3
GND	5	Blue	4
GND	5	White/Blue	5
TD	3	Green	6
DTR	4	White/Brown	7
RTS	7	Brown	8

USB 2.0 Ports

Connect a USB storage device to a USB port on the NXC to archive the NXC system logs or save the NXC operating system core dump to it.

2.5.3 Front Panel LEDs

This section describes the front panel LEDs.

2.5.3.1 NXC2500

The following table describes the LEDs.

Table 7 Front Panel LEDs: NXC2500

LED	COLOR	STATUS	DESCRIPTION
PWR		Off	The NXC is turned off.
	Green	On	The NXC is turned on.
SYS	Green	Off	The NXC is not ready or has failed.
		On	The NXC is ready and running.
		Blinking	The NXC is booting.
	Red	On	There is a hardware component failure. Shut down the device, wait for a few minutes and then restart the device (see Section 1.6 on page 24). If the LED turns red again, then please contact your vendor.
		Blinking	Firmware upgrade is in progress.
P1~P6	Green (Traffic)	Blinking	The NXC is sending or receiving packets to/from an Ethernet network on this port.
		Off	The NXC is not sending or receiving packets on this port.
	Orange (Link)	On	This port has a successful link to an Ethernet network.
		Off	There is no connection on this port.

2.5.3.2 NXC5500

The following table describes the LEDs.

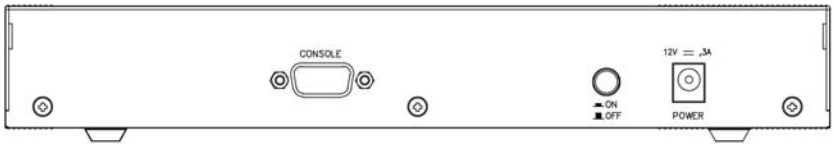
Table 8 Front Panel LEDs: NXC5500

LED	COLOR	STATUS	DESCRIPTION
PWR	Green	Off	The NXC is turned off.
		On	The NXC is turned on.
SYS		Off	The NXC is not ready or has failed.
	Green	On	The NXC is ready and running.
		Blinking	The NXC is booting.
	Red	On	There is a hardware component failure. Shut down the device, wait for a few minutes and then restart the device (see Section 1.6 on page 24). If the LED turns red again, then please contact your vendor.
		Blinking	Firmware upgrade is in progress.
P1~P6 Traffic (Left)	Green	Blinking	The NXC is sending or receiving packets to/from an Ethernet network on this port.
		Off	The NXC is not sending or receiving packets on this port.
P1~P6 Link (Right)	Green	On	This Ethernet connection speed is 100 Mbps on this port.
	Orange	On	This Ethernet connection speed is 1000 Mbps on this port.
		Off	There is no connection on this port.

2.6 Rear Panel

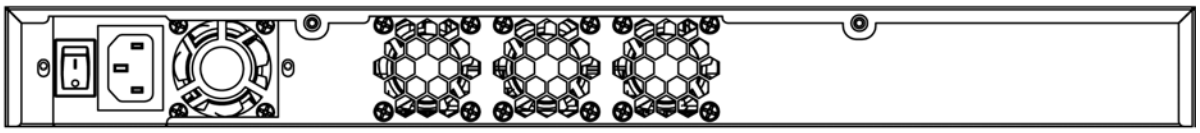
The NXC2500 rear panel contains a console port, a power switch and a connector for the power receptacle.

Figure 9 Rear Panel: NXC2500



The NXC5500 rear panel contains a power switch, a connector for the power receptacle and a fan module.

Figure 10 Rear Panel: NXC5500



Console Port (NXC2500 Only)

Connect this port to your computer (using an RS-232 cable) if you want to configure the NXC using the command line interface (CLI) via the console port.

For local management, you can use a computer with terminal emulation software configured to the following parameters:

- VT100 terminal emulation
- 115200 bps
- No parity, 8 data bits, 1 stop bit
- No flow control

Connect the male 9-pin end of the RS-232 console cable to the console port of the NXC. Connect the female end to a serial port (COM1, COM2 or other COM port) of your computer.

CHAPTER 3
The Web Configurator

3.1 Overview

The NXC Web Configurator allows easy management using an Internet browser. Browsers supported are:

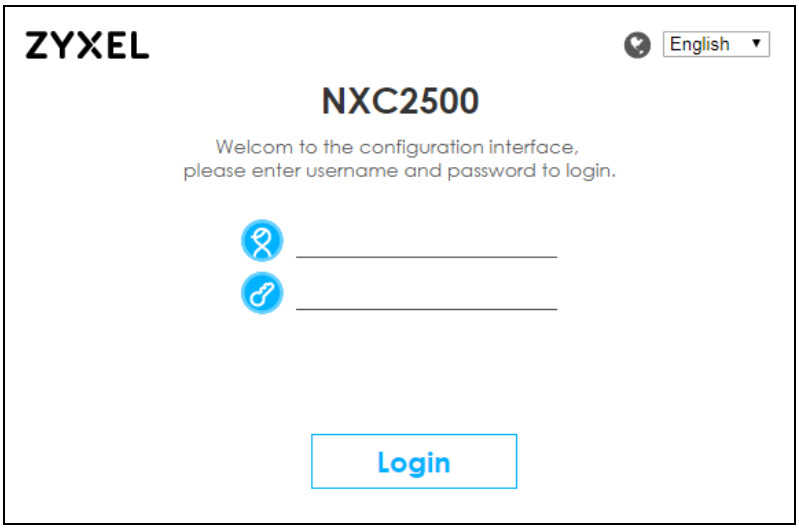
- Firefox 36.0.1 or later
- Chrome 41.0 or later
- IE 10 or later

The recommended screen resolution is 1024 x 768 pixels and higher.

3.2 Access

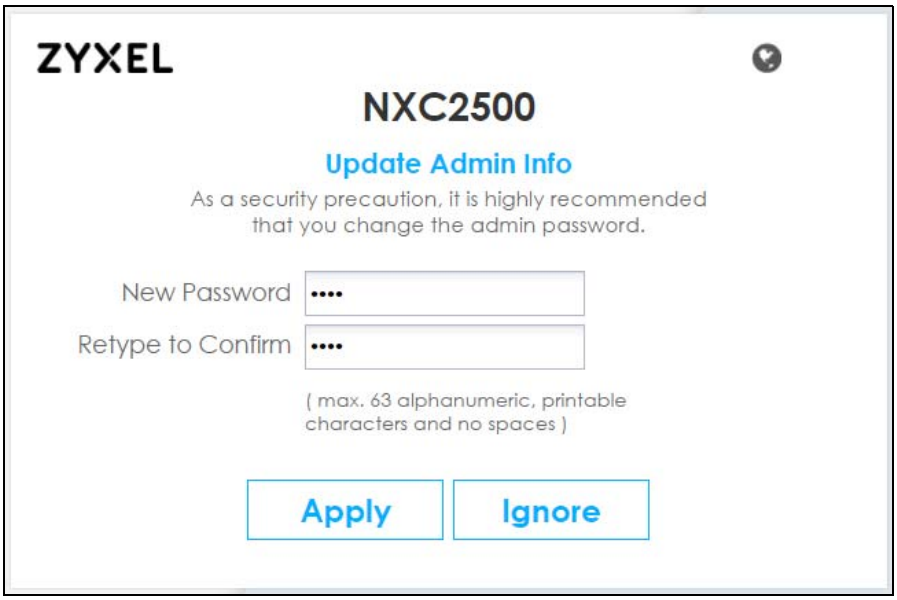
1 Make sure your NXC hardware is properly connected. See the Quick Start Guide.

2 Browse to https://192.168.1.1. The **Login** screen appears.



3 Enter the user name (default: "admin") and password (default: "1234"). Select the language you prefer for the Web Configurator.

4 Click **Login**. If you logged in using the default user name and password, the **Update Admin Info** screen appears. Otherwise, the dashboard appears.



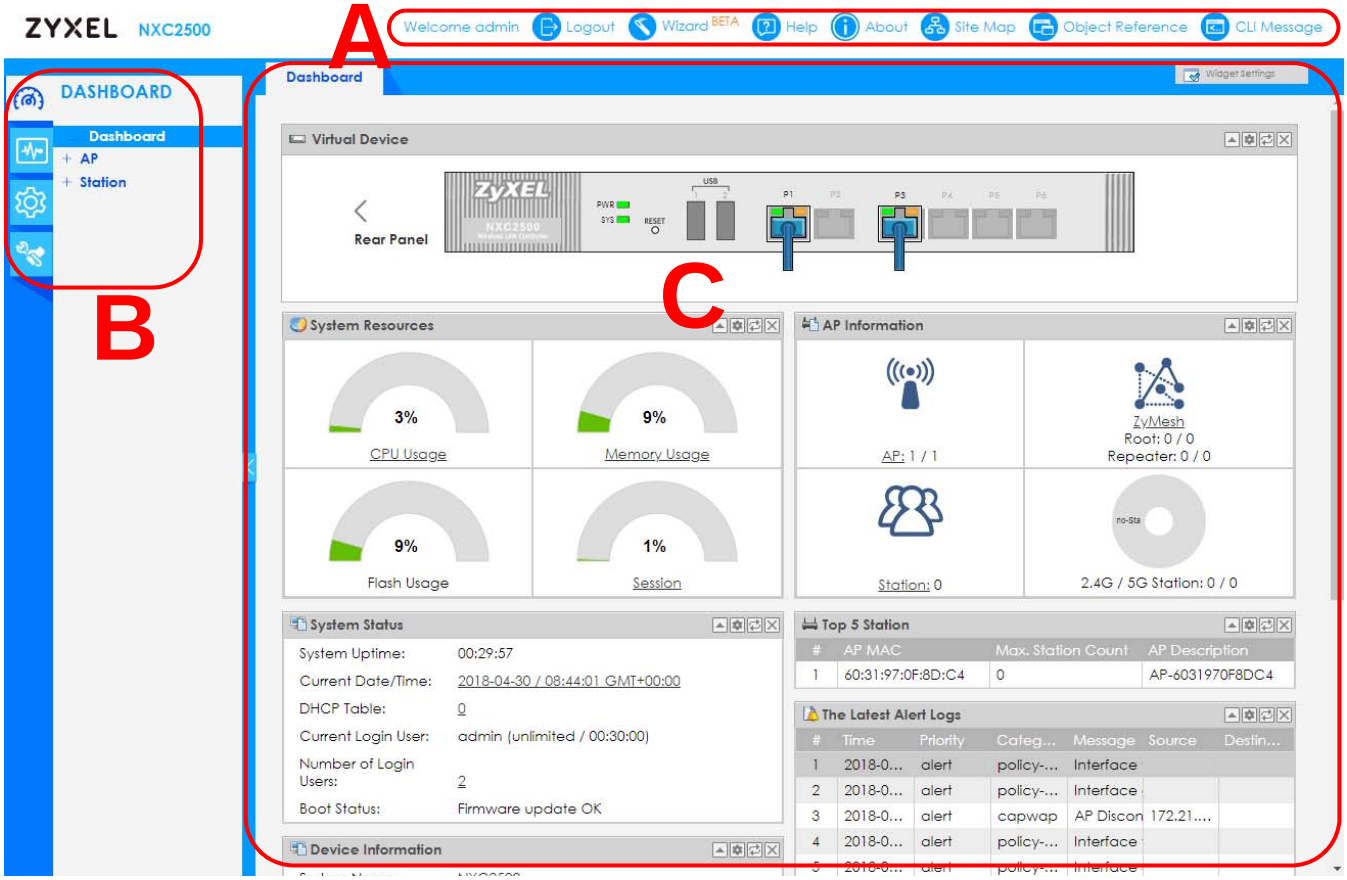
This screen appears every time you log in using the default user name and default password. If you change the password for the default user account, this screen does not appear anymore.

3.3 The Main Screen

This guide uses the NXC2500 screens as an example. The screens may vary slightly for different models.

The Web Configurator's main screen is divided into these parts:

Figure 11 The Web Configurator's Main Screen



- **A** - Title Bar
- **B** - Navigation Panel
- **C** - Main Window

3.3.1 Title Bar

The title bar provides some useful links that always appear over the screens below, regardless of how deep into the Web Configurator you navigate.

Figure 12 Title Bar

The icons provide the following functions.

Table 9 Title Bar: Web Configurator Icons

LABEL	DESCRIPTION
Logout	Click this to log out of the Web Configurator.
Wizard	Click this to open screens where you can configure the NXC's time zone, Internet access and wireless settings.
Help	Click this to open the help page for the current screen.
About	Click this to display basic information about the NXC.
Site Map	Click this to see an overview of links to the Web Configurator screens.

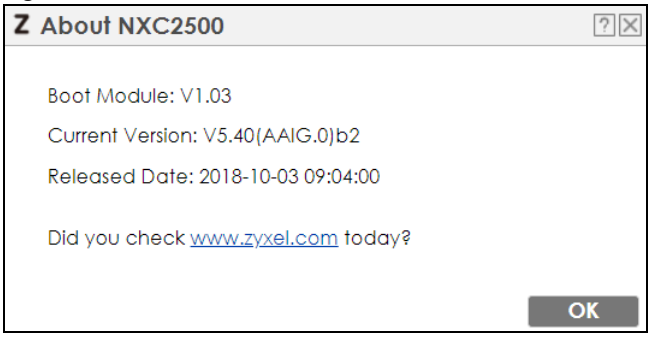
Table 9 Title Bar: Web Configurator Icons (continued)

LABEL	DESCRIPTION
Object Reference	Click this to open a screen where you can check which configuration items reference an object.
CLI Message	Click this to open a popup window that displays the CLI commands sent by the Web Configurator.

About

Click **About** to display basic information about the NXC.

Figure 13 About



The following table describes labels that can appear in this screen.

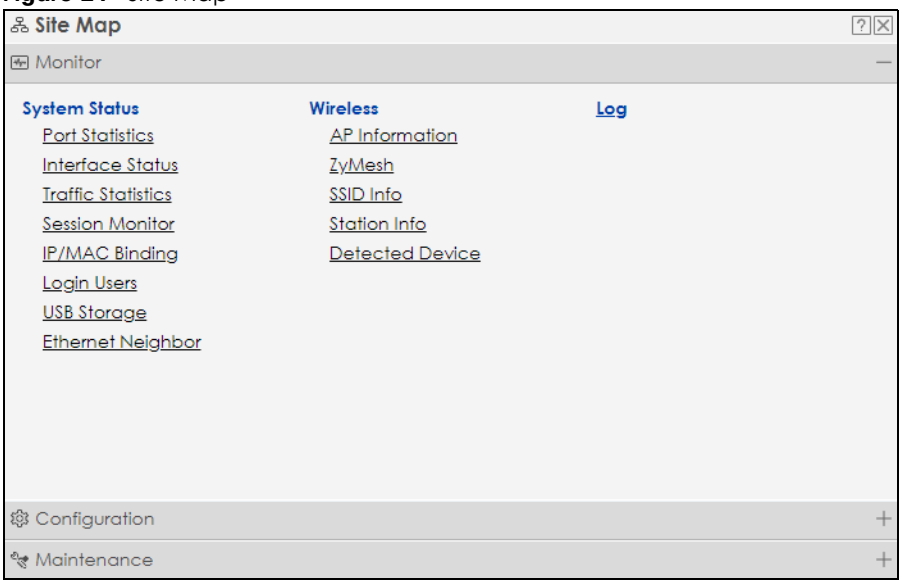
Table 10 About

LABEL	DESCRIPTION
Boot Module	This shows the version number of the software that handles the booting process of the NXC.
Current Version	This shows the firmware version of the NXC.
Released Date	This shows the date (yyyy-mm-dd) and time (hh:mm:ss) when the firmware is released.
OK	Click this to close the screen.

Site Map

Click **Site MAP** to see an overview of links to the Web Configurator screens. Click a screen's link to go to that screen.

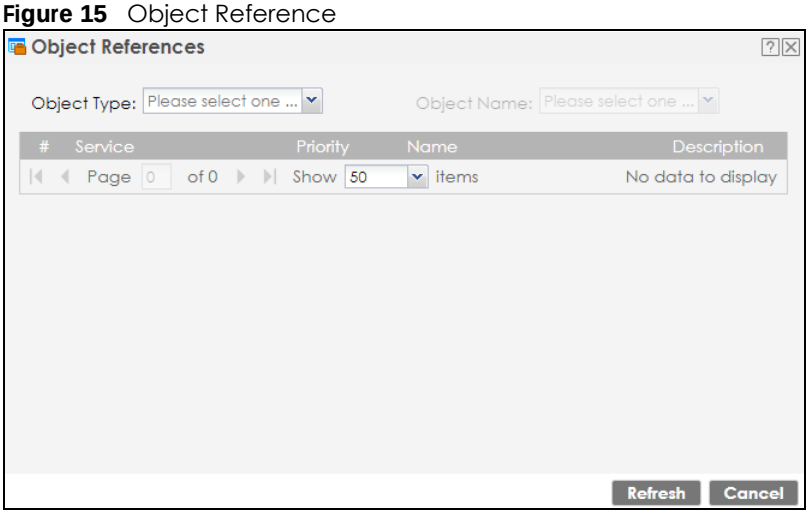
Figure 14 Site Map



Object Reference

Click **Object Reference** to open the **Object Reference** screen. Select the type of object and the individual object and click **Refresh** to show which configuration settings reference the object.

Figure 15 Object Reference



The fields vary with the type of object. The following table describes labels that can appear in this screen.

Table 11 Object References

LABEL	DESCRIPTION
Object Type	Select the type of the object.
Object Name	This identifies the object for which the configuration settings that use it are displayed. Select the object's name to display the object's configuration screen in the main window.
#	This field is a sequential value, and it is not associated with any entry.
Service	This is the type of setting that references the selected object. Click a service's name to display the service's configuration screen in the main window.

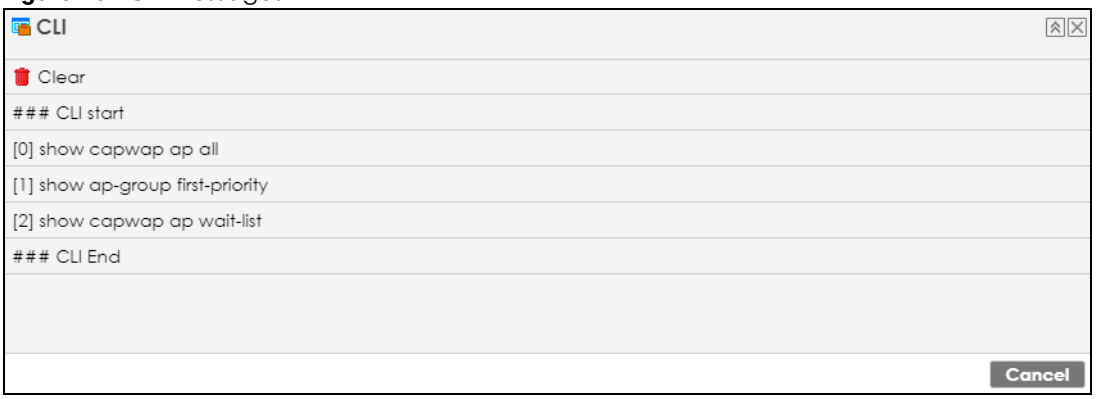
Table 11 Object References (continued)

LABEL	DESCRIPTION
Priority	If it is applicable, this field lists the referencing configuration item's position in its list, otherwise **N/A** displays.
Name	This field identifies the configuration item that references the object.
Description	If the referencing configuration item has a description configured, it displays here.
Refresh	Click this to update the information in this screen.
Cancel	Click **Cancel** to close the screen.

CLI Messages

Click **CLI** to look at the CLI commands sent by the Web Configurator. These commands appear in a popup window, such as the following.

Figure 16 CLI Messages



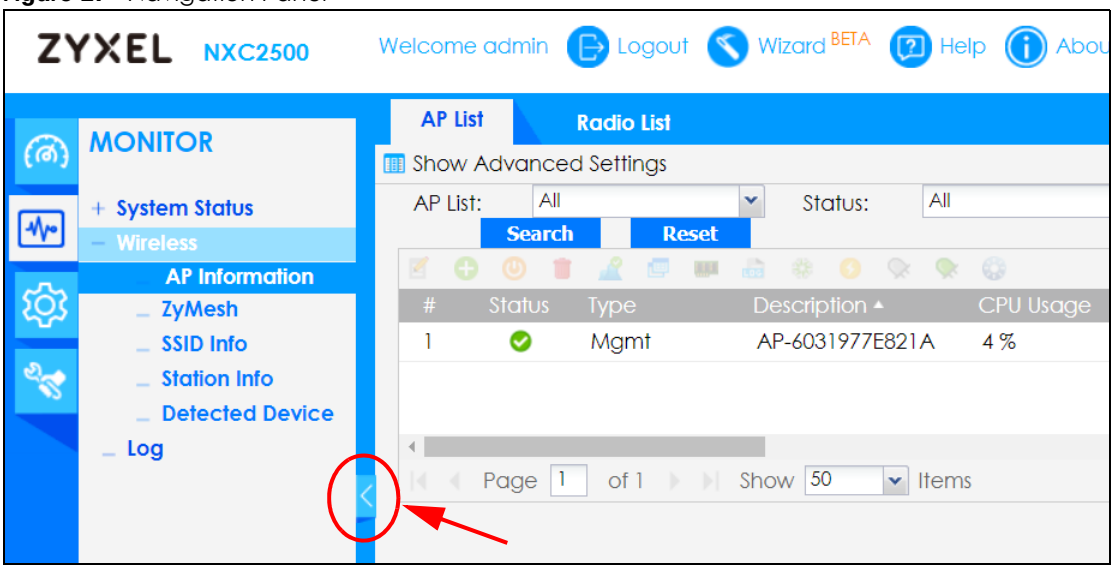
Click **Clear** to remove the currently displayed information.

See the Command Reference Guide for information about the commands.

3.3.2 Navigation Panel

Use the menu items on the navigation panel to open screens to configure NXC features. Click the arrow in the middle of the right edge of the navigation panel to hide the navigation panel menus or drag it to resize them. The following sections introduce the NXC's navigation panel menus and their screens.

Figure 17 Navigation Panel



3.3.2.1 Dashboard

The dashboard menu screens display status information about the NXC.

Table 12 Dashboard Menu Screens Summary

FOLDER OR LINK	TAB	FUNCTION
Dashboard		Display general device information, system status, system resource usage, licensed service status, and interface status in widgets that you can re-arrange to suit your needs.
AP		
Status	Top N APs	Display the number of wireless stations which are connected to the top "N" managed APs and data usage.
	Single AP	Display the number of wireless stations which are connected to a specific managed AP and data usage.
Station		
Traffic	Top N Stations	Display data usage of the top "N" wireless stations.
	Single Station	Display data usage of a specific wireless station.

For details on the Dashboard's features, see Chapter 5 on page 58.

3.3.2.2 Monitor Menu

The monitor menu screens display status and statistics information.

Table 13 Monitor Menu Screens Summary

FOLDER OR LINK	TAB	FUNCTION
System Status		
Port Statistics	Port Statistics	Display packet statistics for each physical port.
Interface Status	Interface Summary	Display general interface information and packet statistics.
Traffic Statistics	Traffic Statistics	Collect and display traffic statistics.
Session Monitor	Session Monitor	Display the status of all current sessions.

Table 13 Monitor Menu Screens Summary (continued)

FOLDER OR LINK	TAB	FUNCTION
IP/MAC Binding	IP/MAC Binding	List the devices that have received an IP address from NXC interfaces using IP/MAC binding.
Login Users	Login Users	List the users currently logged into the NXC.
	Dynamic Guest	List the dynamic guest accounts in the NXC's local database.
	Trusted MAC Address List	List the MAC addresses that are authenticated and allowed to access the network.
USB Storage	Storage Information	Display details about a USB device connected to the NXC.
Ethernet Neighbor	Ethernet Neighbor	Display the NXC's neighboring devices in one place.
Wireless		
AP Information	AP List	Display information about the connected APs.
	Radio List	Display information about the radios of the connected APs.
ZyMesh	ZyMesh Link Info	Display statistics about the ZyMesh connections between the managed APs.
SSID Info	SSID Info	Display information about the SSID's wireless clients.
Station Info	Station List	Display information about the connected stations.
Detected Device	Detected Device	Display information about suspected rogue APs.
Log	View Log	List log entries for the NXC.
	View AP Log	Allow you to query connected APs and view log entries for them.

3.3.2.3 Configuration Menu

Use the configuration menu screens to configure the NXC's features.

Table 14 Configuration Menu Screens Summary

FOLDER OR LINK	TAB	FUNCTION
Licensing		
Registration	Registration	Register the device.
	Service	View the licensed service status and upgrade licensed services.
Wireless		
Controller	Configuration	Configure how the NXC handles APs that newly connect to the network.
AP Management	Mgmt. AP List	Edit wireless AP information, remove APs, and reboot them.
	AP Policy	Configure the AP controller's IP address on the managed APs and determine the action the managed APs take if the current AP controller fails.
	AP Group	Configure AP groups, which define the radio, port, VLAN and load balancing settings and apply the settings to all APs in the group.
	Firmware	Have the NXC check and download the latest AP firmware from the firmware server.
Rogue AP	Rogue/Friendly AP List	Configure how the NXC monitors for rogue APs.
Auto Healing	Auto Healing	Enable auto healing to extend the wireless service coverage area of the managed APs when one of the APs fails.
Network		

Table 14 Configuration Menu Screens Summary (continued)

FOLDER OR LINK	TAB	FUNCTION
Interface	Ethernet	Manage Ethernet interfaces and virtual Ethernet interfaces.
	VLAN	Create and manage VLAN interfaces and virtual VLAN interfaces.
	LAG	Combine multiple physical Ethernet interfaces into a single logical interface.
Routing	Policy Route	Create and manage routing policies.
	Static Route	Create and manage IP static routing information.
Zone	Zone	Configure zones used to define various policies.
NAT	NAT	Set up and manage port forwarding rules.
ALG	ALG	Configure FTP pass-through settings.
IP/MAC Binding	Summary	Configure IP to MAC address bindings for devices connected to each supported interface.
	Exempt List	Configure ranges of IP addresses to which the NXC does not apply IP/MAC binding.
Captive Portal	Captive Portal	Enable captive portal and specify the captive portal page that displays when a client makes an initial network connection.
	Custom Captive Portal	Create a customized login theme or upload one.
	Redirect on Controller	Allow clients to authenticate themselves to the NXC with a QR code, and configure the authentication policy rules for the NXC.
	Redirect on AP	Configure the authentication policy rules for the managed APs.
RTLS	Real Time Location System	Use the managed APs as part of an Ekahau RTLS to track the location of Ekahau WiFi tags.
Firewall	Firewall	Enable or disable the firewall and asymmetrical routes, and configure firewall rules.
	Session Control	Limit the number of concurrent NAT/firewall sessions a client can use.
Object		
User/Group	User	Create and manage users.
	Group	Create and manage groups of users.
	Setting	Manage default settings for all users, general settings for user sessions, and rules to force user authentication.
	MAC Address	Map wireless client MAC addresses to MAC roles (MAC address user accounts).
AP Profile	Radio	Create and manage wireless radio settings files that can be associated with different APs.
	SSID	Create and manage wireless SSID, security, MAC filtering and Layer-2 isolation settings files that can be associated with different APs.
MON Profile	MON Profile	Create and manage rogue AP monitoring files that can be associated with different APs.
ZyMesh Profile	ZyMesh Profile	Create and manage ZyMesh files that can be associated with different APs.
Address	Address	Create and manage host, range, and network (subnet) addresses.
	Address Group	Create and manage groups of addresses.
Service	Service	Create and manage TCP and UDP services.
	Service Group	Create and manage groups of services.
Schedule	Schedule	Create one-time and recurring schedules.

Table 14 Configuration Menu Screens Summary (continued)

FOLDER OR LINK	TAB	FUNCTION
AAA Server	Active Directory	Configure the default Active Directory settings.
	LDAP	Configure the default LDAP settings.
	RADIUS	Configure the default RADIUS settings.
Auth. Method	Authentication Method	Create and manage ways of authenticating users.
Certificate	My Certificates	Create and manage the NXC's certificates.
	Trusted Certificates	Import and manage certificates from trusted sources.
DHCPv6	Request	Configure DHCPv6 request type objects.
System		
Host Name	Host Name	Configure the system and domain name for the NXC.
USB Storage	USB Storage	Configure the settings for the connected USB devices.
Date/Time	Date/Time	Configure the current date, time, and time zone in the NXC.
Console Speed	Console Speed	Set the console speed.
DNS	DNS	Configure the DNS server and address records for the NXC.
WWW	Service Control	Configure HTTP, HTTPS, and general authentication.
SSH	SSH	Configure SSH server and SSH service settings.
TELNET	TELNET	Configure telnet server settings for the NXC.
FTP	FTP	Configure FTP server settings.
SNMP	SNMP	Configure SNMP communities and services.
Auth. Server	Auth. Server	Configure the NXC to act as a RADIUS server.
Language	Language	Select the Web Configurator language.
IPv6	IPv6	Enables or disables IPv6 support on the NXC.
Log & Report		
Email Daily Report	Email Daily Report	Configure where and how to send daily reports and what reports to send.
Log Settings	Log Settings	Configure the system log, e-mail logs, and remote syslog servers.

3.3.2.4 Maintenance Menu

Use the maintenance menu screens to manage configuration and firmware files, run diagnostics, and reboot or shut down the NXC.

Table 15 Maintenance Menu Screens Summary

FOLDER OR LINK	TAB	FUNCTION
File Manager	Configuration File	Manage and upload configuration files for the NXC.
	Firmware Package	View the current firmware version and to upload firmware.
	Shell Script	Manage and run shell script files for the NXC.

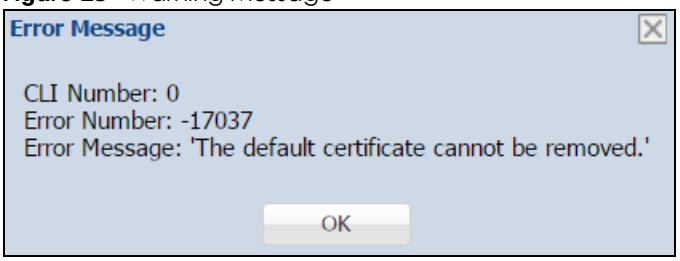
Table 15 Maintenance Menu Screens Summary (continued)

FOLDER OR LINK	TAB	FUNCTION
Diagnostics	Diagnostics	Collect diagnostic information.
	Packet Capture	Capture packets for analysis.
	Core Dump	Connect a USB device to the NXC and save the NXC operating system kernel to it here.
	System Log	Connect a USB device to the NXC and archive the NXC system logs to it here.
	Wireless Frame Capture	Capture wireless frames from APs for analysis.
Packet Flow Explore	Routing Status	Check how the NXC determines where to route a packet.
	SNAT Status	View a clear picture on how the NXC converts a packet's source IP address and check the related settings.
Reboot	Reboot	Restart the NXC.
Shutdown	Shutdown	Turn off the NXC.

3.3.3 Warning Messages

Warning messages, such as those resulting from misconfiguration, display in a popup window.

Figure 18 Warning Message



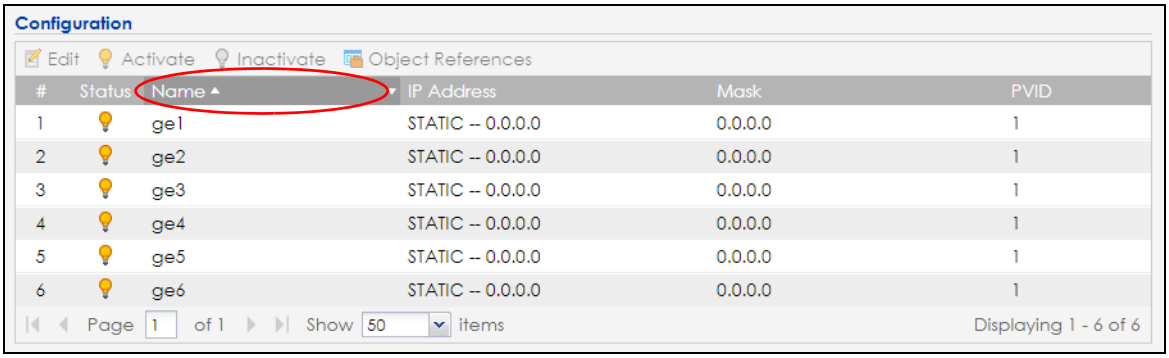
3.3.4 Tables and Lists

The Web Configurator tables and lists are quite flexible and provide several options for how to display their entries.

Manipulating Table Display

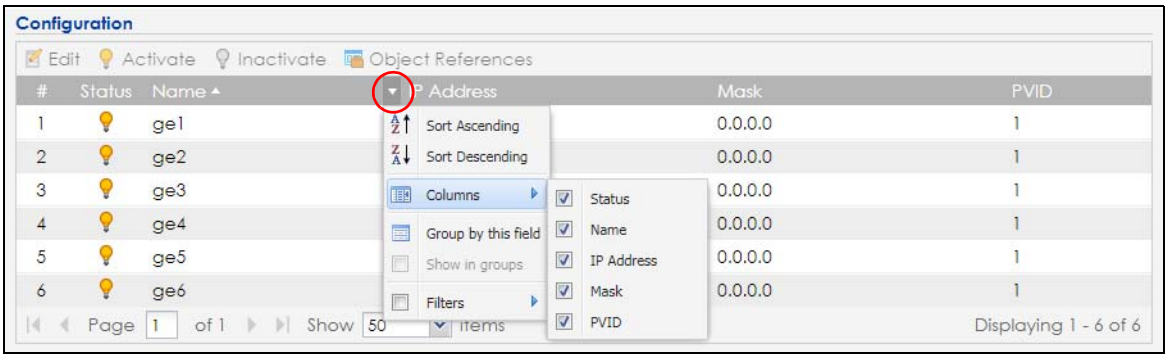
Here are some of the ways you can manipulate the Web Configurator tables.

1 Click a column heading to sort the table's entries according to that column's criteria.

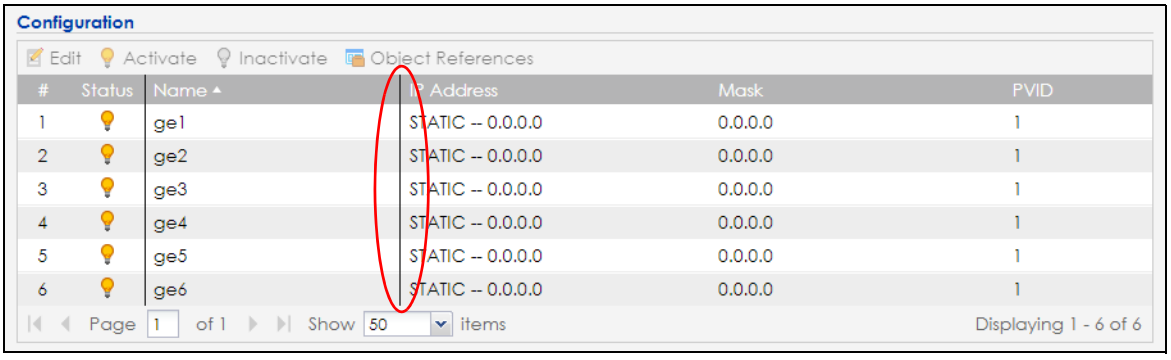


2 Click the down arrow next to a column heading for more options about how to display the entries. The options available vary depending on the type of fields in the column. Here are some examples of what you can do:

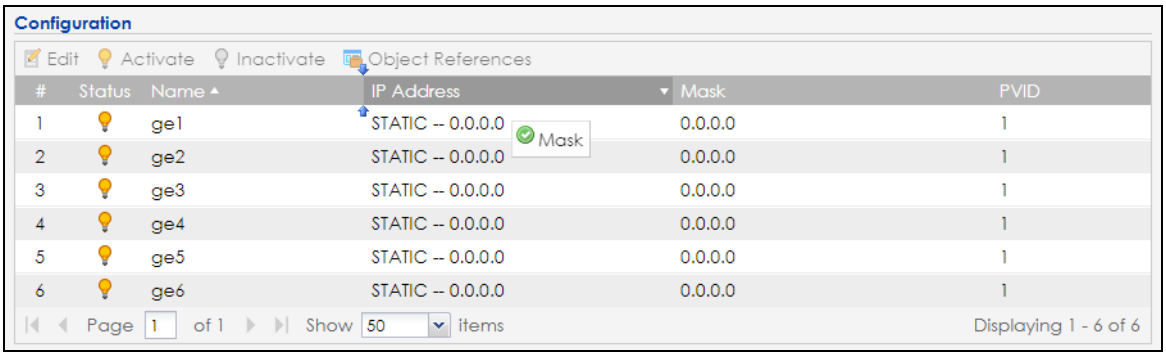
- Sort in ascending alphabetical order
- Sort in descending (reverse) alphabetical order
- Select which columns to display
- Group entries by field
- Show entries in groups
- Filter by mathematical operators (<, >, or =) or searching for text.



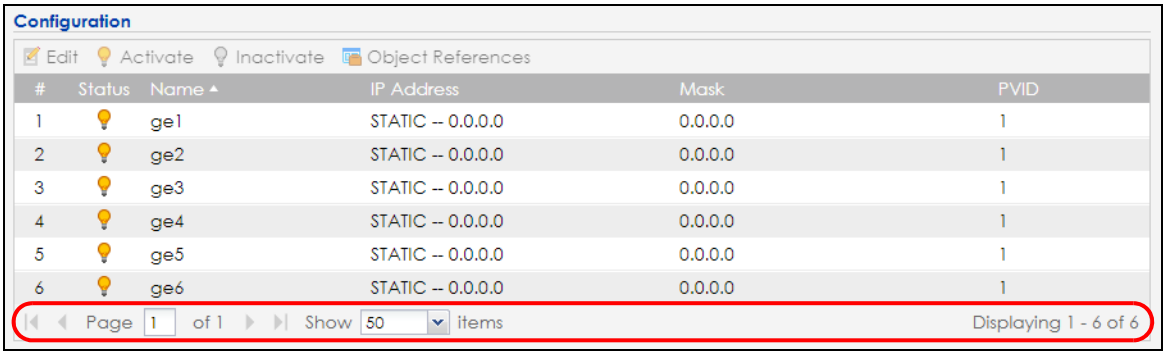
3 Select a column heading cell's right border and drag to re-size the column.



4 Select a column heading and drag and drop it to change the column order. A green check mark displays next to the column's title when you drag the column to a valid new location.



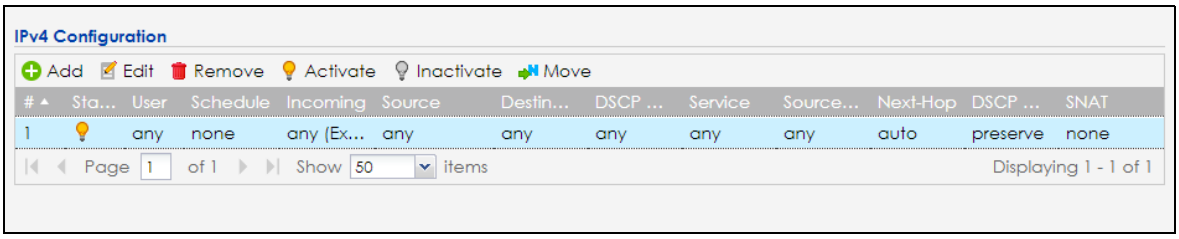
5 Use the icons and fields at the bottom of the table to navigate to different pages of entries and control how many entries display at a time.



Working with Table Entries

The tables have icons for working with table entries. A sample is shown next. You can often use the [Shift] or [Ctrl] key to select multiple entries to remove, activate, or deactivate.

Table 16 Common Table Icons



Here are descriptions for the most common table icons.

Table 17 Common Table Icons

LABEL	DESCRIPTION
Add	Click this to create a new entry. For features where the entry's position in the numbered list is important (features where the NXC applies the table's entries in order), you can select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings. In some tables you can just click a table entry and edit it directly in the table. For those types of tables small red triangles display for table entries with changes that you have not yet applied.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.

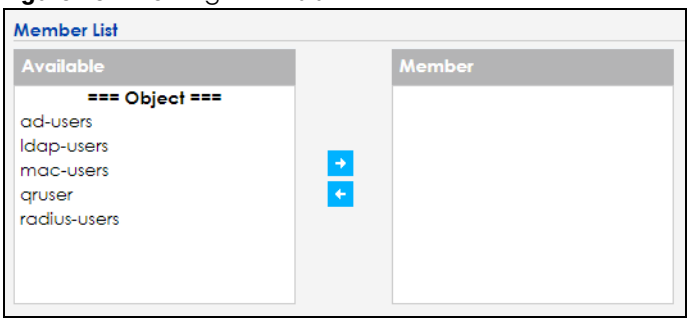
Table 17 Common Table Icons (continued)

LABEL	DESCRIPTION
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
Move	To change an entry's position in a numbered list, select it and click **Move** to display a field to type a number for where you want to put that entry and press [ENTER] to move the entry to the number that you typed. For example, if you type 6, the entry you are moving becomes number 6 and the previous entry 6 (if there is one) gets pushed up (or down) one.

Working with Lists

When a list of available entries displays next to a list of selected entries, you can often just double-click an entry to move it from one list to the other. In some lists you can also use the [Shift] or [Ctrl] key to select multiple entries, and then use the arrow button to move them to the other list.

Figure 19 Working with Lists



CHAPTER 4
Setup Wizard

4.1 Accessing the Wizard

Connect a router or switch with Internet access to port 1 (ge1), and your computer to ports 2-6 (ge 2-6) of the NXC. When you log into the Web Configurator for the first time or when you reset the NXC to its default configuration, the wizard screens display automatically. For subsequent logins, click the **Wizard** icon at the top of any Web Configurator screen.

4.2 Using the Wizard

This wizard helps you configure the following settings:

1. For the NXC:
   - Country code
   - Time zone
   - Daylight saving
   - IP address
   - VLAN interfaces
2. For managed APs:
   - Radio settings
   - SSID profiles

4.2.1 Step 1 Password and Time Settings

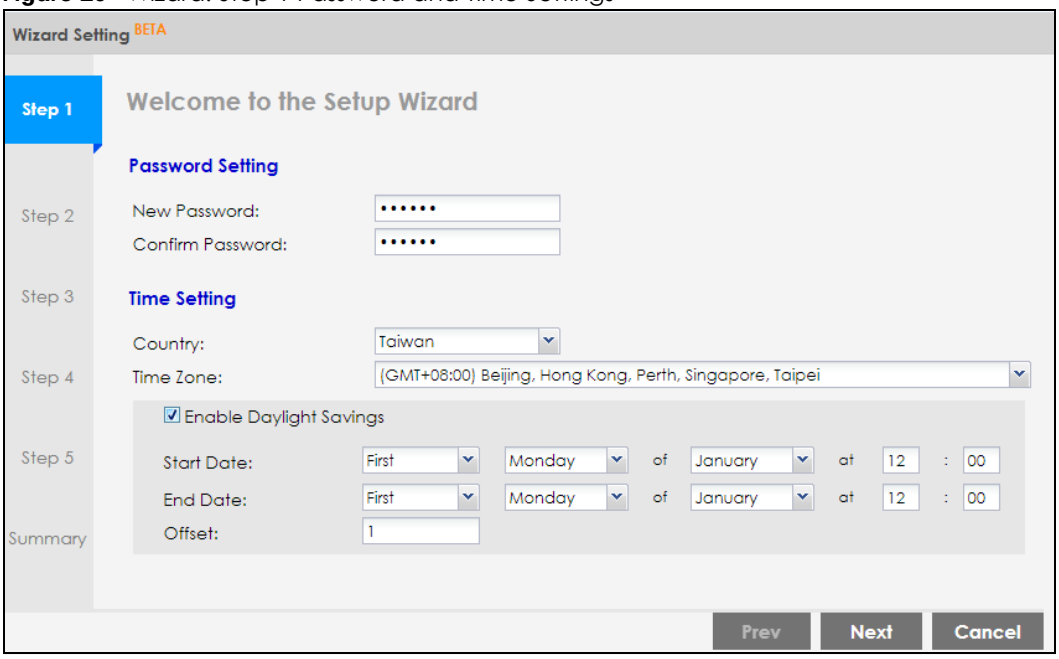
Use this screen to configure the NXC's system password, time zone and daylight savings time.

It's important to have correct date and time values in the logs. If your NXC cannot get the correct date and time, it may not be able to connect to a time server.

- **New Password** & **Confirm Password**: Enter a new password and retype it to confirm.
- **Country**: Select the country where the NXC is located.
- **Time Zone**: Select the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
- **Enable Daylight Savings**: Select the option if you use Daylight Saving Time. Configure the day and time when Daylight Saving Time starts and ends. The default daylight savings settings vary depending on the time zone you selected.
- **Offset** allows you to specify how much the clock changes when daylight saving begins and ends. Enter a number from 1 to 5.5 (by 0.5 increments).

Click **Next** to proceed. Click **Cancel** to close the wizard without saving.

Figure 20 Wizard: Step 1 Password and Time Settings



4.2.2 Step 2 Uplink Connection and Management VLAN

A Virtual Local Area Network (VLAN) allows you to group ports into multiple independent logical networks.

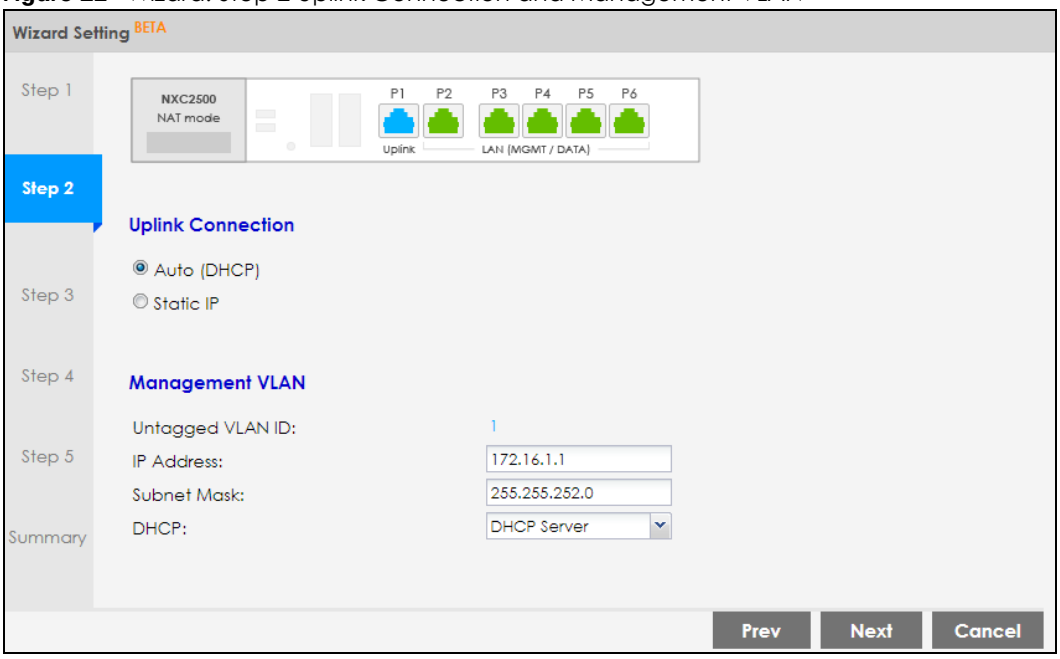
Use this screen to configure the IP address of port 1 (ge1) for Internet access and configure vlan0, the default management VLAN interface. The default members of vlan0 are ports 2-6 (ge2-6), and it uses VLAN ID 1 by default. You can't change the members in the **Wizard**.

- **Uplink Connection**: Select **Auto (DHCP)** if the NXC is connected to a router with the DHCP server enabled. You then need to check the router for the IP address assigned to the NXC in order to access the NXC's web configurator again.

  Otherwise, select **Static IP** when the NXC is NOT connected to a router or you want to assign it a fixed IP address. You will need to manually enter:

  - the NXC's IP address and subnet mask.
  - the IP address of the router that helps forward traffic.
  - a DNS server's IP address. The Domain Name System (DNS) maps a domain name to an IP address and vice versa.
- **Untagged VLAN ID**: This shows the ID number of the default management VLAN interface.
- **IP Address** & **Subnet Mask**: Configure the IP address, subnet mask, and gateway manually.
- **DHCP**: Select **DHCP Server** if you want the NXC to assign IP addresses to the connected devices. Select **DHCP Relay** if you want a DHCP server to do so.

Figure 21 Wizard: Step 2 Uplink Connection and Management VLAN



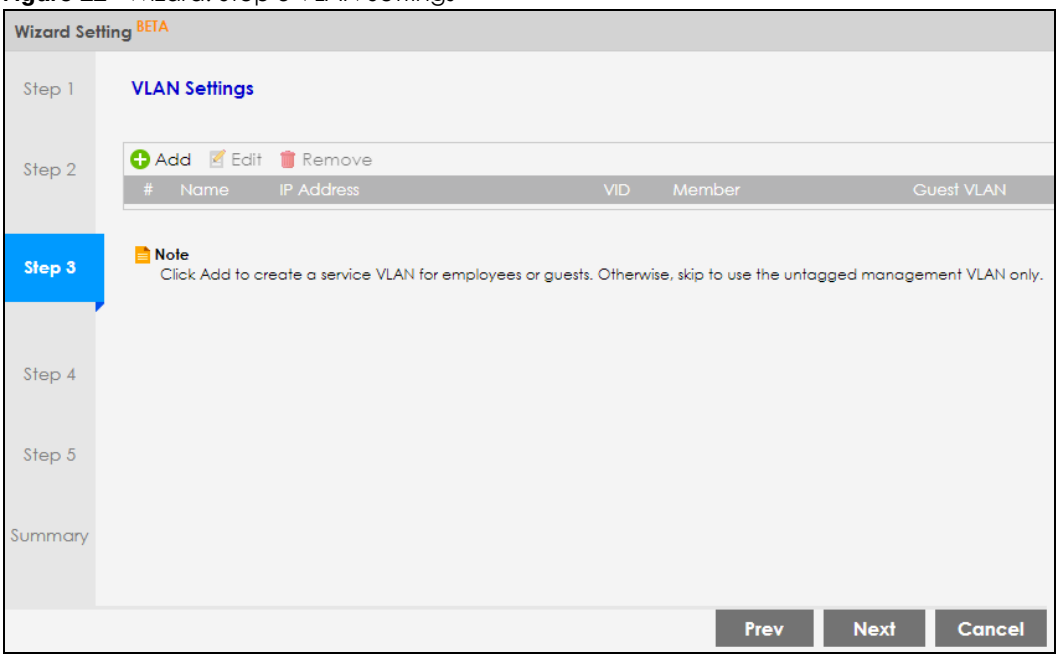
4.2.3 Step 3 VLAN Settings

The NXC ports the managed APs are connected to must be in the same VLAN interface to communicate with each other. Apart from this, you also need to connect your managed APs to the correct ports according to the settings of the VLAN interface in order to communicate with the NXC.

Click the **Add** button to add a new VLAN interface, or select an entry and click the **Edit** button to configure an existing VLAN interface.

- **Name:** This field displays the interface name of this VLAN.
- **IP Address:** This field displays the IP address of this VLAN.
- **VID:** This field displays the VLAN ID.
- **Member**: This field displays the ports that are members of this VLAN. You cannot configure members for VLAN interfaces in the Wizard. The default members are ports 2-6 (ge2-6).
- **Guest VLAN**: This field displays whether this is a guest VLAN and whether the captive portal (web authentication) feature is enabled.

Figure 22 Wizard: Step 3 VLAN Settings



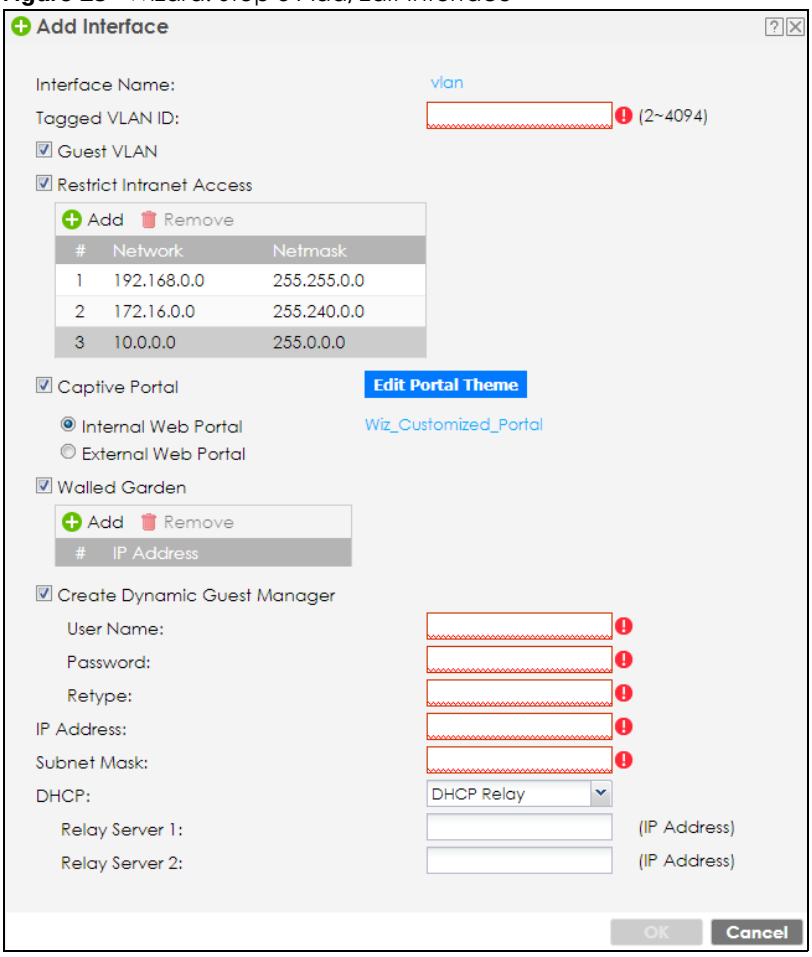
4.2.3.1 Add/Edit VLAN Interfaces

Use this screen to add a new VLAN interface, or configure an existing VLAN interface.

- **Interface Name:** This field consists of the word **vlan** and the VLAN ID configured in the next field.
- **Tagged VLAN ID**: Configure your VLAN ID here. The allowed values are 2-4094. You cannot configure duplicate VLANs.
- **Guest VLAN**: Select this option to have the VLAN act as a guest VLAN, on which you can enable a captive portal.
- **Restrict Internet Access**: If you select **Guest VLAN**, you can define the local networks to which wireless clients cannot have access. Therefore, clients associated with the managed APs connected to a port in this guest VLAN are not allowed to access the specified networks.
- **Captive Portal**: If you select **Guest VLAN**, you can enable captive portal on the VLAN. You then select to use either an internal captive web portal (built into the NXC) or external captive web portal (on an external web server).

  Click **Edit Portal Theme** to design customized portal pages.
- **Walled Garden**: If you select **Guest VLAN**, select this option and click **Add** or **Remove** to manage web site addresses that all users can access without logging in. The web site link(s) displays in the user login page.
- **Create Dynamic Guest Manager**: If you select **Guest VLAN**, select this option and enter a user name and password to create a guest manager account. This user can log in via the web configurator login screen and create dynamic guest accounts using the **Guest Manager** screen that pops up.
- **IP Address** & **Subnet Mask**: Configure the IP address, subnet mask, and gateway manually.
- **DHCP**: Select **DHCP Server** if you want the NXC to assign IP addresses to the connected devices. Select **DHCP Relay** if you want a DHCP server to do so.

Figure 23 Wizard: Step 3 Add/Edit Interface



Add Customized Page

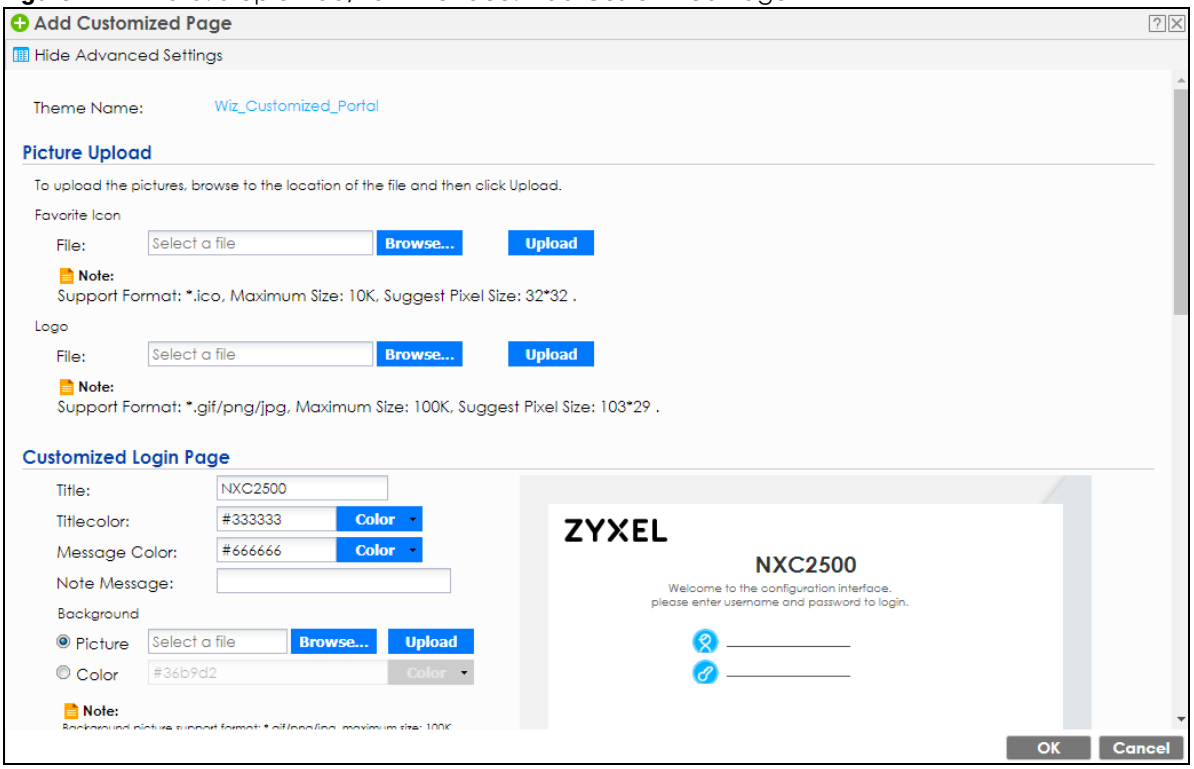
Use this screen to create a customized login theme.

- **Picture Upload**: Choose and upload a custom favorite icon or logo image for the customized login page.
  - **Favorite Icon**: The favorite icon is an image associated with the captive portal page. The icon displays in the web browser's address bar and also next to the page's title on the tab.
  - **Logo**: The logo corresponds to the "Zyxel" logo image in the default page.
- **Customized Login/Access/User-logout Page**: Customize the other elements on the captive portal login page, on the 'access' page that appears upon successful login or on the user logout page.
  - **Title**: Enter 1-64 characters for the page title. Spaces are allowed.
  - **Title Color**: Select a font color for the page title. You can use the color palette chooser, or enter a color value of your own.
  - **Message Colo**r: Specify the color of the screen's text.
  - **Note Message**: Enter a note to display below the title. Use up to 1024 printable ASCII characters. Spaces are allowed.
  - **Background**: Set how the window's background looks.

    To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG.

To use a color, select **Color** and specify the color.

Figure 24 Wizard: Step 3 Add/Edit Interface: Add Customized Page

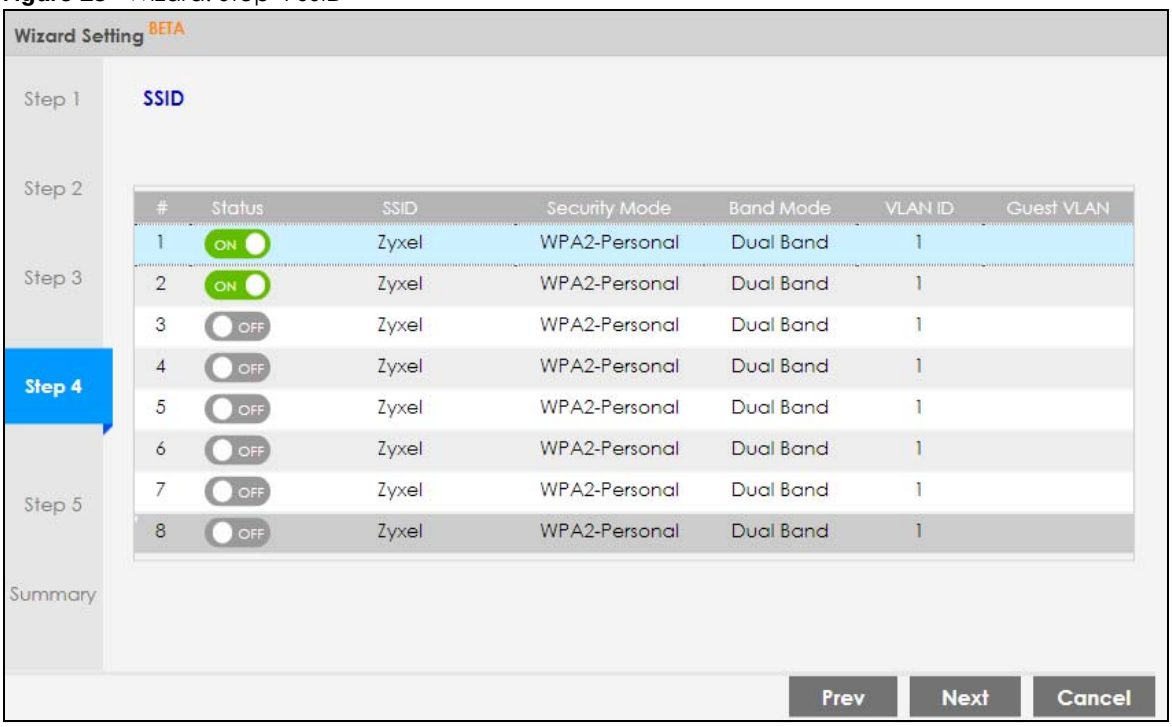


4.2.4 Step 4 SSID

Use this screen to enable, disable or edit an SSID profile of a managed AP.

Select an SSID profile from the list, and click the **On** or **Off** icon to enable or disable the selected SSID profiles of a managed AP by the NXC. To change an SSID profile's settings, such as the SSID (WiFi network name) and WiFi password, double-click the SSID profile from the list.

Figure 25 Wizard: Step 4 SSID



4.2.4.1 Edit SSID Profile

Use this screen to configure an SSID profile. The screen varies depending on the security mode you select.

- **Wireless Name (SSID)** - Enter a descriptive name of up to 32 printable characters to identify the wireless network on the manged AP.
- **Status**: Select **Activate** to enable the SSID profile. Otherwise, select **Inactive** to disable the profile.
- **Guest VLAN**: This field is available only when you create a guest VLAN interface in the previous screen. Select this option to automatically add the guest VLAN tag to traffic from this SSID.
- **Tagged VLAN ID**: Select this option and **Others**, and then enter a VLAN ID for the managed AP to tag traffic originating from this SSID. If you select **Guest VLAN**, this field is not configurable.
- **Band Mode**: Select the wireless band which this profile should use. 2.4 GHz is the frequency used by IEEE 802.11b/g/n/ax wireless clients. 5 GHz is the frequency used by IEEE 802.11ax/ac/a/n wireless clients.

  Not all managed APs support both 2.4 GHz and 5 GHz frequency bands.
- **Security Mode**: Select **WPA2** to add security on this wireless network. Otherwise, select **Open** to allow any wireless client to associate with this network without authentication.
- **Personal**: If you set **Security Mode** to **WPA2** and select **Personal**, enter a pre-shared key of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols) or 64 hexadecimal characters.
- **Enterprise**: Select **Enterprise** and the **Primary / Secondary RADIUS Server Activate** check box to have the managed AP use the specified RADIUS server to authenticate their wireless clients. You have to enter the IP address, port number and shared secret password of the RADIUS server to be used for authentication. This option is not available if you select **Guest VLAN**.

Click **OK** to proceed. Click **Cancel** to close the screen without saving.

Figure 26 Wizard: SSID: Edit (802.1x)

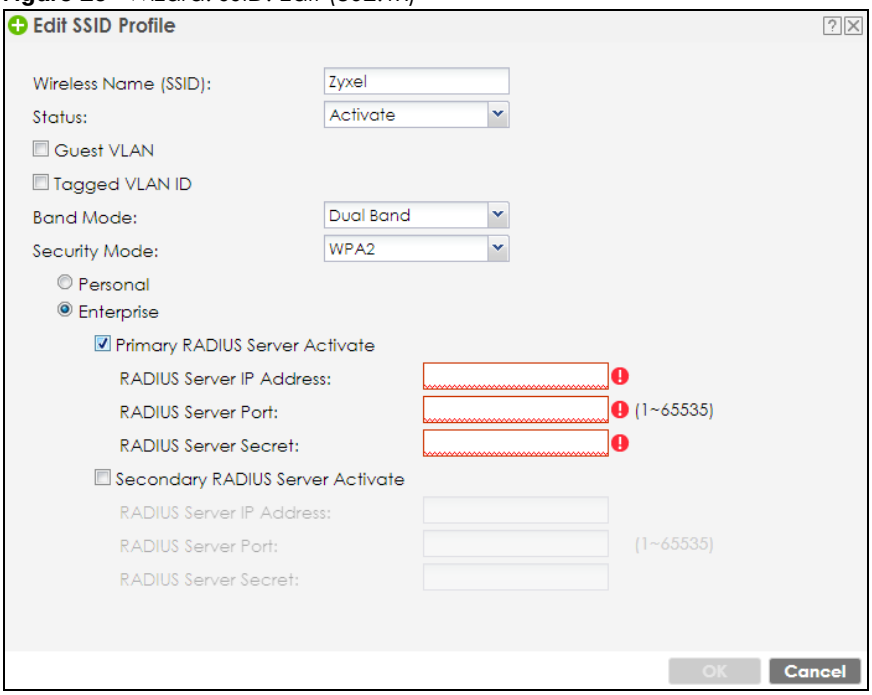
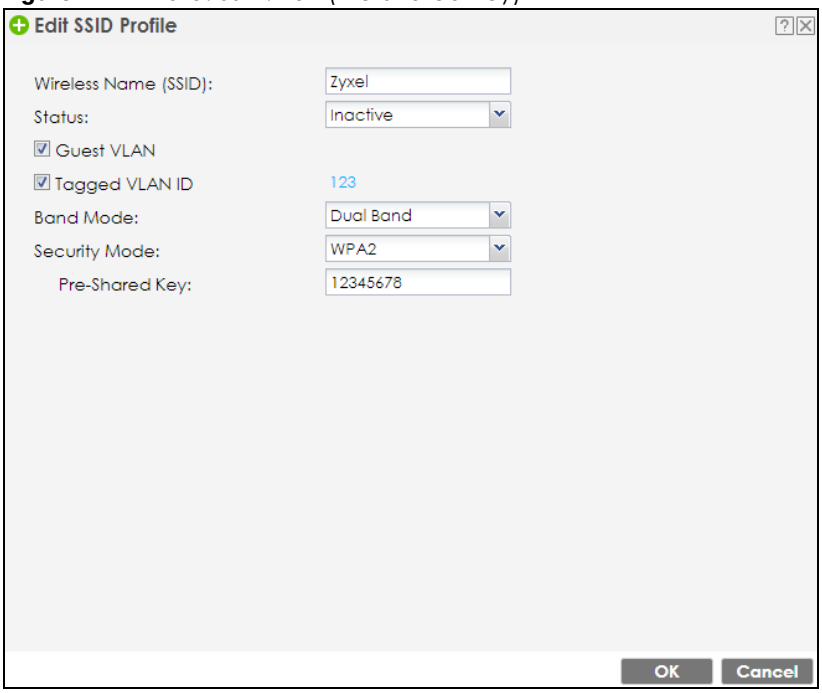


Figure 27 Wizard: SSID: Edit (Pre-Shared Key)



4.2.5 Step 5 Radio

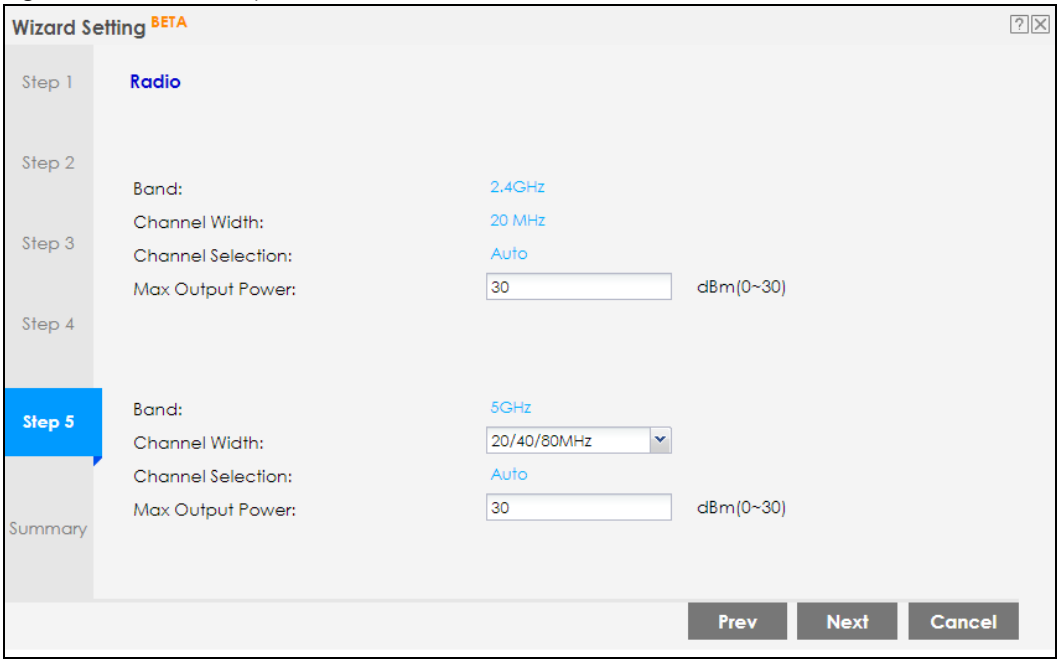
Use this screen to configure managed APs' radio transmitter(s).

- **Channel Selection**: This shows **Auto** and the managed AP will automatically choose a radio channel that has least interference.

- **Channel Width**: Select the wireless channel bandwidth you want the managed AP to use. Because not all devices support 40 MHz and/or 80 MHz channels, select **20/40/80MHz** to allow the AP to adjust the channel bandwidth automatically.
- **Maximum Output Power**: Enter the maximum output power of the managed AP. If there is a high density of APs in an area, decrease the output power of the managed AP to reduce interference with other APs. The default output power settings vary depending on the time zone you selected.

Note: Reducing the output power also reduces the managed AP's effective broadcast radius.

Figure 28 Wizard: Step 5 Radio

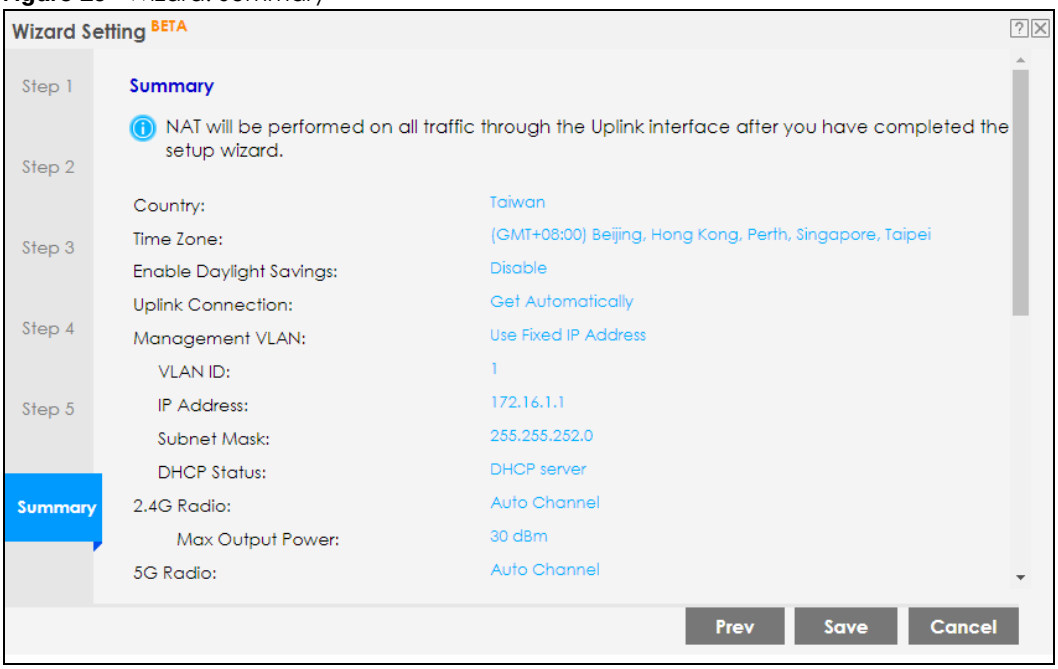


4.2.6 Summary

Use this screen to check whether what you have configured is correct. Click **Save** to save your settings and complete the wizard setup. Otherwise, click **Prev** to return to the previous screen or click **Cancel** to close the wizard without saving.

To configure advanced settings on date/time, the uplink connection, a VLAN interface, and managed APs, go to the configuration screens after you finish setting up the **Wizard**.

Figure 29 Wizard: Summary



PART II
Technical Reference

CHAPTER 5
Dashboard

5.1 Overview

Use the **Dashboard** screens to check status information about the NXC.

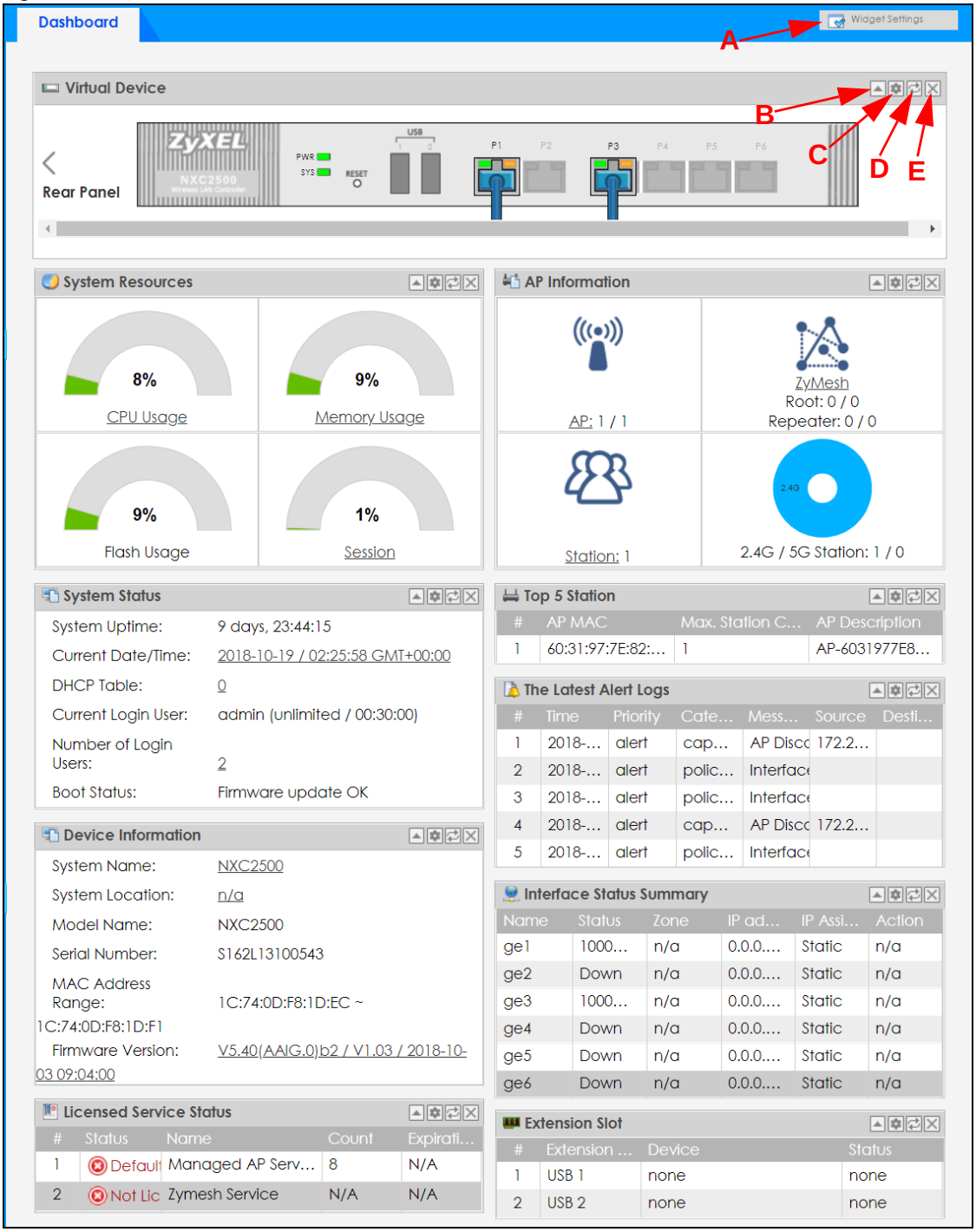
5.1.1 What You Can Do in this Chapter

- The main **Dashboard** screen (Section 5.2 on page 59) displays the NXC's general device information, system status, system resource usage, licensed service status, and interface status. You can also display other status screens for more information.
- The **DHCP Table** screen (Section 5.2.4 on page 64) displays the IP addresses currently assigned to DHCP clients and the IP addresses reserved for specific MAC addresses.
- The **Number of Login Users** screen (Section 5.2.5 on page 66) displays the users currently logged into the NXC.
- The **AP > Status** screen (Section 5.2.6 on page 66) displays how many wireless stations are connected to the managed AP(s) and data usage.
- The **Station > Traffic** screen (Section 5.2.7 on page 68) displays data usage of the connected wireless station(s).

5.2 Dashboard

This screen is the first thing you see when you log into the NXC. It also appears every time you click the **Dashboard** icon in the navigation panel. The Dashboard displays general device information, system status, system resource usage, licensed service status, and interface status in widgets that you can re-arrange to suit your needs. You can also collapse, refresh, and close individual widgets.

Figure 30 Dashboard



The following table describes the labels in this screen.

Table 18 Dashboard

LABEL	DESCRIPTION
Widget Settings (A)	Use this link to re-open closed widgets. Widgets that are already open appear grayed out.
Arrow (B)	Click this to collapse or expand a widget.
Refresh Time Setting (C)	Set the interval for refreshing the information displayed in the widget.
Refresh Now (D)	Click this to update the widget's information immediately.
Close Widget (E)	Click this to close the widget. Use **Widget Settings** to re-open it.
Virtual Device	Hover your cursor over a LED or connected Ethernet port to view details about the status of the NXC's LEDs and connections. See Section 2.5.3 on page 30 for LED descriptions. An unconnected interface appears grayed out. The following labels display when you hover your cursor over a connected interface.
Name	This field displays the name of the interface or slot.
Status	This field displays the current status of each interface or device installed in a slot. The possible values depend on what type of interface it is. **Inactive** - The Ethernet interface is disabled. **Down** - The Ethernet interface is enabled but not connected. **Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**).
Zone	This field displays the zone to which the interface is currently assigned.
IP Address/Mask	This field displays the current IP address and subnet mask assigned to the interface.
System Resources	
CPU Usage	This field displays what percentage of the NXC's processing capability is currently being used. Click the **CPU Usage** link to display a chart of the NXC's recent CPU usage.
Flash Usage	This field displays what percentage of the NXC's onboard flash memory is currently being used.
Memory Usage	This field displays what percentage of the NXC's RAM is currently being used. Click the **Memory Usage** link to display a chart of the NXC's recent memory usage.
Session	This field displays how many traffic sessions are currently open on the NXC. These are the sessions that are traversing the NXC. Hover your cursor over this field to display icons. Click the **Session** link to display a chart of NXC's recent session usage.
System Status	
System Uptime	This field displays how long the NXC has been running since it last restarted or was turned on.
Current Date/ Time	This field displays the current date and time in the NXC. The format is yyyy-mm-dd hh:mm:ss. Click the link to open the screen where you can configure the NXC's date and time.
DHCP Table	This field displays the number of IP addresses the NXC has assigned via DHCP. Click the link to look at the IP addresses currently assigned to the NXC's DHCP clients and the IP addresses reserved for specific MAC addresses.
Current Login User	This field displays the user name used to log in to the current session, the amount of reauthentication time remaining, and the amount of lease time remaining.
Number of Login Users	This field displays the number of users currently logged in to the NXC. Click the link to pop-open a list of the users who are currently logged in to the NXC.

Table 18 Dashboard (continued)

LABEL	DESCRIPTION
Boot Status	This field displays details about the NXC's startup state. **OK** - The NXC started up successfully. **Firmware update OK** - A firmware update was successful. **Problematic configuration after firmware update** - The application of the configuration failed after a firmware upgrade. **System default configuration** - The NXC successfully applied the system default configuration. This occurs when the NXC starts for the first time or you intentionally reset the NXC to the system default settings. **Fallback to lastgood configuration** - The NXC was unable to apply the startup-config.conf configuration file and fell back to the lastgood.conf configuration file. **Fallback to system default configuration** - The NXC was unable to apply the lastgood.conf configuration file and fell back to the system default configuration file (system-default.conf). **Booting in progress** - The NXC is still applying the system configuration.
Device Information	
System Name	This field displays the name used to identify the NXC on any network. Click the link to open the screen where you can change it.
System Location	This field displays the location of the NXC. Click the link to open the screen where you can change it.
Model Name	This field displays the model name of this NXC.
Serial Number	This field displays the serial number of this NXC.
MAC Address Range	This field displays the MAC addresses used by the NXC. Each physical port has one MAC address. The first MAC address is assigned to physical port 1, the second MAC address is assigned to physical port 2, and so on.
Firmware Version	This field displays the version number and date of the firmware the NXC is currently running. Click the link to open the screen where you can upload firmware.
Licensed Service Status	
#	This shows how many licensed services there are.
Status	This is the current status of the license.
Name	This identifies the licensed service.
Version	This is the version number of the service.
Expiration	If the service license is valid, this shows when it will expire. **n/a** displays if the service license does not have a limited period of validity. **0** displays if the service is not licensed or has expired.
Extension Slot	This section of the screen displays the status of the USB ports.
#	This field displays how many USB ports there are.
Extension Slot	This field displays the name of each extension slot.
Device	This field displays the name of the device connected to the extension slot (or **none** if no device is detected).
Status	**Ready** - A USB storage device connected to the NXC is ready for the NXC to use. **none** - The NXC is unable to mount a USB storage device connected to the NXC.
AP Information	This shows a summary of connected wireless Access Points (APs).
AP	This displays the number of currently connected managed APs and the number of all managed APs. Click the link to go to the **Monitor > Wireless > AP information** > **AP List** screen.

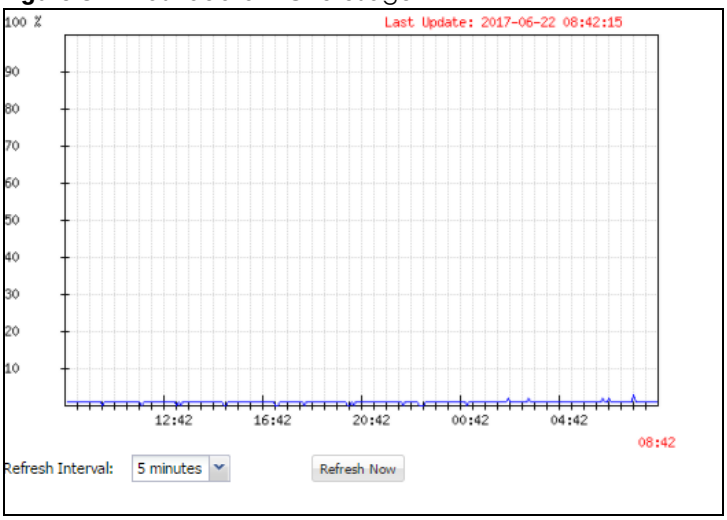
Table 18 Dashboard (continued)

LABEL	DESCRIPTION
Station	This displays the number of stations currently connected to the network through managed APs. Click the link to go to the **Monitor > Wireless > Station Info** > **Station List** screen.
ZyMesh	A ZyMesh AP is a managed APs that act as a root AP or a repeater to form a ZyMesh. This shows the number of currently connected ZyMesh APs and the number of all ZyMesh APs. Click the link to go to the **Monitor > Wireless > ZyMesh > ZyMesh Link Info** screen.
2.4G / 5G Station	This displays the number of stations connecting to the 2.4 GHz and 5 GHz networks respectively.
Top 5 Station	Displays the top 5 Access Points (APs) with the highest number of station (aka wireless client) connections.
#	This field displays the rank of the AP.
AP MAC	This field displays the MAC address of the AP to which the station belongs.
Max. Station Count	This field displays the maximum number of wireless clients that have connected to this AP.
AP Description	This field displays the AP's description. The default description is "AP-" followed by the AP's MAC address.
Interface Status Summary	
Name	This field displays the name of each interface.
Status	This field displays the current status of each interface. The possible values depend on what type of interface it is. **Inactive** - The Ethernet interface is disabled. **Down** - The Ethernet interface is enabled but not connected. **Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**).
Zone	This field displays the zone to which the interface is currently assigned.
IP Addr/Netmask	This field displays the current IP address and subnet mask assigned to the interface. If the IP address is 0.0.0.0, the interface is disabled or did not receive an IP address and subnet mask via DHCP.
IP Assignment	This field displays how the interface gets its IP address. **Static** - This interface has a static IP address. **DHCP Client** - This interface gets its IP address from a DHCP server.
Action	Use this field to get or to update the IP address for the interface. Click **Renew** to send a new DHCP request to a DHCP server.
The Latest Alert Logs	This section of the screen displays recent logs generated by the NXC.
#	This is the entry's rank in the list of alert logs.
Time	This field displays the date and time the log was created.
Priority	This field displays the severity of the log.
Category	This field displays the type of log generated.
Message	This field displays the actual log message.
Source	This field displays the source address (if any) in the packet that generated the log.
Destination	This field displays the destination address (if any) in the packet that generated the log.

5.2.1 CPU Usage

Use this screen to look at a chart of the NXC's recent CPU usage. To access this screen, click **Show CPU Usage** in the dashboard.

Figure 31 Dashboard > CPU Usage



The following table describes the labels in this screen.

Table 19 Dashboard > CPU Usage

LABEL	DESCRIPTION
	The y-axis represents the percentage of CPU usage.
	The x-axis shows the time period over which the CPU usage occurred
Refresh Interval	Enter how often you want this window to be automatically updated.
Refresh Now	Click this to update the information in the window right away.

5.2.2 Memory Usage

Use this screen to look at a chart of the NXC's recent memory (RAM) usage. To access this screen, click **Show Memory Usage** in the dashboard.

Figure 32 Dashboard > Memory Usage

The following table describes the labels in this screen.

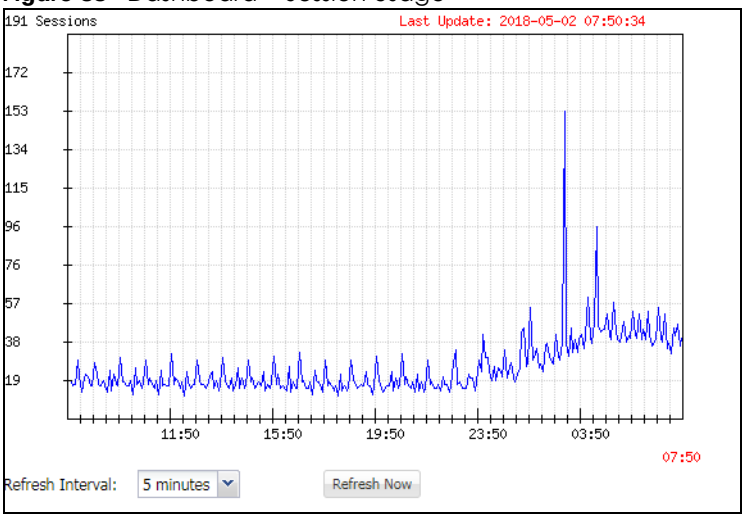
Table 20 Dashboard > Memory Usage

LABEL	DESCRIPTION
	The y-axis represents the percentage of RAM usage.
	The x-axis shows the time period over which the RAM usage occurred.
Refresh Interval	Enter how often you want this window to be automatically updated.
Refresh Now	Click this to update the information in the window right away.

5.2.3 Session Usage

Use this screen to look at a chart of the NXC's recent traffic session usage. To access this screen, click **Show Active Sessions** in the dashboard.

Figure 33 Dashboard > Session Usage



The following table describes the labels in this screen.

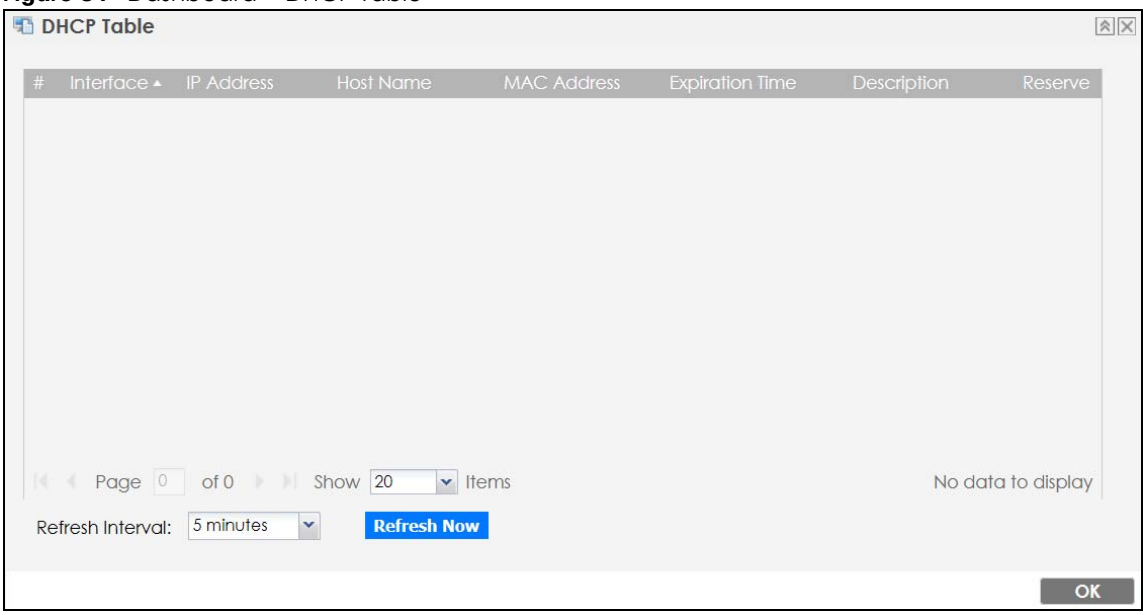
Table 21 Dashboard > Session Usage

LABEL	DESCRIPTION
Sessions	The y-axis represents the number of session.
	The x-axis shows the time period over which the session usage occurred.
Refresh Interval	Enter how often you want this window to be automatically updated.
Refresh Now	Click this to update the information in the window right away.

5.2.4 DHCP Table

Use this screen to look at the IP addresses currently assigned to DHCP clients and the IP addresses reserved for specific MAC addresses. To access this screen, click the link beside **DHCP Table** in the dashboard.

Figure 34 Dashboard > DHCP Table



The following table describes the labels in this screen.

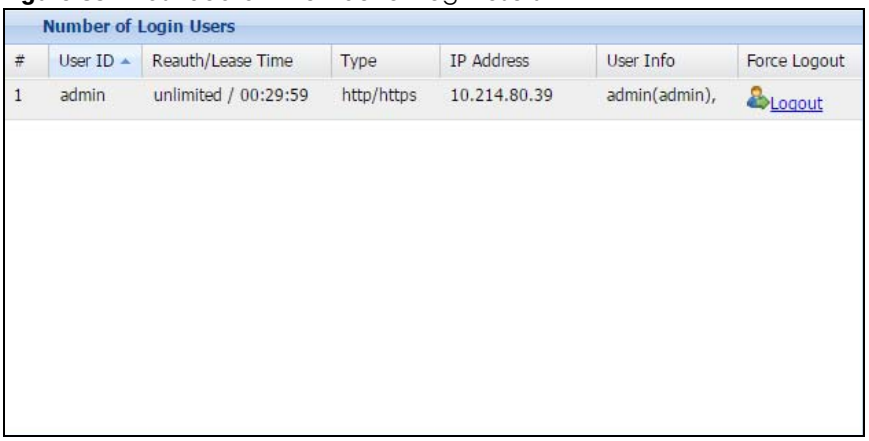
Table 22 Dashboard > DHCP Table

LABEL	DESCRIPTION
#	This field is a sequential value, and it is not associated with a specific entry.
Interface	This field identifies the interface that assigned an IP address to a DHCP client.
IP Address	This field displays the IP address currently assigned to a DHCP client or reserved for a specific MAC address. Click the column's heading cell to sort the table entries by IP address. Click the heading cell again to reverse the sort order.
Host Name	This field displays the name used to identify this device on the network (the computer name). The NXC learns these from the DHCP client requests. "None" shows here for a static DHCP entry.
MAC Address	This field displays the MAC address to which the IP address is currently assigned or for which the IP address is reserved. Click the column's heading cell to sort the table entries by MAC address. Click the heading cell again to reverse the sort order.
Expiration Time	This field displays the date and time the IP address becomes invalid and the DHCP client then has to request the information again. It shows **n/a** if the IP address is reserved for the MAC address.
Description	For a static DHCP entry, the host name or the description you configured shows here. This field is blank for dynamic DHCP entries.
Reserve	If this field is selected, this entry is a static DHCP entry. The IP address is reserved for the MAC address. If this field is clear, this entry is a dynamic DHCP entry. The IP address is assigned to a DHCP client. To create a static DHCP entry using an existing dynamic DHCP entry, select this field. To remove a static DHCP entry, clear this field.
Refresh Interval	Enter how often you want this screen to be automatically updated.
Refresh Now	Click this to update the information in the screen right away.
OK	Click this to close the screen.

5.2.5 Number of Login Users

Use this screen to look at a list of the users currently logged into the NXC. To access this screen, click the dashboard's **Number of Login Users** icon.

Figure 35 Dashboard > Number of Login Users



The following table describes the labels in this screen.

Table 23 Dashboard > Number of Login Users

LABEL	DESCRIPTION
#	This field is a sequential value and is not associated with any entry.
User ID	This field displays the user name of each user who is currently logged in to the NXC.
Reauth/Lease Time	This field displays the amount of reauthentication time remaining and the amount of lease time remaining for each user.
Type	This field displays the way the user logged in to the NXC.
IP address	This field displays the IP address of the computer used to log in to the NXC.
User Info	This field displays the types and user names of user accounts the NXC uses. If the user type is **ext-user** (external user), this field will show its external-group information when you move your mouse over it. If the external user matches two external-group objects, both external-group object names will be shown.
Force Logout	Click this icon to end a user's session.

5.2.6 AP Status

Use this screen to view how many wireless stations are connected to the managed AP(s) and the data usage. To access this screen, click **Dashboard > AP > Status**. Click the **Single AP** tab to view a specific AP's usage details, or click the **Top N APs** tab to view usage information for multiple APs at a time.

For the traffic usage bar chart, the y-axis shows the amount of data (in MB or GB) sent or received by the stations connected to the selected AP(s). The x-axis shows the time period over which the traffic flow occurred. You can select a specific 24-hour period to view by selecting a date at the top of the charts.

For the station count bar chart, the y-axis shows the number of the connected wireless stations. The x-axis shows the time period over which the number is recorded.

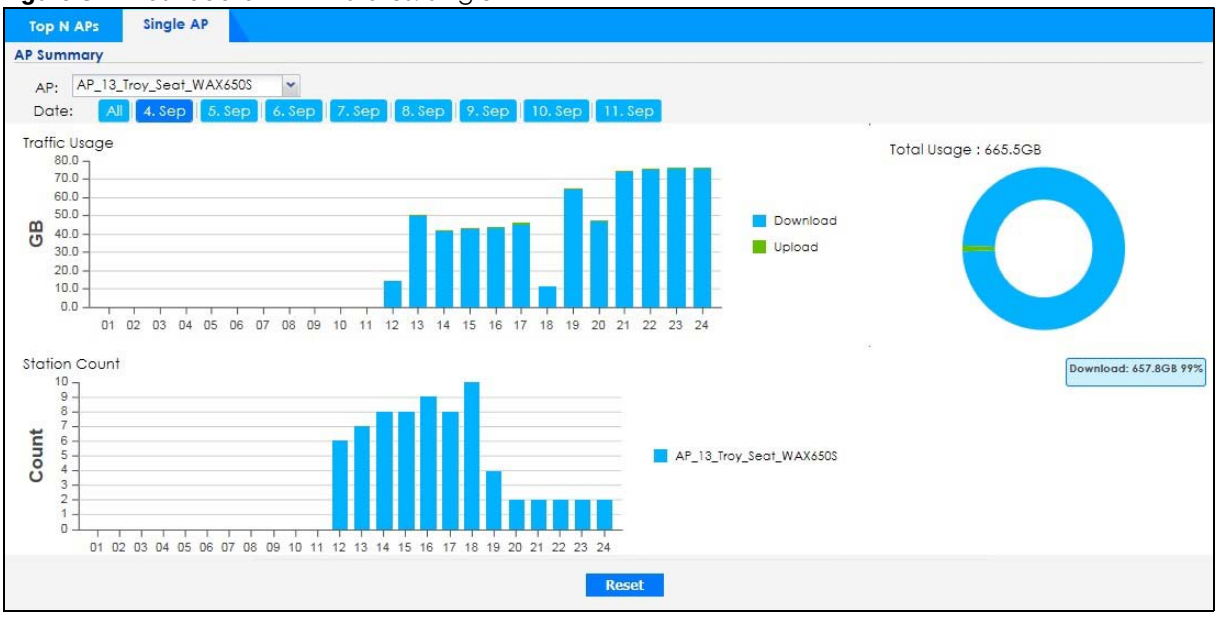
Move the cursor over a bar to see usage details over a specific time period. The **Total Usage** or **Total Count** bars include other APs not shown in the graphs. Click a bar to open the **Monitor > Wireless > Station Info > Station List** screen and view information about the connected wireless stations.

In the **Top N APs** screen, if you select **Top 5 by Usage** or **Top 10 by Usage** to show statistics for the top APs which are ranked according to the AP's data usage over the past eight days, the NXC also updates the station count chart for these APs, and vice versa. You can also filter the data by wireless bandwidth (2.4G or 5G).

The pie chart on the right displays the breakdown of traffic usage and station count by client within the selected time period. The gray area represents other APs not shown in the graph.

Figure 36 Dashboard > AP > Status: Top N APs

Figure 37 Dashboard > AP > Status: Single AP



5.2.7 Station Traffic

Use this screen to view data usage of the connected wireless station(s). To access this screen, click **Dashboard > Station > Traffic**. Click the **Single Station** tab to view a specific wireless station's usage details, or click the **Top N Stations** tab to view usage information for multiple stations at a time.

The y-axis shows the amount of data (in MB or GB) consumed by the selected station(s). The x-axis shows the time period over which the traffic flow occurred. You can select a specific 24-hour period to view by selecting a date at the top of the charts.

Move the cursor over a bar to see usage details over a more specific time period. The pie chart on the right displays the breakdown of traffic usage and station count by client within the selected time period. The gray area represents other stations not shown in the graph.

Figure 38 Dashboard > Station > Traffic: Top N Stations

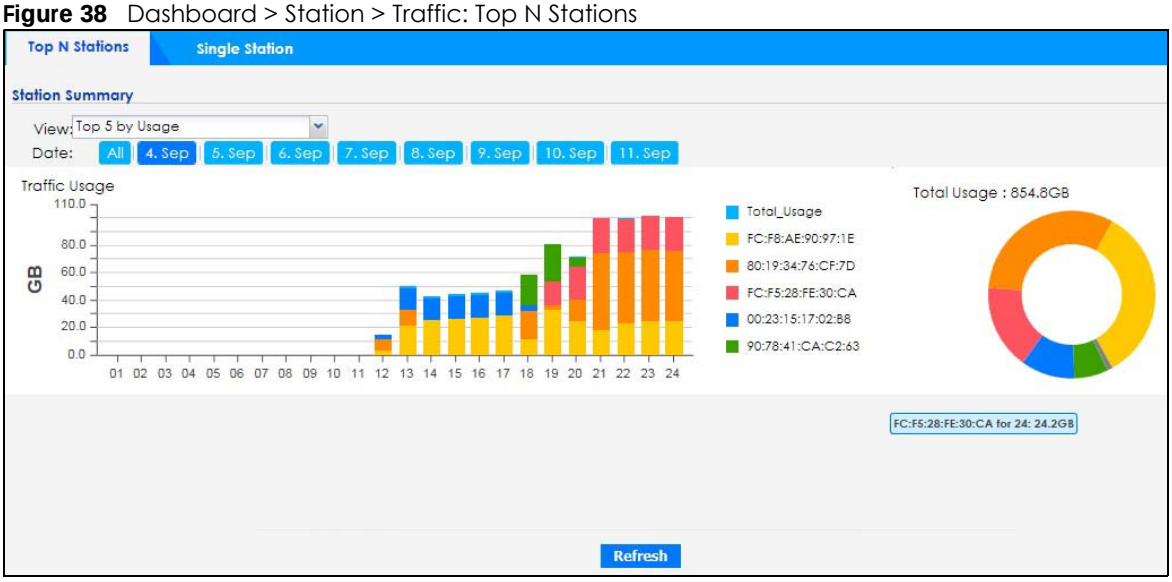
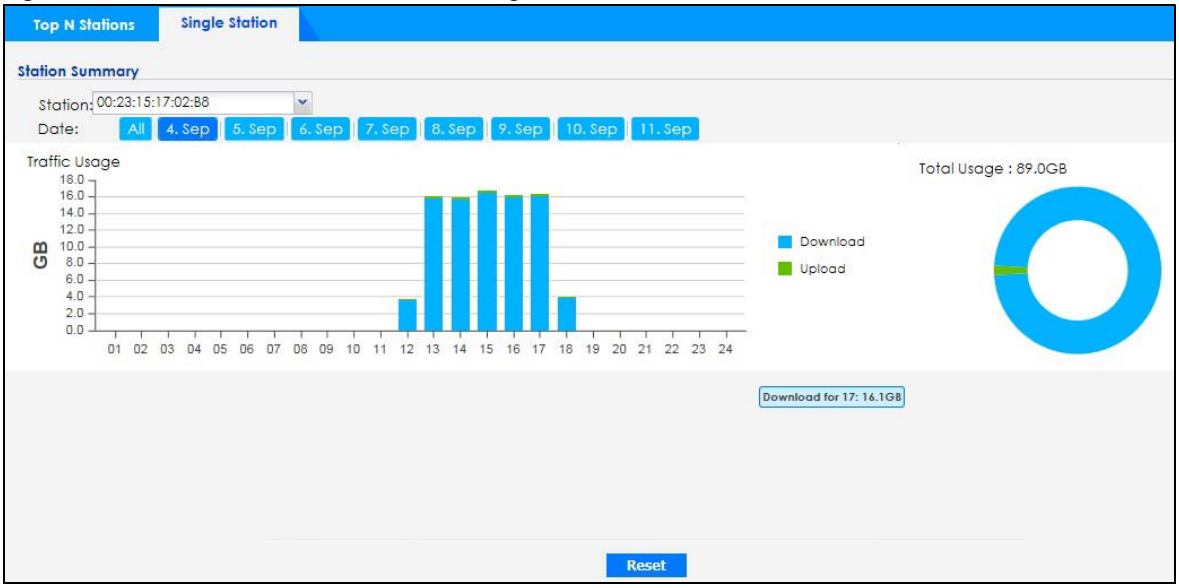


Figure 39 Dashboard > Station > Traffic: Single Station



CHAPTER 6
Monitor

6.1 Overview

Use the **Monitor** screens to check status and statistics information.

6.1.1 What You Can Do in this Chapter

- The **Port Statistics** screen (Section 6.3 on page 71) displays packet statistics for each physical port.
- The **Port Statistics Graph** screen (Section 6.3.1 on page 72) displays a line graph of packet statistics for each physical port.
- The **Interface Status** screen (Section 6.4 on page 73) displays all of the NXC's interfaces and their packet statistics.
- The **Traffic Statistics** screen (Section 6.5 on page 75) allows you to start or stop data collection and view statistics.
- The **Session Monitor** screen (Section 6.6 on page 78) displays sessions by user or service.
- The **IP/MAC Binding** screen (Section 6.7 on page 80) displays lists of the devices that have received an IP address from NXC interfaces with IP/MAC binding enabled.
- The **Login Users** screen (Section 6.8 on page 81) displays a list of the users currently logged into the NXC.
- The **Login Users > Dynamic Guest** screen (Section 6.8.1 on page 82) displays a list of the guest user accounts, which are created automatically and allowed to access the NXC's services for a certain period of time.
- The **Login Users > Trusted MAC Address** screen (Section 6.8.2 on page 83) displays a list of MAC addresses, which are authenticated and allowed to access the network.
- The **USB Storage** screen (Section 6.9 on page 84) displays information about a connected USB storage device.
- The **Ethernet Neighbor** screen (Section 6.10 on page 85) displays the NXC's neighboring devices in one place.
- The **AP List** screen (Section 6.11 on page 86) displays which APs are currently connected to the NXC.
- The **Radio List** screen (Section 6.12 on page 102) displays statistics about the wireless radio transmitters in each of the APs connected to the NXC.
- The **ZyMesh Link Info** screen (Section 6.13 on page 105) displays statistics about the ZyMesh connections between the managed APs.
- The **SSID Info** screen (Section 6.14 on page 106) displays the number of wireless clients that are currently connected to an SSID and the SSID's security mode.
- The **Station List** screen (Section 6.15 on page 107) displays statistics pertaining to the connected stations (or "wireless clients").
- The **Detected Device** screen (Section 6.16 on page 109) displays the wireless devices passively detected by the NXC.

- The **View Log** screen (Section 6.17 on page 111) displays the NXC's current log messages. You can change the way the log is displayed, you can e-mail the log, and you can also clear the log in this screen.
- The **View AP Log** screen (Section 6.18 on page 113) displays the NXC's current wireless AP log messages.

6.2 What You Need to Know

The following terms and concepts may help as you read through the chapter.

Rogue AP

Rogue APs are wireless access points operating in a network's coverage area that are not under the control of the network's administrators, and can open up holes in a network's security. See Chapter 20 on page 279 for details.

Friendly AP

Friendly APs are other wireless access points that are detected in your network, as well as any others that you know are not a threat (those from neighboring networks, for example). See Chapter 20 on page 279 for details.

Bluetooth Low Energy

Beacon is Apple's communication protocol on top of Bluetooth Low Energy wireless technology. Beacons (Bluetooth radio transmitters) or BLE enabled devices broadcast packets to every device around it to announce their presence. Advertising packets contain their iBeacon ID which mainly consists of the UUID, major number, minor number and TX (transmit) power. The ID is used to distinguish beacons in your network.

The universally unique identifier (UUID) is a 128-bit (16-byte) number which can be used to identify a service, a device, a manufacturer or an owner. The 2-byte major number is to identify and distinguish a group, and the 2-byte minor number is to identify and distinguish an individual.

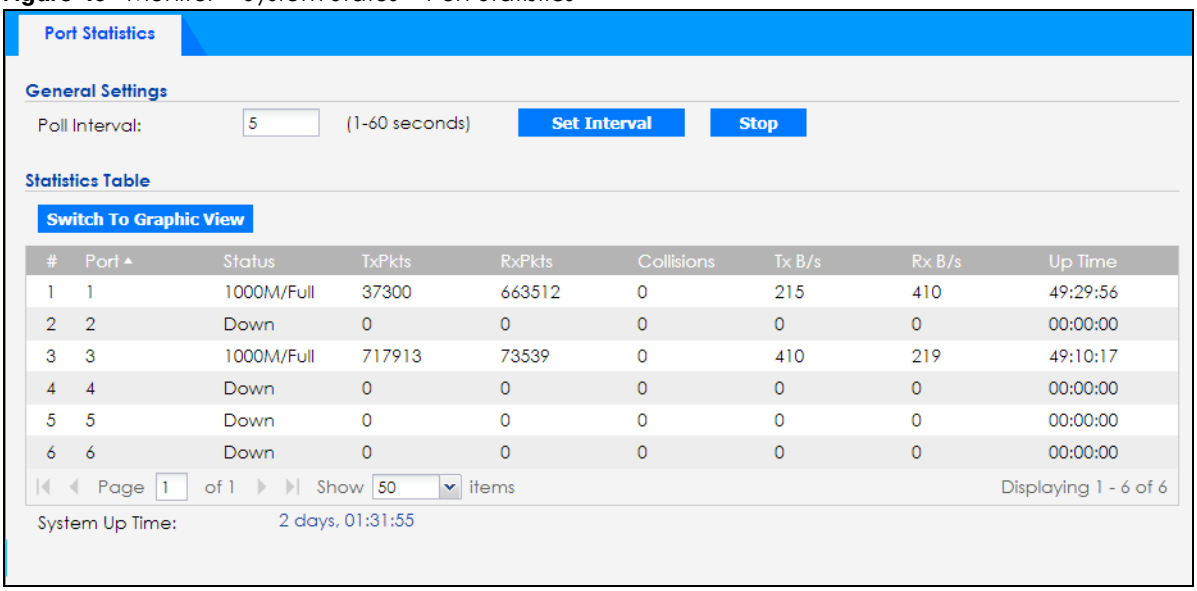
For example, you can set all the beacons in one network to share the same UUID, the beacons in a particular room to use the same major number, and each beacon in the room can have its own minor number.

	NETWORK A		
	ROOM X		ROOM Y
	BEACON 1	BEACON 2	BEACON 3
UUID	EBAECFAF-DFE0-4039-BE5A-F030EED4303C		
Major	10	10	20
Minor	1	2	1

6.3 Port Statistics

Use this screen to look at packet statistics for each Gigabit Ethernet port. To access this screen, click **Monitor > System Status** > **Port Statistics**.

Figure 40 Monitor > System Status > Port Statistics



The following table describes the labels in this screen.

Table 24 Monitor > System Status > Port Statistics

LABEL	DESCRIPTION
General Settings	
Poll Interval	Enter how often you want this window to be updated automatically, and click **Set Interval**.
Set Interval	Click this to set the **Poll Interval** the screen uses.
Stop	Click this to stop the window from updating automatically. You can start it again by setting the **Poll Interval** and clicking **Set Interval**.
Statistics Table	
Switch to Graphic View	Click this to display the port statistics as a line graph.
#	This field displays the port's number in the list.
Port	This field displays the physical port number.
Status	This field displays the current status of the physical port. **Down** - The physical port is not connected. **Speed / Duplex** - The physical port is connected. This field displays the port speed and duplex setting (**Full** or **Half**).
TxPkts	This field displays the number of packets transmitted from the NXC on the physical port since it was last connected.
RxPkts	This field displays the number of packets received by the NXC on the physical port since it was last connected.
Collisions	This field displays the number of collisions on the physical port since it was last connected.
Tx B/s	This field displays the transmission speed, in bytes per second, on the physical port in the one-second interval before the screen updated.

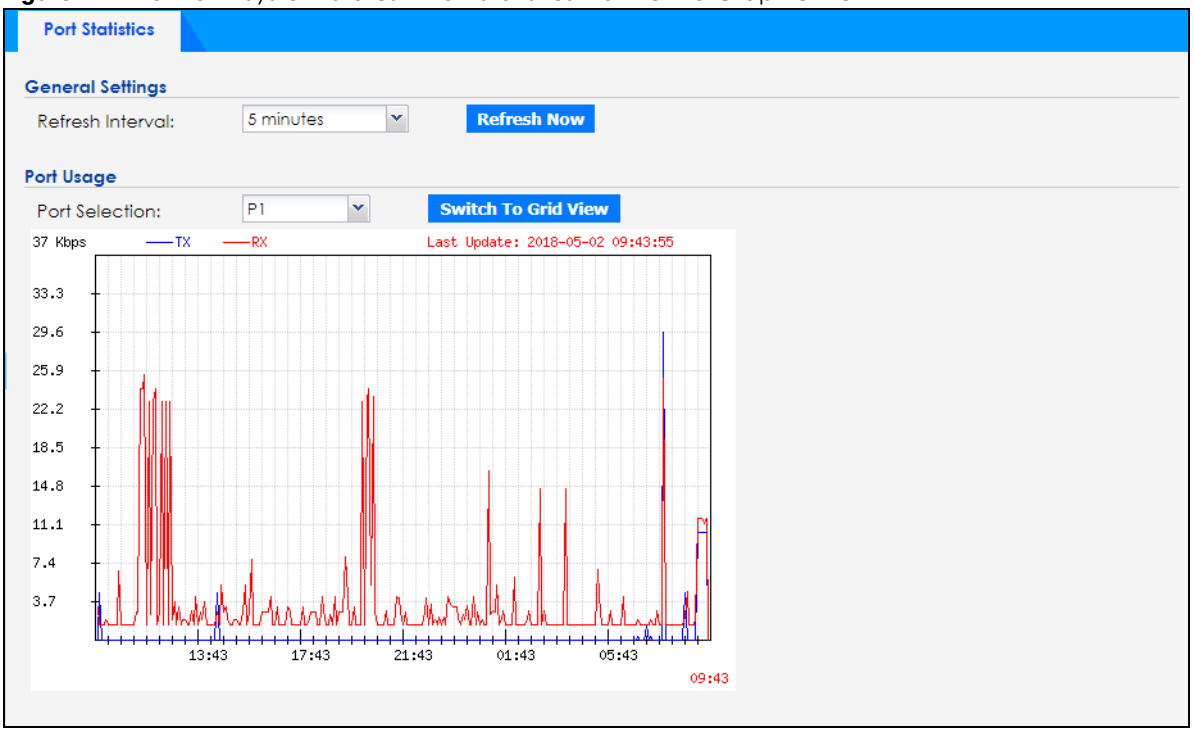
Table 24 Monitor > System Status > Port Statistics (continued)

LABEL	DESCRIPTION
Rx B/s	This field displays the reception speed, in bytes per second, on the physical port in the one-second interval before the screen updated.
Up Time	This field displays how long the physical port has been connected.
System Up Time	This field displays how long the NXC has been running since it last restarted or was turned on.

6.3.1 Port Statistics Graph

Use the port statistics graph to look at a line graph of packet statistics for each physical port. To view, click **Monitor > System Status** > **Port Statistics** and then the **Switch to Graphic View** button.

Figure 41 Monitor > System Status > Port Statistics > Switch to Graphic View



The following table describes the labels in this screen.

Table 25 Monitor > System Status > Port Statistics > Switch to Graphic View

LABEL	DESCRIPTION
General Settings	
Refresh Interval	Enter how often you want this window to be automatically updated.
Refresh Now	Click this to update the information in the window right away.
Port Usage	
Port Selection	Select the number of the physical port for which you want to display graphics.
Switch to Grid View	Click this to display the port statistics as a table.
Mbps/Kbps	The y-axis represents the speed of transmission or reception.
time	The x-axis shows the time period over which the transmission or reception occurred

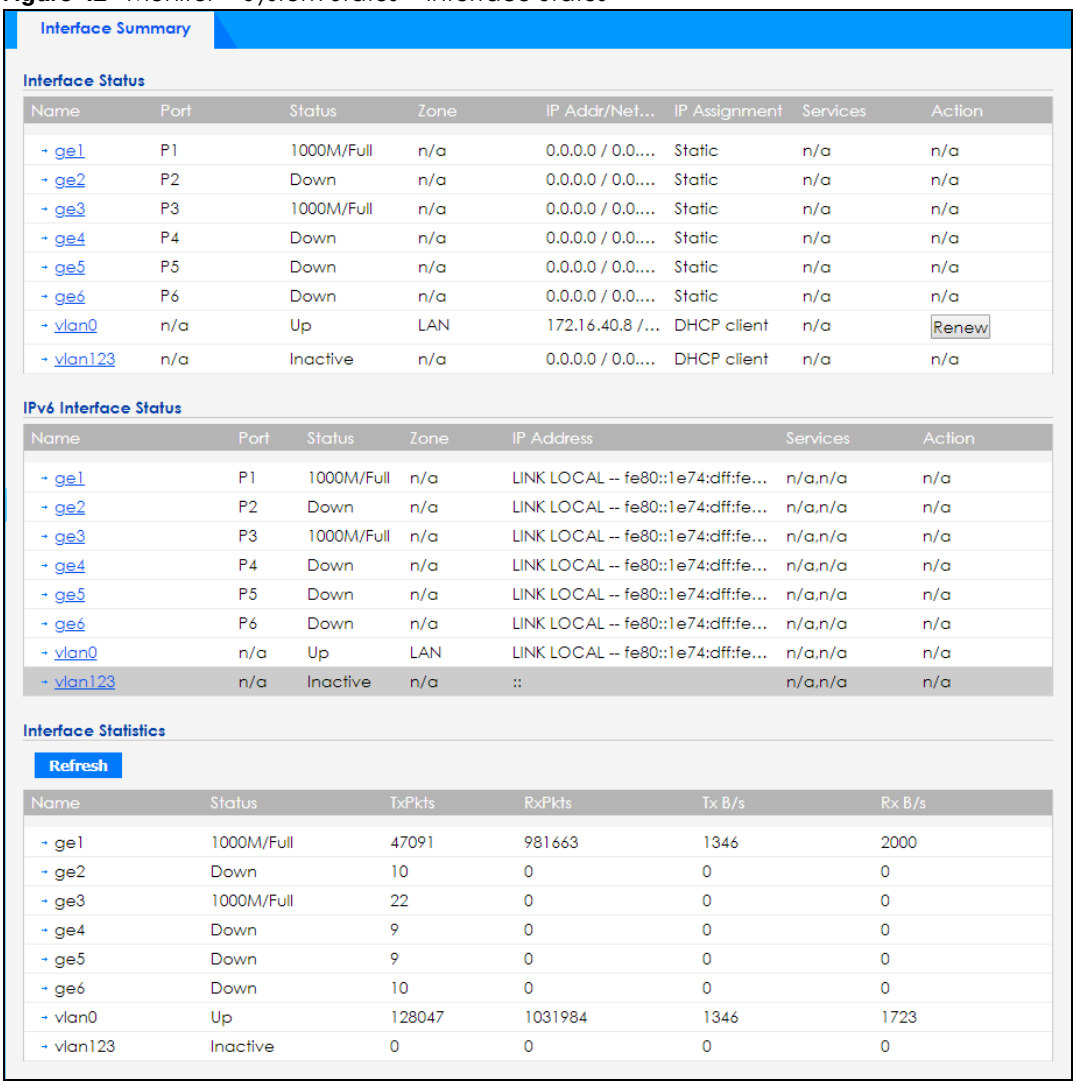
Table 25 Monitor > System Status > Port Statistics > Switch to Graphic View (continued)

LABEL	DESCRIPTION
TX	This line represents traffic transmitted from the NXC on the physical port since it was last connected.
RX	This line represents the traffic received by the NXC on the physical port since it was last connected.
Last Update	This field displays the date and time the information in the window was last updated.

6.4 Interface Status

This screen lists all of the NXC's interfaces and gives packet statistics for them. If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also view your IPv6 interface status on this screen. Click **Monitor > System Status > Interface Status** to access this screen.

Figure 42 Monitor > System Status > Interface Status



Each field is described in the following table.

Table 26 Monitor > System Status > Interface Status

LABEL	DESCRIPTION
Interface Status IPv6 Interface Status	Use the **Interface Status** section for IPv4 network settings. Use the **IPv6 Interface Status** section for IPv6 network settings if you connect your NXC to an IPv6 network. Both sections have similar fields as described below.
Name	This field displays the name of each interface.
Port	This field displays the physical port number.
Status	This field displays the current status of each interface. The possible values depend on what type of interface it is. For Ethernet interfaces: **Inactive** - The Ethernet interface is disabled. **Down** - The Ethernet interface is enabled but not connected. **Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**). For VLAN interfaces: **Up** - The VLAN interface is enabled and one of its member Ethernet interfaces is connected. **Down** - The VLAN interface is enabled but none of its member Ethernet interfaces is connected. **Inactive** - The VLAN interface is disabled.
Zone	This field displays the zone to which the interface is assigned.
IP Addr/Netmask IP Address	This field displays the current IP address (and subnet mask) of the interface. If the IP address and subnet mask are 0.0.0.0 (in the IPv4 network) or the IP address is :: (in the IPv6 network), the interface is disabled or does not have an IP address yet. In the IPv6 network, this screen also shows whether the IP address is a static IP address (**STATIC**), link-local IP address (**LINK LOCAL**), dynamically assigned (**DHCP**), or an IPv6 StateLess Address AutoConfiguration IP address (**SLAAC**). See Appendix E on page 502 for more information about IPv6.
IP Assignment	This field displays how the interface gets its IP address. **Static** - This interface has a static IP address. **DHCP Client** - This interface gets its IP address from a DHCP server.
Services	This field lists which services the interface provides to the network. Examples include **DHCP relay** and **DHCP server**. This field displays **n/a** if the interface does not provide any services to the network.
Action	Use this field to get or to update the IP address for the interface. Click **Renew** to send a new DHCP request to a DHCP server. Click **Connect** to try to connect the interface. If the interface cannot use one of these ways to get or to update its IP address, this field displays **n/a**.
Interface Statistics	This table provides packet statistics for each interface.
Refresh	Click this button to update the information in the screen.
Name	This field displays the name of each interface.

Table 26 Monitor > System Status > Interface Status (continued)

LABEL	DESCRIPTION
Status	This field displays the current status of each interface. The possible values depend on what type of interface it is. For Ethernet interfaces: **Inactive** - The Ethernet interface is disabled. **Down** - The Ethernet interface is enabled but not connected. **Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**). For VLAN interfaces: **Up** - The VLAN interface is enabled and one of its member Ethernet interfaces is connected. **Down** - The VLAN interface is enabled but none of its member Ethernet interfaces is connected. **Inactive** - The VLAN interface is disabled.
TxPkts	This field displays the number of packets transmitted from the NXC on the interface since it was last connected.
RxPkts	This field displays the number of packets received by the NXC on the interface since it was last connected.
Tx B/s	This field displays the transmission speed, in bytes per second, on the interface in the one-second interval before the screen updated.
Rx B/s	This field displays the reception speed, in bytes per second, on the interface in the one-second interval before the screen updated.

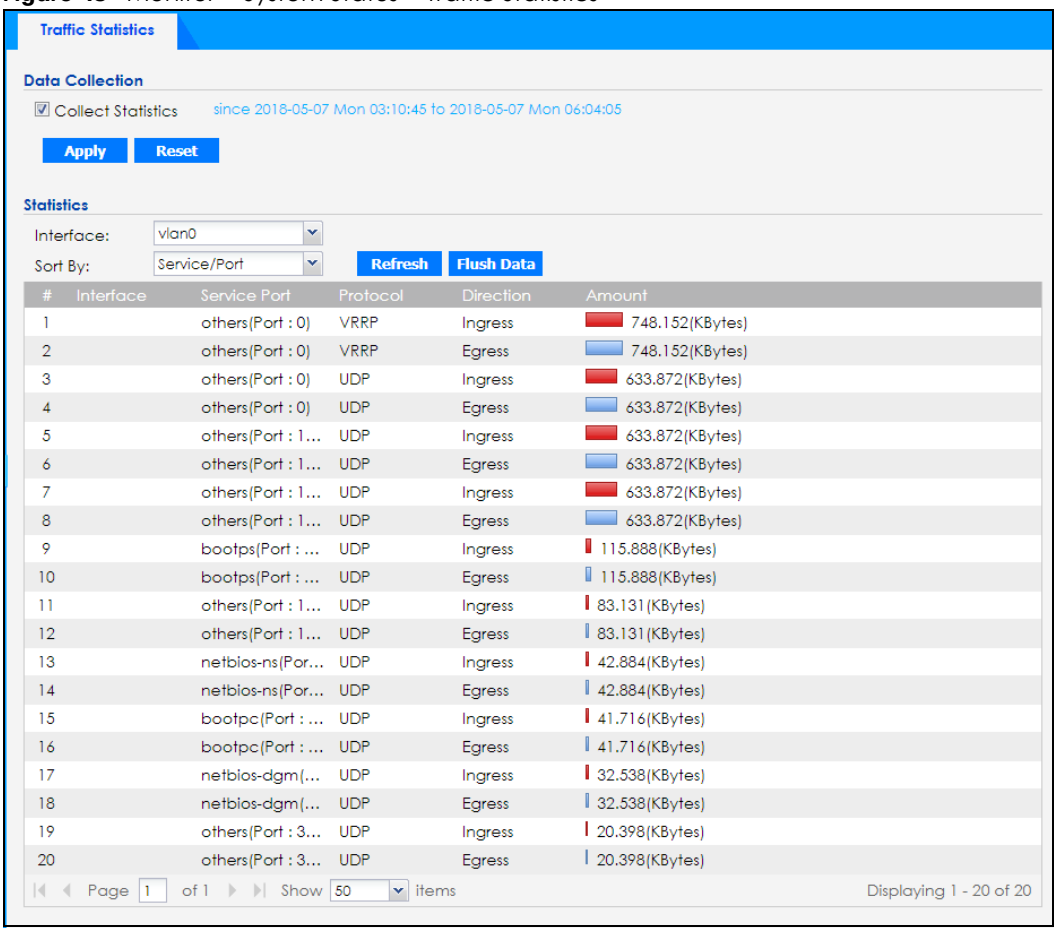
6.5 Traffic Statistics

Click **Monitor > System Status > Traffic Statistics** to display this screen. This screen provides basic information about the different kinds of data traffic moving through the NXC. For example:

- Most-visited Web sites and the number of times each one was visited. This count may not be accurate in some cases because the NXC counts HTTP GET packets.
- Most-used protocols or service ports and the amount of traffic on each one.
- LAN IP with heaviest traffic and how much traffic has been sent to and from each one.

You use the **Traffic Statistics** screen to tell the NXC when to start and when to stop collecting information for these reports. You cannot schedule data collection; you have to start and stop it manually in the **Traffic Statistics** screen.

Figure 43 Monitor > System Status > Traffic Statistics



There is a limit on the number of records shown in the report. See Table 28 on page 78 for more information. The following table describes the labels in this screen.

Table 27 Monitor > System Status > Traffic Statistics

LABEL	DESCRIPTION
Data Collection	
Collect Statistics	Select this to have the NXC collect data for the report. If the NXC has already been collecting data, the collection period displays to the right. The progress is not tracked here real-time, but you can click the **Refresh** button to update it.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.
Statistics	
Interface	Select the interface from which to collect information. You can collect information from Ethernet or VLAN interfaces.

Table 27 Monitor > System Status > Traffic Statistics (continued)

LABEL	DESCRIPTION
Sort By	Select the type of report to display. Choices are: **Host IP Address/User** - displays the IP addresses or users with the most traffic and how much traffic has been sent to and from each one. **Service/Port** - displays the most-used protocols or service ports and the amount of traffic for each one. **Web Site Hits** - displays the most-visited Web sites and how many times each one has been visited. Each type of report has different information in the report (below).
Refresh	Click this button to update the report display.
Flush Data	Click this button to discard all of the screen's statistics and update the report display.
	These fields are available when the report type is **Host IP Address/User**.
#	This field is the rank of each record. The IP addresses and users are sorted by the amount of traffic.
Interface	This field displays the interface(s) from which the NXC collects information.
Direction	This field indicates whether the IP address or user is sending or receiving traffic. **Rx From**- traffic is coming from the IP address or user to the NXC. **Tx To** - traffic is going from the NXC to the IP address or user.
IP Address/User	This field displays the IP address or user in this record. The maximum number of IP addresses or users in this report is indicated in Table 28 on page 78.
Amount	This field displays how much traffic was sent or received from the indicated IP address or user. If the **Direction** is **Rx From**, a red bar is displayed; if the **Direction** is **Tx To**, a blue bar is displayed. The unit of measure is bytes, Kbytes, Mbytes or Gbytes, depending on the amount of traffic for the particular IP address or user. The count starts over at zero if the number of bytes passes the byte count limit. See Table 28 on page 78.
	These fields are available when the report type is **Service/Port**.
#	This field is the rank of each record. The protocols and service ports are sorted by the amount of traffic.
Interface	This field displays the interface(s) from which the NXC collects information.
Service Port	This field displays the service and port in this record. The maximum number of services and service ports in this report is indicated in Table 28 on page 78.
Protocol	This field indicates what protocol the service was using.
Direction	This field indicates whether the indicated protocol or service port is sending or receiving traffic. **Ingress** - traffic is coming into the NXC through the interface. **Egress** - traffic is going out from the NXC through the interface.
Amount	This field displays how much traffic was sent or received from the indicated service / port. If the **Direction** is **Ingress**, a red bar is displayed; if the **Direction** is **Egress**, a blue bar is displayed. The unit of measure is bytes, Kbytes, Mbytes, Gbytes, or Tbytes, depending on the amount of traffic for the particular protocol or service port. The count starts over at zero if the number of bytes passes the byte count limit. See Table 28 on page 78.
	These fields are available when the report type is **Web Site Hits**.
#	This field is the rank of each record. The domain names are sorted by the number of hits.
Interface	This field displays the interface(s) from which the NXC collects information.

Table 27 Monitor > System Status > Traffic Statistics (continued)

LABEL	DESCRIPTION
Web Site	This field displays the domain names most often visited. The NXC counts each page viewed on a Web site as another hit. The maximum number of domain names in this report is indicated in Table 28 on page 78.
Hits	This field displays how many hits the Web site received. The NXC counts hits by counting HTTP GET packets. Many Web sites have HTTP GET references to other Web sites, and the NXC counts these as hits too. The count starts over at zero if the number of hits passes the hit count limit. See Table 28 on page 78.

The following table displays the maximum number of records shown in the report, the byte count limit, and the hit count limit.

Table 28 Maximum Values for Reports

LABEL	DESCRIPTION
Maximum Number of Records	20
Byte Count Limit	2^{64} bytes; this is just less than 17 million terabytes.
Hit Count Limit	2^{64} hits; this is over 1.8×10^{19} hits.

6.6 Session Monitor

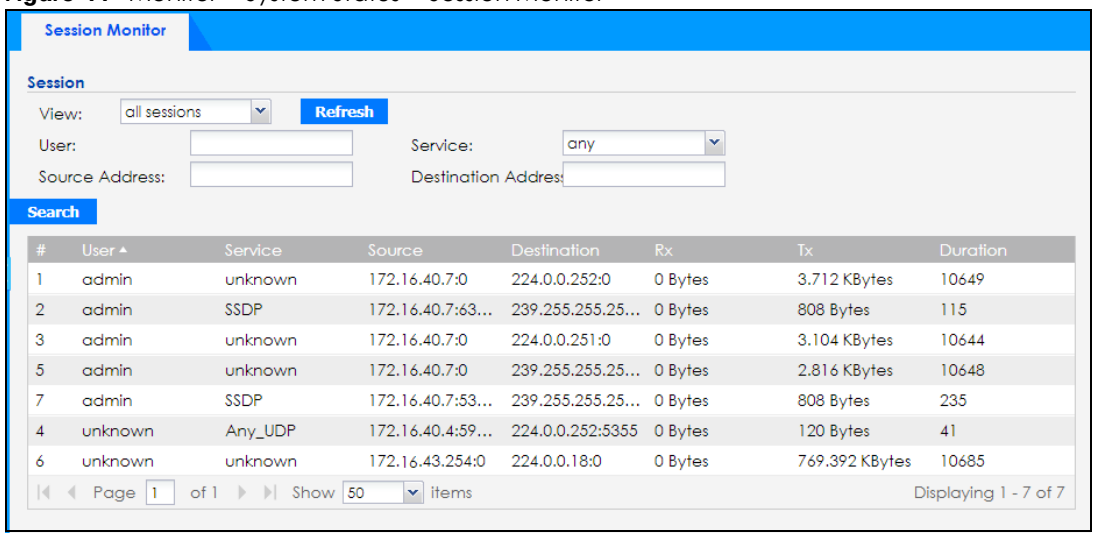
This screen displays information about active sessions for debugging or statistical analysis. It is not possible to manage sessions in this screen. The following information is displayed.

- User who started the session
- Protocol or service port used
- Source IP address
- Destination IP address
- Number of bytes received (so far)
- Number of bytes transmitted (so far)
- Duration (so far)

You can look at all the active sessions by user, service, source IP address, or destination IP address. You can also filter the information by user, protocol / service or service group, source address, and/or destination address and view it by user.

Click **Monitor > System Status > Session Monitor** to display the following screen.

Figure 44 Monitor > System Status > Session Monitor



The following table describes the labels in this screen.

Table 29 Monitor > System Status > Session Monitor

LABEL	DESCRIPTION
Session	
View	Select how you want the information to be displayed. Choices are: **sessions by users** - display all active sessions grouped by user **sessions by services** - display all active sessions grouped by service or protocol **sessions by source IP** - display all active sessions grouped by source IP address **sessions by destination IP** - display all active sessions grouped by destination IP address **all sessions** - filter the active sessions by the **User**, **Service**, **Source Address**, and **Destination Address**, and display each session individually (sorted by user).
Refresh	Click this button to update the information on the screen. The screen also refreshes automatically when you open and close the screen.
	The **User**, **Service**, **Source Address**, and **Destination Address** fields display if you view all sessions. Select your desired filter criteria and click the **Search** button to filter the list of sessions.
User	This field displays when **View** is set to **all sessions**. Type the user whose sessions you want to view. It is not possible to type part of the user name or use wildcards in this field; you must enter the whole user name.
Service	This field displays when **View** is set to **all sessions**. Select the service or service group whose sessions you want to view. The NXC identifies the service by comparing the protocol and destination port of each packet to the protocol and port of each services that is defined. (See Chapter 23 on page 293 for more information about services.)
Source Address	This field displays when **View** is set to **all sessions**. Type the source IP address whose sessions you want to view. You cannot include the source port.
Destination Address	This field displays when **View** is set to **all sessions**. Type the destination IP address whose sessions you want to view. You cannot include the destination port.
Search	This button displays when **View** is set to **all sessions**. Click this button to update the information on the screen using the filter criteria in the **User**, **Service**, **Source Address**, and **Destination Address** fields.
#	This field displays the index number of each active session.

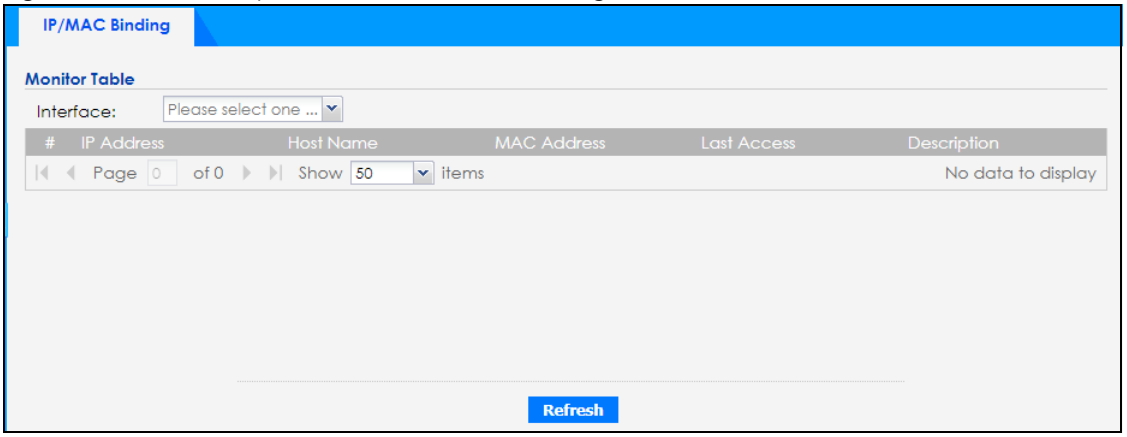
Table 29 Monitor > System Status > Session Monitor (continued)

LABEL	DESCRIPTION
User	This field displays the user in each active session. If you are looking at the **sessions by users** (or **all sessions**) report, click **+** or **-** to display or hide details about a user's sessions.
Service	This field displays the protocol used in each active session. If you are looking at the **sessions by services** report, click **+** or **-** to display or hide details about a protocol's sessions.
Source	This field displays the source IP address and port in each active session. If you are looking at the **sessions by source IP** report, click **+** or **-** to display or hide details about a source IP address's sessions.
Destination	This field displays the destination IP address and port in each active session. If you are looking at the **sessions by destination IP** report, click **+** or **-** to display or hide details about a destination IP address's sessions.
Rx	This field displays the amount of information received by the source in the active session.
Tx	This field displays the amount of information transmitted by the source in the active session.
Duration	This field displays the length of the active session in seconds.

6.7 IP/MAC Binding Monitor

Click **Monitor > System Status > IP/MAC Binding** to display the following screen. This screen lists the devices that have received an IP address from NXC interfaces with IP/MAC binding enabled and have ever established a session with the NXC. Devices that have never established a session with the NXC do not display in the list.

Figure 45 Monitor > System Status > IP/MAC Binding



The following table describes the labels in this screen.

Table 30 Monitor > System Status > IP/MAC Binding

LABEL	DESCRIPTION
Monitor Table	
Interface	Select a NXC interface that has IP/MAC binding enabled to show to which devices it has assigned an IP address.

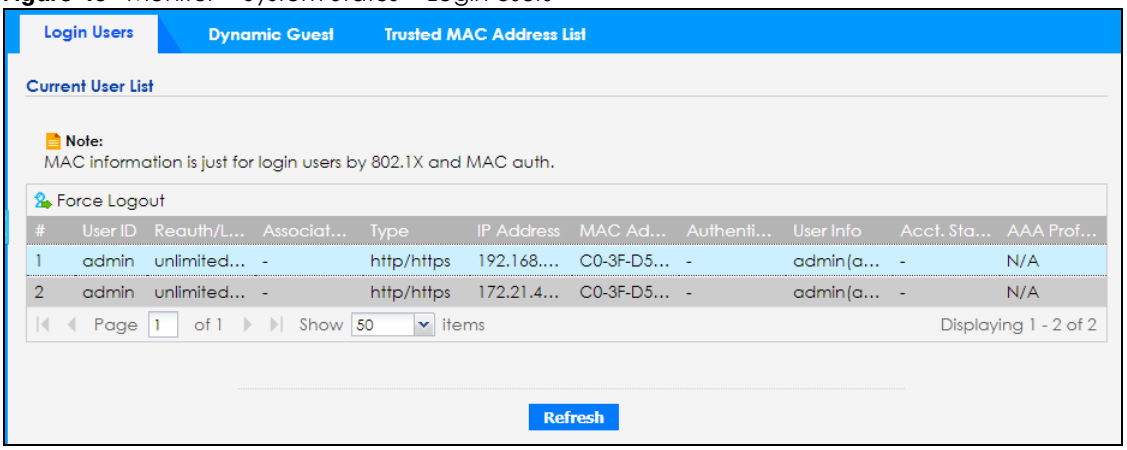
Table 30 Monitor > System Status > IP/MAC Binding (continued)

LABEL	DESCRIPTION
#	This is the index number of an IP/MAC binding entry.
IP Address	This is the IP address that the NXC assigned to a device.
Host Name	This field displays the name used to identify this device on the network (the computer name). The NXC learns these from the DHCP client requests.
MAC Address	This field displays the MAC address to which the IP address is currently assigned.
Last Access	This is when the device last established a session with the NXC through this interface.
Description	This field displays the descriptive name that helps identify the entry.
Refresh	Click this button to update the information in the screen.

6.8 Login Users

Use this screen to look at a list of the users currently logged into the NXC. To access this screen, click **Monitor > System Status > Login Users**.

Figure 46 Monitor > System Status > Login Users



The following table describes the labels in this screen.

Table 31 Monitor > System Status > Login Users

LABEL	DESCRIPTION
Current User List	
Force Logout	Select a user ID and click this icon to end a user's session.
#	This field is a sequential value and is not associated with any entry.
User ID	This field displays the user name of each user who is currently logged into the NXC. For a MAC authentication login, this field displays the MAC address of the user's computer.
Reauth/Lease Time	This field displays the amount of reauthentication time remaining and the amount of lease time remaining for each user. See Chapter 18 on page 238.
Associated AP	This field displays the description of the managed AP through which the user logs into the NXC. The default description is "AP-" followed by the AP's MAC address. A "**-**" displays if the user is not connecting to the NXC wirelessly.
Type	This field displays the way the user logged in to the NXC.

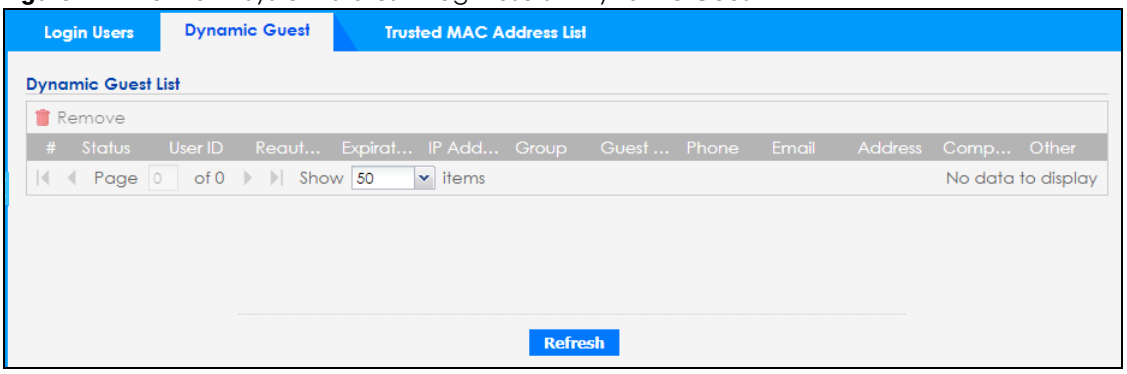
Table 31 Monitor > System Status > Login Users

LABEL	DESCRIPTION
IP address	This field displays the IP address of the computer used to log into the NXC.
MAC Address	This field displays the MAC address of the user's computer.
Authenticator	This field displays the IP address of the authenticator that helps clients to log in with a QR code. A "**-**" displays if the user logged in without an authenticator's help.
User Info	This field displays the types of user accounts the NXC uses. If the user type is **ext-user** (external user), this field will show its external-group information when you move your mouse over it. If the external user matches two external-group objects, both external-group object names will be shown.
Acct. Status	For a captive portal login, this field displays the accounting status of the account used to log into the NXC. **Accounting-on** means accounting is being performed for the user login. **Accounting-off** means accounting has stopped for this user login. A "**-**" displays if accounting is not enabled for this login.
AAA Profile Name	This field displays the name of the RADIUS profile used to authenticate the login through the captive portal. **N/A** displays for logins that do not use the captive portal and RADIUS server authentication.
Refresh	Click this button to update the information in the screen.

6.8.1 Dynamic Guest

A dynamic guest account has a dynamically-created user name and password that allows a guest user to access the Internet or the NXC's services in a specified period of time. Multiple dynamic guest accounts can be automatically generated at one time for guest users by using the web configurator and the guest-manager account. Guest users can log in with the dynamic accounts when connecting to an SSID for a specified time unit. Use this screen to look at a list of dynamic guest user accounts on the NXC's local database. To access this screen, click **Monitor > System Status > Login Users > Dynamic Guest**.

Figure 47 Monitor > System Status > Login Users > Dynamic Guest



The following table describes the labels in this screen.

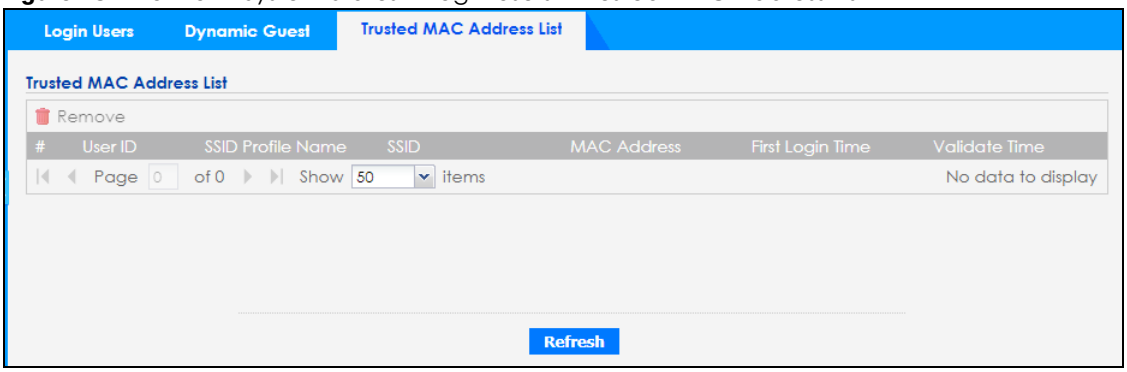
Table 32 Monitor > System Status > Login Users > Dynamic Guest

LABEL	DESCRIPTION
Dynamic Guest List	
Remove	Select an entry and click this button to remove it from the list. Note: If you delete a valid user account which is in use, the NXC ends the user session.
#	This field is a sequential value and is not associated with any entry.
Status	This field displays whether an account expires or not.
User ID	This field displays the user name of the user account.
Reauth/Lease Time	This field displays the amount of reauthentication time remaining and the amount of lease time remaining for each user. See Chapter 18 on page 238.
Expiration Time	This field displays the date and time the user account becomes invalid.
IP Address	This field displays the IP address of the computer used to log in to the NXC.
Group	This field displays the name of the dynamic guest group to which the account belongs.
Guest Name	This field displays the name of the person that uses the account.
Phone	This field displays the telephone number for the user account.
Email	This field displays the E-mail address for the user account.
Address	This field displays the geographic address for the user account.
Company	This field displays the company name for the user account.
Other	This field displays the additional information for the user account.
Refresh	Click this button to update the information in the screen.

6.8.2 Trusted MAC Address List

This screen lists the wireless client which has been authenticated by MAC address and allowed to access the network. To access this screen, click **Monitor > System Status > Login Users > Trusted MAC Address**.

Figure 48 Monitor > System Status > Login Users > Trusted MAC Address List



The following table describes the labels in this screen.

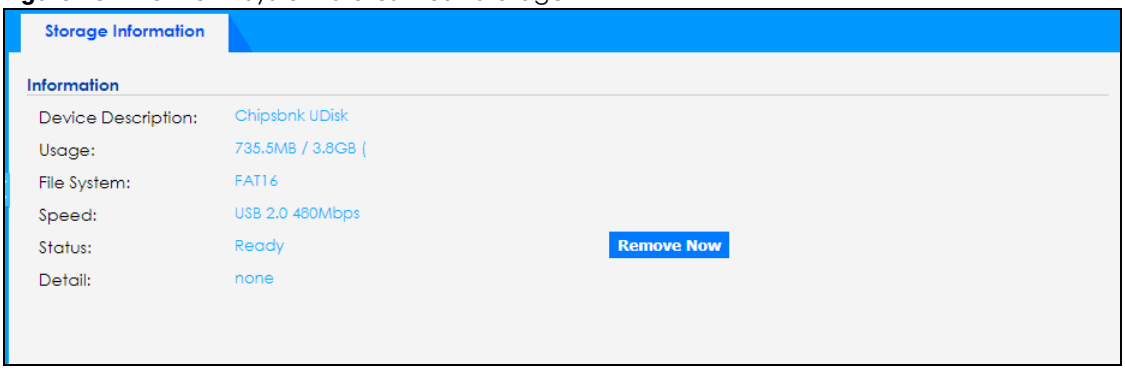
Table 33 Monitor > System Status > Login Users > Trusted MAC Address List

LABEL	DESCRIPTION
Trusted MAC Address List	
Remove	Select an entry and click this button to remove it from the list. Note: If you delete a MAC address, the client device of the MAC address needs to log in via the captive portal page next time he/she wants to connect to the same SSID.
#	This field is a sequential value and is not associated with any entry.
User ID	This field displays the user name of the client.
SSID Profile Name	This field displays the name of the SSID profile in which the associated SSID is defined,
SSID	This field displays the SSID to which the wireless client is currently connecting.
MAC Address	This field displays the MAC address of the client device.
First Login Time	This field displays the time the client first logged in to the NXC.
Validate Time	This field displays the date and time the client becomes invalid and needs to re-authenticate the connection.

6.9 USB Storage

This screen displays information about a connected USB storage device. Click **Monitor > System Status > USB Storage** to display this screen.

Figure 49 Monitor > System Status > USB Storage



The following table describes the labels in this screen.

Table 34 Monitor > System Status > USB Storage

LABEL	DESCRIPTION
Information	
Device Description	This is a basic description of the type of USB device.
Usage	This field displays how much of the USB storage device's capacity is currently being used out of its total capacity and what percentage that makes.
File System	This field displays what file system the USB storage device is formatted with. This field displays **Unknown** if the file system of the USB storage device is not supported by the NXC, such as NTFS.

Table 34 Monitor > System Status > USB Storage (continued)

LABEL	DESCRIPTION
Speed	This field displays the connection speed the USB storage device supports.
Status	**Ready** - you can have the NXC use the USB storage device. Click **Remove Now** to stop the NXC from using the USB storage device so you can remove it. **Unused** - the connected USB storage device was manually unmounted by using the **Remove Now** button or for some reason the NXC cannot mount it. Click **Use It** to have the NXC mount a connected USB storage device. This button is grayed out if the file system is not supported (unknown) by the NXC. **none** - no USB storage device is connected.
Detail	This field displays any other information the NXC retrieves from the USB storage device. **Deactivated** - the use of a USB storage device is disabled (turned off) on the NXC. **OutofSpace** - the available disk space is less than the disk space full threshold (see Section 29.3 on page 334 for how to configure this threshold). **Mounting** - the NXC is mounting the USB storage device. **Removing** - the NXC is unmounting the USB storage device. **none** - the USB device is operating normally or not connected.

6.10 Ethernet Neighbor

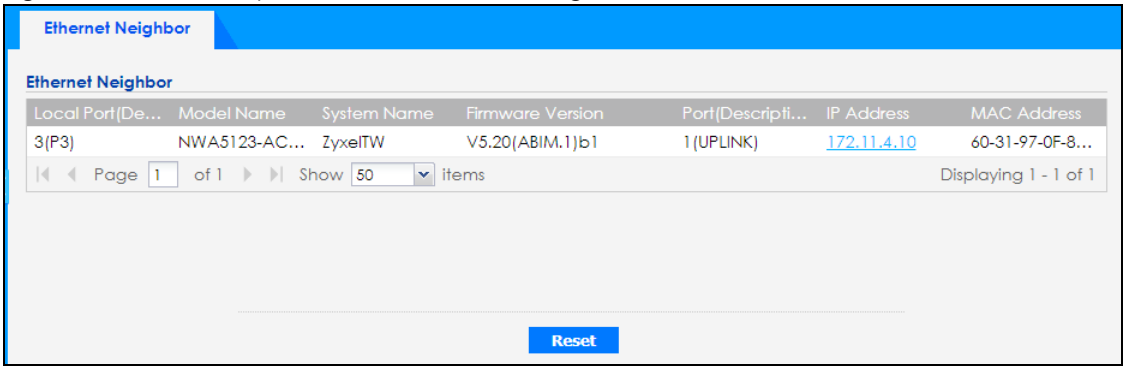
The NXC uses Smart Connect, that is Link Layer Discovery Protocol (LLDP) for discovering and configuring LLDP-aware devices in the same broadcast domain as the NXC that you're logged into using the web configurator.

LLDP is a layer-2 protocol that allows a network device to advertise its identity and capabilities on the local network. It also allows the device to maintain and store information from adjacent devices which are directly connected to the network device. This helps you discover network changes and perform necessary network reconfiguration and management.

Note: Smart Connect is enabled by default in the NXC.

Use this screen to view the NXC's neighboring devices in one place. To access this screen, click **Monitor > System Status > Ethernet Neighbor**.

Figure 50 Monitor > System Status > Ethernet Neighbor



The following table describes the labels in this screen.

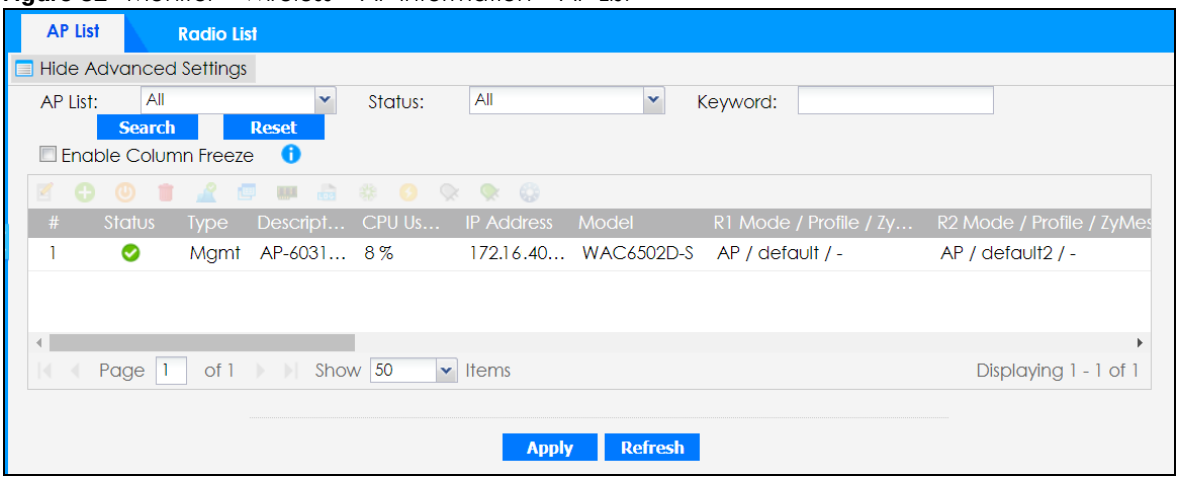
Table 35 Monitor > System Status > Ethernet Neighbor

LABEL	DESCRIPTION
Local Port(Description)	This field displays the port of the NXC, on which the neighboring device is discovered.
Model Name	This field displays the model name of the discovered device.
System Name	This field displays the system name of the discovered device.
Firmware Version	This field displays the firmware version of the discovered device.
Port(Description)	This field displays the discovered device's port which is connected to the NXC.
IP Address	This field displays the IP address of the discovered device. Click the IP address to log into and manage the discovered device using its web configurator.
MAC Address	This field displays the MAC address of the discovered device.
Reset	Click this button to update the information in the screen.

6.11 AP List

Use this screen to view which APs are currently connected to the NXC. To access this screen, click **Monitor > Wireless > AP Information > AP List**.

Figure 51 Monitor > Wireless > AP Information > AP List



The following table describes the labels in this screen.

Table 36 Monitor > Wireless > AP Information > AP List

LABEL	DESCRIPTION
Hide/Show Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
AP List	Select the type of APs you want to display. Select **All** to show all kinds of APs that are currently or used to be connected to the NXC. Select **NebulaFlexPRO** to show the APs that can work in Nebula cloud management mode.
Status	Select the status of APs you want to display.

Table 36 Monitor > Wireless > AP Information > AP List (continued)

LABEL	DESCRIPTION
Keyword	Enter a keyword to display the APs that include it in their AP information, such as model number, firmware version, MAC address and so on. This field is case-sensitive.
Search	Click this to update the list of APs based on the search criteria. Your search criteria is retained when navigating between screens.
Reset	Click this to return the search criteria to the factory defaults and display all currently or previously connected APs without a filter.
Enable Column Freeze	Select the check box to freeze the first column (**#**) so it will be always visible when you scroll through the list. Clear the check box to unfreeze the column.
Edit the selected rule	Select an AP and click this to change the selected AP's properties, such as its group, radio, VLAN and port settings.
Add to Mgmt AP List	Select an AP and click this to add the selected AP to the managed AP list.
Reboot device	Select one or multiple APs and click this button to force the AP(s) to restart.
Remove the selected rule	Select one or multiple APs and click this button to remove the AP(s) from the manged AP list. Note: If in the **Configuration > Wireless > Controller** screen you set the **Registration Type** to **Always Accept**, then as soon as you remove an AP from this list it reconnects.
DCS Now	Select one or multiple APs and click this button to use DCS (Dynamic Channel Selection) to allow the AP to automatically find a less-used channel in an environment where there are many APs and there may be interference. Note: You should have enabled DCS in the applied AP radio profile before the APs can use DCS. Note: DCS is not supported on the radio which is working in repeater AP mode.
More Information	Select an AP and click this to view a daily station count about the selected AP. The count records station activity on the AP over a consecutive 24 hour period.
Radio Information	Select an online AP and click this button to go to the **Monitor > Wireless > AP Information > Radio List** screen to view detailed information about the AP's radios.
Query Controller Log	Select one or multiple APs and click this button to go to the **Monitor > Log > View Log** screen to view the selected AP's current log messages.
Nebula	Select an AP and click this to open a screen where you can set whether the AP's IP address and VLAN settings will be changed when it goes into Nebula cloud management mode. See Section 6.11.2.4 on page 100. Note: The AP will be set to Nebula cloud management mode and removed from the managed AP list right after you click **OK**.
Upgrade Firmware Now	Select one or more APs and click this button to update the APs' firmware version.
Suppression On	Select an AP and click this button to enable the AP's LED suppression mode. All the LEDs of the AP will turn off after the AP is ready. This button is not available if the selected AP doesn't support suppression mode.
Suppression Off	Select an AP and click this button to disable the AP's LED suppression mode. The AP LEDs stay lit after the AP is ready. This button is not available if the selected AP doesn't support suppression mode.
Locator On	Select an AP and click this button to run the locator feature. The AP's Locator LED will start to blink for 10 minutes by default. It will show the actual location of the AP between several devices in the network.

Table 36 Monitor > Wireless > AP Information > AP List (continued)

LABEL	DESCRIPTION
#	This is the AP's index number in this list.
Status	This visually displays the AP's connection status with icons. For details on the different **Status** states, see the next table.
Type	This indicates whether the AP is on the managed AP list (**Mgmt**) or not (**Un-Mgmt**). This displays **Limited** when the AP is configured by conflicted or unsupported setting(s).
Description	This displays the AP's associated description. The default description is "AP-" + the AP's MAC address.
CPU Usage	This displays what percentage of the AP's processing capability is currently being used.
IP Address	This displays the AP's IP address.
Model	This displays the AP's model number. This field displays **n/a** if the NXC cannot get model information from the AP.
Version	This displays the AP's current firmware version.
Group	This displays the name of the AP group to which the AP belongs. The group becomes editable immediately upon clicking.
Station 2.4G	This displays the number of stations (aka wireless clients) associated with the AP's 2.4 GHz WiFi network.
Station 5G	This displays the number of stations (aka wireless clients) associated with the AP's 5 GHz WiFi network.
Recent On-line Time	This displays the most recent time the AP came on-line. **N/A** displays if the AP has not come on-line since the NXC last started up.
MAC Address	This displays the AP's MAC address.
Mgmt. VLAN ID(AC/AP)	This displays the Access Controller (the NXC) management VLAN ID setting for the AP and the runtime management VLAN ID setting on the AP. **VLAN Conflict** displays if the AP's management VLAN ID does not match the NXC's management VLAN ID setting for the AP. This field displays **n/a** if the NXC cannot get VLAN information from the AP.
Last Off-line Time	This displays the most recent time the AP went off-line. **N/A** displays if the AP has either not come on-line or gone off-line since the NXC last started up.
LED Status	This displays the AP LED status. **N/A** displays if the AP does not support LED suppression mode and/or have a locator LED to show the actual location of the AP. A gray LED icon signifies that the AP LED suppression mode is enabled. All the LEDs of the AP will turn off after the AP is ready. A green LED icon signifies that the AP LED suppression mode is disabled and the AP LEDs stay lit after the AP is ready. A sun icon signifies that the AP's locator LED is blinking. A circle signifies that the AP's locator LED is extinguished.
Ethernet Uplink	This field displays the AP's uplink port speed and duplex mode (**Full** or **Half**).

Table 36 Monitor > Wireless > AP Information > AP List (continued)

LABEL	DESCRIPTION
Power	This displays the AP's power status. (Full power) - the AP receives optimal power from the power sourcing equipment. (Force Full Power- the power sourcing equipment provides full power to the AP even in cases where a PoE injector that does not support PoE negotiation is used. (Limited power) - the AP receives less than optimal power from the power sourcing equipment. This may be due to the PoE switch/injector using an earlier PoE standard. This may impact wireless transmission throughput or disable a radio transmitter, depending on the AP's power requirements. (Off-Line) - the AP is not receiving power.
Bluetooth	This field displays the AP's Bluetooth Low Energy (BLE) capability. Bluetooth Low Energy, which is also known as Bluetooth Smart, transmits less data over a shorter distance and consumes less power than classic Bluetooth. APs communicate with other BLE enabled devices using advertisements. **N/A** displays if the AP does not support BLE. **Unavailable** displays if the AP supports Bluetooth, but there is no BLE USB dongle connected to the USB port of the AP. Some APs, such as the WAC5302D-S, need to have a supported BLE USB dongle attached to act as a beacon to broadcast packets. **Available** displays if the AP supports Bluetooth, detects a BLE device and advertising is inactive. **Advertising** displays if the AP supports Bluetooth, detects a BLE device and advertising is activated, which means the BLE device can broadcasts packets to every device around it.
Location	This field displays the AP's location you configured.
Roaming Group	This field displays the name of roaming group to which the AP belongs.
S/N	This field displays the serial number of the AP.
System Name	This field displays the system name to identify the AP on a network.
Load Balancing Group	This field displays the load balancing group(s) to which the AP belongs.
Refresh	Click this button to update the information in the screen.

The following table describes the icons in this screen.

Table 37 Monitor > Wireless > AP Information > AP List Icons

LABEL	DESCRIPTION
	This AP is not on the management list.
	This AP is on the management list and online.
	This AP is in the process of having its firmware updated.
	This AP is on the management list but offline.
	This indicates one of the following cases: • This AP has a runtime management VLAN ID setting that conflicts with the VLAN ID setting on the Access Controller (the NXC). • A setting the NXC assigns to this AP does not match the AP's capability. • Packets sent out on a LAN port of this AP loop back to the AP.
	This AP is offline and in the process of having its firmware updated.

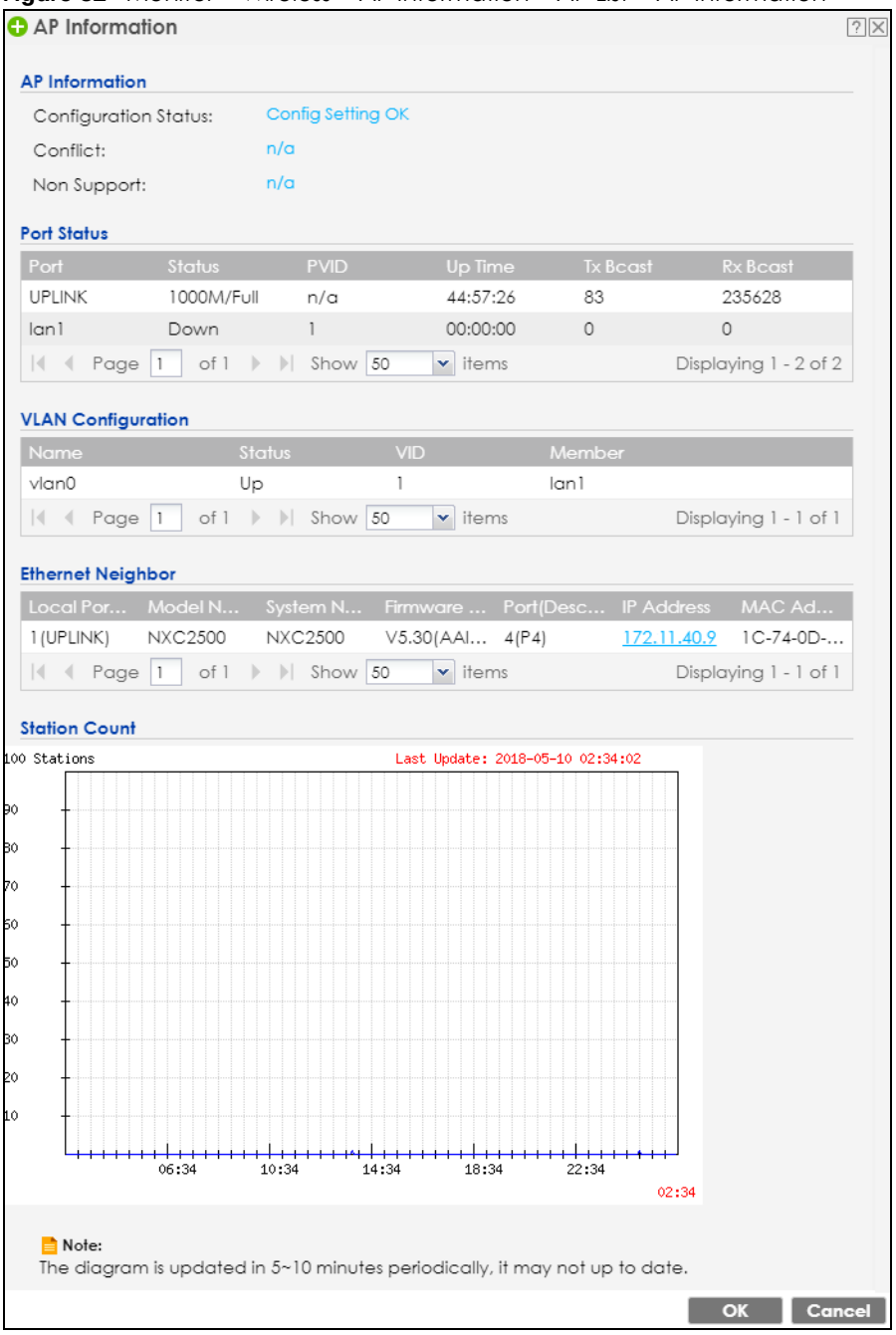
Table 37 Monitor > Wireless > AP Information > AP List Icons (continued)

LABEL	DESCRIPTION
	This AP has a configuration conflict.
	This AP is not supported and cannot be managed by the NXC.

6.11.1 Station Count of AP

Use this screen to look at configuration information, port status and station statistics for the connected AP. To access this screen, select an entry and click the **More Information** button in the **AP List** screen.

Figure 52 Monitor > Wireless > AP Information > AP List > AP Information



The following table describes the labels in this screen.

Table 38 Monitor > Wireless > AP Information > AP List > AP Information

LABEL	DESCRIPTION
AP Information	
Configuration Status	This displays whether or not any of the AP's configuration is in conflict with the NXC's settings for the AP.
Conflict	If any of the AP's configuration conflicts with the NXC's settings for the AP, this field displays which configuration conflicts. It displays **n/a** if none of the AP's configuration conflicts with the NXC's settings for the AP.

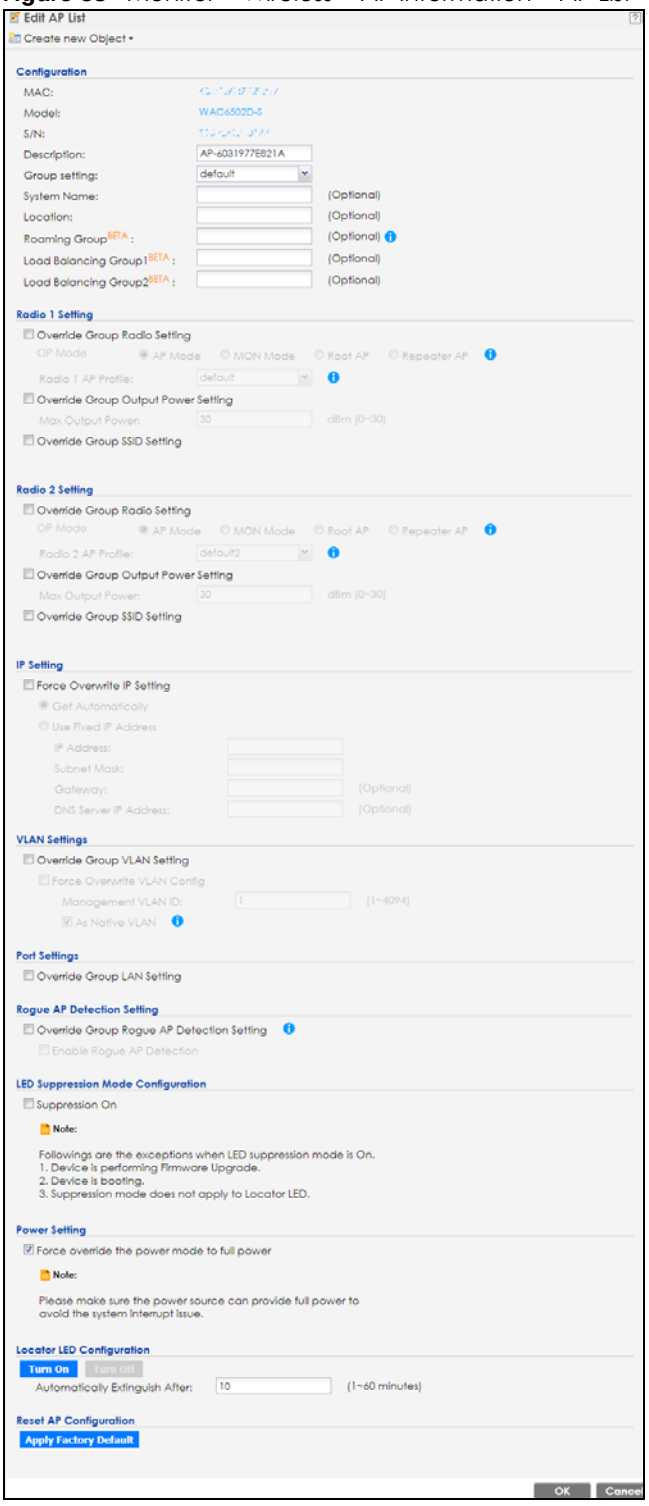
Table 38 Monitor > Wireless > AP Information > AP List > AP Information (continued)

LABEL	DESCRIPTION
Non Support	If any of the NXC's settings for the AP are not supported by the AP, this field displays which settings are not supported. It displays **n/a** if all the settings are supported by the AP.
Port Status	
Port	This shows the name of the physical Ethernet port on the AP.
Status	This field displays the current status of each physical port on the AP. **Down** - The port is not connected. **Speed / Duplex** - The port is connected. This field displays the port speed and duplex setting (**Full** or **Half**).
PVID	This shows the port's PVID. A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines.
Up Time	This field displays how long the physical port has been connected.
Tx Bcast	This field displays the number of broadcast packets transmitted on the port.
Rx Bcast	This field displays the number of broadcast packets received on the port.
VLAN Configuration	
Name	This shows the name of the VLAN.
Status	This displays whether or not the VLAN is activated.
VID	This shows the VLAN ID number.
Member	This field displays the Ethernet port(s) that is a member of this VLAN.
Ethernet Neighbor	
Local Port(Description)	This field displays the port of the AP, on which the neighboring device is discovered.
Model Name	This field displays the model name of the discovered device.
System Name	This field displays the system name of the discovered device.
Firmware Version	This field displays the firmware version of the discovered device.
Port(Description)	This field displays the discovered device's port which is connected to the AP.
IP Address	This field displays the IP address of the discovered device. Click the IP address to access and manage the discovered device using the web configurator.
MAC Address	This field displays the MAC address of the discovered device.
Station Count	The y-axis represents the number of connected stations. The x-axis shows the time over which a station was connected.
Last Update	This field displays the date and time the information in the window was last updated.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

6.11.2 Edit AP List

Use this screen to change the group and radio, VLAN, and port settings of the connected AP. To access this screen, select an entry and click the **Edit the selected rule** button in the **AP List** screen.

Figure 53 Monitor > Wireless > AP Information > AP List > Edit AP List



The following table describes the labels in this screen.

Table 39 Monitor > Wireless > AP Information > AP List > Edit AP List

LABEL	DESCRIPTION
Create new Object	Use this menu to create a new **Radio Profile**, **MON Profile**, **SSID Profile** or **ZyMesh Profile** object to associate with this AP.
Configuration	
MAC	This displays the MAC address of the selected AP.
Model	This field displays the AP's hardware model information. It displays **N/A** (not applicable) only when the AP disconnects from the NXC and the information is unavailable as a result.
S/N	This displays the serial number of the selected AP.
Description	Enter a description for this AP. You can use up to 31 characters, spaces and underscores allowed. The system automatically generates a default name in the format of AP-xxxxxxxxxxxx (where xxxxxxxxxxxx is the AP's MAC address).
Group Setting	Select an AP group to which you want this AP to belong.
System Name	Enter a name to identify the AP on a network. This is usually the AP's fully qualified domain name.
Location	Specify the name of the place where the AP is located.
Roaming Group	Specify the name of the roaming group to which the AP belongs. You can use up to 31 alphanumeric and @# characters. Dashes and underscores are also allowed. The name should start with a letter or digit. The 802.11k neighbor list a client requests from the AP is generated according to the roaming group and RCPI (Received Channel Power Indicator) value of its neighbor APs. When a client wants to roam from the current AP to another, other APs in the same roaming group or not in a roaming group will be candidates for roaming. Neighbor APs in a different roaming group will be excluded from the 802.11k neighbor lists even when the neighbor AP has the best signal strength. If the AP's roaming group is not configured, any neighbor APs can be candidates for roaming.
Load Balancing Group 1/2	Load balancing is only applied to APs within the same group. If a load balancing group is not assigned to an AP, it will belong to a default group. See Table 59 on page 135. Each AP can belong to up to two groups.
Radio 1/2 Setting	
Override Group Radio Setting	Select this option to overwrite the AP radio settings with the settings you configure here.

Table 39 Monitor > Wireless > AP Information > AP List > Edit AP List (continued)

LABEL	DESCRIPTION
OP Mode	Select the operating mode for radio 1 or radio 2. **AP Mode** means the AP can receive connections from wireless clients and pass their data traffic through to the NXC to be managed (or subsequently passed on to an upstream gateway for managing). **MON Mode** means the AP monitors the broadcast area for other APs, then passes their information on to the NXC where it can be determined if those APs are friendly or rogue. If an AP is set to this mode it cannot receive connections from wireless clients. **Root AP** means the radio acts as an AP and also supports the wireless connections with other APs (in repeater mode) to form a ZyMesh to extend its wireless network. **Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode). Note: To prevent bridge loops, do NOT set both radios on a managed AP to **Repeater AP** mode. Note: The root AP and repeater AP(s) in a ZyMesh must use the same country code and AP radio profile settings in order to communicate with each other. Note: Ensure you restart the managed AP after you change its operating mode.
Radio 1/2 AP Profile	Select an AP profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 Profile	Select a monitor mode profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 ZyMesh Profile	This field is available only when the radio is in **Root AP** or **Repeater AP** mode. Select the ZyMesh profile the radio uses to connect to a root AP or repeater.
Enable Wireless Bridging	This field is available only when the radio is in **Repeater AP** mode. Select this option to enable wireless bridging on the radio. The managed AP must support LAN provision and the radio should be in repeater mode. VLAN and bridge interfaces are created automatically according to the LAN port's VLAN settings. When wireless bridging is enabled, the managed repeater AP can still transmit data through its Ethernet port(s) after the ZyMesh link is up. Be careful to avoid bridge loops. The managed APs in the same ZyMesh must use the same static VLAN ID.
Override Group Output Power Setting	Select this option to overwrite the AP output power setting with the setting you configure here.
Max Output Power	Enter the maximum output power of the AP.
Override Group SSID Setting	Select this option to overwrite the AP SSID profile setting with the setting you configure here. This section allows you to associate an SSID profile with the radio.
Edit	Select an SSID and click this button to reassign it. The selected SSID becomes editable immediately upon clicking.
#	This is the index number of the SSID profile. You can associate up to eight SSID profiles with an AP radio.
SSID Profile	Indicates which SSID profile is associated with this radio profile.
Bluetooth Advertising Setting This section is available only when the AP supports Bluetooth Low Energy (BLE).	
Edit	Click this to edit the selected entry. See Section 6.11.2.1 on page 98.
Activate	To turn on an entry, select it and click **Activate**.

Table 39 Monitor > Wireless > AP Information > AP List > Edit AP List (continued)

LABEL	DESCRIPTION
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This field is a sequential value, and it is not associated with a specific entry.
Status	This field shows whether or not the entry is activated. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
UUID	This field indicates the UUID to be included in the Bluetooth advertising packets.
Major	This field indicates the major number to be included in the Bluetooth advertising packets.
Minor	This field indicates the minor number to be included in the Bluetooth advertising packets.
IP Setting	
Force Overwrite IP Setting	Select this to have the NXC change the AP's IP address setting to match the configuration in this screen.
Get Automatically	Select this to have the AP act as a DHCP client and automatically get the IP address, subnet mask, and gateway address from a DHCP server.
Use Fixed IP Address	Select this if you want to specify the IP address, subnet mask, gateway and DNS server address manually.
IP Address	Enter the IP address for the AP.
Subnet Mask	Enter the subnet mask of the AP in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all devices in the network.
Gateway	Enter the IP address of the gateway. The AP sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the AP.
DNS Server IP Address	Enter the IP address of the DNS server.
VLAN Settings	
Override Group VLAN Setting	Select this option to overwrite the AP VLAN setting with the setting you configure here.
Force Overwrite VLAN Config	Select this to have the NXC change the AP's management VLAN to match the configuration in this screen.
Management VLAN ID	Enter a VLAN ID for this AP.
As Native VLAN	Select this option to treat this VLAN ID as a VLAN created on the NXC and not one assigned to it from outside the network.
Port Settings	
Override Group LAN Setting	Select this option to overwrite the AP LAN port settings with the settings you configure here.
Port Setting	This section displays only when you select **Override Group LAN Setting**.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings. See Section 6.11.2.2 on page 99.
Activate/ Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the port's index number in this list.
Status	This displays whether or not the port is activated.
Port	This shows the name of the physical Ethernet port on the managed AP.
PVID	This shows the port's PVID. A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines.

Table 39 Monitor > Wireless > AP Information > AP List > Edit AP List (continued)

LABEL	DESCRIPTION
VLAN Configuration	This section displays only when you select **Override Group LAN Setting**.
Add	Click this to create a new entry. See Section 6.11.2.3 on page 99.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings. See Section 6.11.2.3 on page 99.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate/ Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the VLAN's index number in this list.
Status	This displays whether or not the VLAN is activated.
Name	This shows the name of the VLAN.
VID	This shows the VLAN ID number.
Member	This field displays the Ethernet port(s) that is a member of this VLAN.
Storm Control Setting	
Broadcast Storm Control	Enabling this will drop ingress broadcast traffic in the physical Ethernet port if it exceeds the maximum traffic rate. The maximum traffic rate can be changed using the CLI (see CLI Reference Guide).
Multicast Storm Control	Enabling this will drop ingress multicast traffic in the physical Ethernet port if it exceeds the maximum traffic rate. The maximum traffic rate can be changed using the CLI (see CLI Reference Guide).
Rogue AP Detection Setting	
Override Group Rogue AP Detection Setting	Select this option to overwrite the AP Rogue Detection Settings with the settings you configure here.
Enable Rogue AP Detection	Select this option to detect Rogue APs in the network.
LED Suppression Mode Configuration This section is available only when the AP supports LED suppression mode.	
Suppression On	Select this option to enable the AP's LED suppression mode. All the LEDs of the AP will turn off after the AP is ready. If the check box is unchecked, it means the LEDs will stay lit after the AP is ready.
Power Setting	Enable **Force override the power mode to full power** if you are using a PoE injector that does not support PoE negotiation. Otherwise, the AP cannot draw full power from the power sourcing equipment. Enable this power mode to improve the AP's performance in this situation. Note: Ensure that the power sourcing equipment can supply enough power to the AP to avoid abnormal system reboots. Note: Only enable this if you are using a passive PoE injector that is not IEEE 802.3at/ bt compliant but can still provide full power.
Locator LED Configuration This section is available only when the AP has a locator LED.	
Turn On/Turn Off	When the locator LED is off, click the **Turn On** button to activate the locator function. It will show the actual location of the AP between several devices in the network. If the locator LED is blinking, click the **Turn Off** button to stop the locator LED from blinking immediately.

Table 39 Monitor > Wireless > AP Information > AP List > Edit AP List (continued)

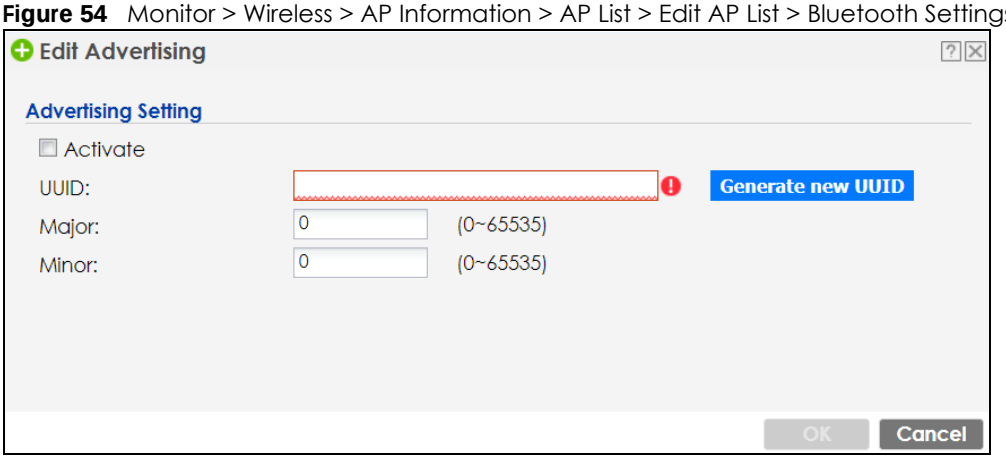
LABEL	DESCRIPTION
Automatically Extinguish After	Enter a time interval between 1 and 60 minutes to stop the locator LED from blinking. The locator LED will start to blink for the number of minutes set here. If you make changes to the time default setting, it will be stored as the default when the AP restarts.
Reset AP Configuration This section is available only when the AP is online.	
Apply Factory Default	Click the button to reset all of the AP settings to the factory defaults.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

6.11.2.1 Edit Bluetooth Advertising

Use this screen to modify the AP's Bluetooth advertising settings.

To access this screen, click the **Edit** button in the **Monitor > Wireless > AP information > AP List > Edit AP List > Bluetooth Settings** screen.

Figure 54 Monitor > Wireless > AP Information > AP List > Edit AP List > Bluetooth Settings > Edit



The following table describes the labels in this screen.

Table 40 Monitor > Wireless > AP Information > AP List > Edit AP List > Bluetooth Settings > Edit

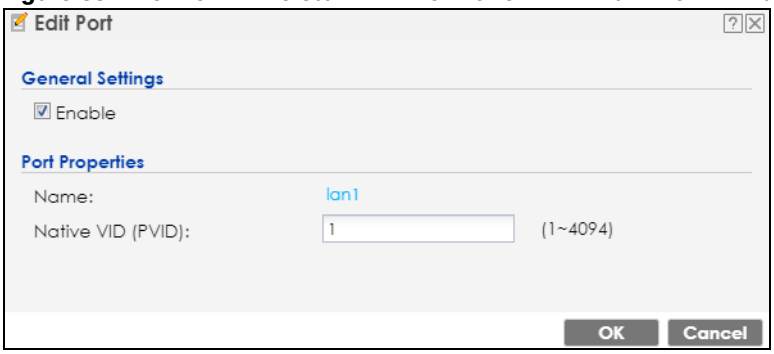
LABEL	DESCRIPTION
General Settings	
Activate	Select this option to enable the Bluetooth advertising settings.
UUID	To specify a UUID of the AP's beacon ID, enter 32 hexadecimal digits in the range of "A-F", "a-f" and "0-9", split into five groups separated by hyphens (-). The UUID format is as follows: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (8-4-4-4-12).
Generate new UUID	Click this button to have the AP generate a UUID automatically.
Major	Enter an integer from 0 to 65535 as the major value to identify the beacon.
Minor	Enter an integer from 0 to 65535 as the minor value to identify the beacon.
OK	Click **OK** to save your changes back to the AP.
Cancel	Click **Cancel** to exit this screen without saving your changes.

6.11.2.2 Port Setting Edit

Use this screen to enable or disable a port on the managed AP and configure the port's PVID.

To access this screen, select a port and click the **Edit** button in the **Port Setting** table of the **Monitor > Wireless > AP Information > AP List > Edit AP List** or **Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List** screen.

Figure 55 Monitor > Wireless > AP Information > AP List > Edit AP List > Edit Port



Each field is described in the following table.

Table 41 Monitor > Wireless > AP Information > AP List > > Edit AP List > Edit Port

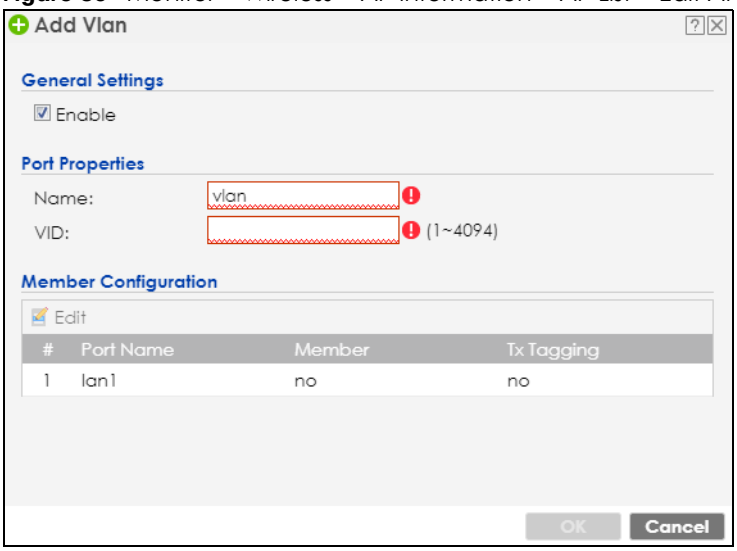
LABEL	DESCRIPTION
General Settings	
Enable	Select this option to activate the port. Otherwise, cancel the selection.
Port Properties	
Name	This shows the name of the port.
Native VID (PVID)	A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines. Enter the PVID from 1 to 4094 for this port.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

6.11.2.3 VLAN Add/Edit

Use this screen to create a new VLAN or configure an existing VLAN on the NXC.

To access this screen, click **Add** or select a VLAN and click the **Edit** button in the **VLAN Configuration** table of the **Monitor > Wireless > AP Information > AP List > Edit AP List** or **Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List** screen.

Figure 56 Monitor > Wireless > AP Information > AP List > Edit AP List > Add/Edit VLAN



Each field is described in the following table.

Table 42 Monitor > Wireless > AP Information > AP List > Edit AP List > Add/Edit VLAN

LABEL	DESCRIPTION
Enable	Select this option to activate the VLAN. Otherwise, cancel the selection.
Name	This field is read-only if you are editing an existing VLAN. Enter the number of the VLAN. You can use a number from 1~4094. For example, vlan0, vlan8, and so on.
VID	Enter the VLAN ID. This 12-bit number uniquely identifies each VLAN. Allowed values are 1 - 4094. (0 and 4095 are reserved.)
Member Configuration	Use these settings to assign ports to this VLAN as members.
Edit	Click this to edit the selected port's membership values.
#	This is sequential indicator of the port number.
Port Name	This indicates the port name.
Member	This indicates whether the selected port is a member or not of the VLAN which is currently being edited. Click this field to edit the value.
Tx Tagging	This indicates whether the selected port tags outbound traffic with this VLAN's ID. Click this field to edit the value.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

6.11.2.4 Change Mode Behavior

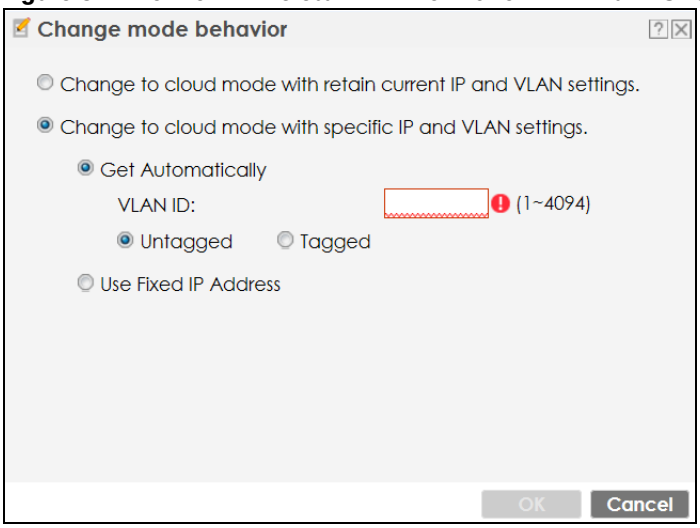
Use this screen to configure the IP address and VLAN settings of a tri-mode AP and set it to run in Nebula cloud management mode immediately.

The AP that supports tri-mode can work as a normal AP, a CAPWAP managed AP controlled by the NXC, or an AP managed by the Zyxel Nebula Control Center (NCC). See the AP's user's guide for more information about tri-mode.

Note: It is highly recommended that you register the AP with the NCC before pressing the Nebula button to change its management mode.

To access this screen, select a tri-mode AP from the list and click the **Nebula** button in the **Monitor > Wireless > AP Information > AP List** screen.

Figure 57 Monitor > Wireless > AP Information > AP List > Change mode behavior



The following table describes the labels in this screen.

Table 43 Monitor > Wireless > AP Information > AP List > Change mode behavior

LABEL	DESCRIPTION
Change to cloud mode with retain current IP and VLAN settings.	Select this option to have the AP run in Nebula cloud management mode without changing its IP address and VLAN settings.
Change to cloud mode with specific IP and VLAN settings	Select this option to have the AP run in Nebula cloud management mode using the IP address and VLAN settings you configure below.
Get Automatically	Select this to make the AP a DHCP client and automatically get the IP address, subnet mask, and gateway address from a DHCP server.
Use Fixed IP Address	Select this if you want to specify the IP address, subnet mask, gateway and DNS server address manually.
VLAN ID	Enter a management VLAN ID for the AP.
Untagged/Tagged	Set whether the AP adds the VLAN ID to outbound traffic transmitted through its Ethernet port.
IP Address	Enter the IP address for the AP.
Subnet Mask	Enter the subnet mask of the AP in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all devices in the network.
Gateway	Enter the IP address of the gateway. The AP sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the AP.
DNS	Enter the IP address of the DNS server.

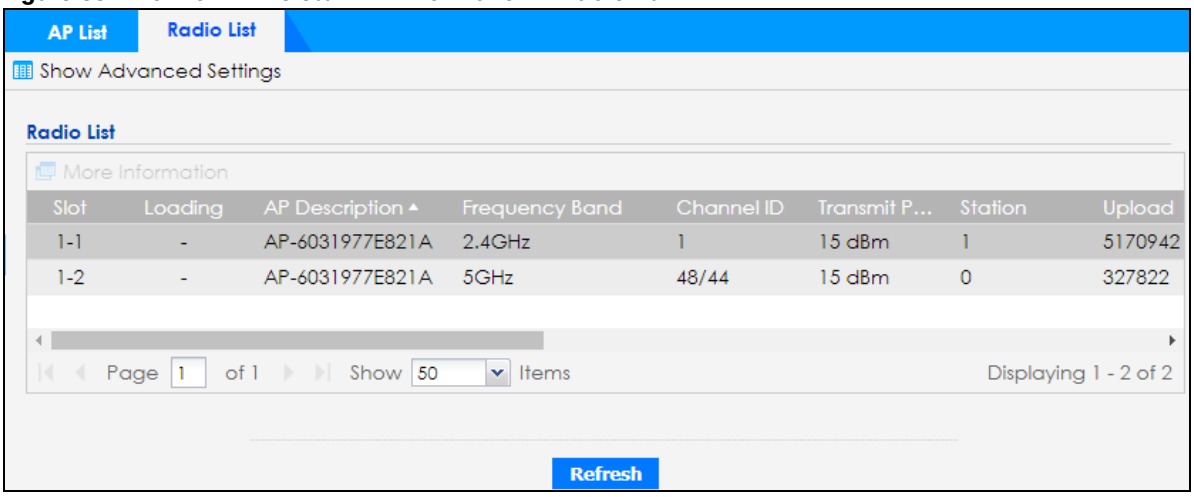
Table 43 Monitor > Wireless > AP Information > AP List > Change mode behavior

LABEL	DESCRIPTION
OK	Click **OK** to save your changes back to the AP. Note: The AP will be set to Nebula cloud management mode and removed from the managed AP list right after you click **OK**.
Cancel	Click **Cancel** to exit this screen without saving your changes.

6.12 Radio List

Use this screen to view statistics about the wireless radio transmitters in each of the APs connected to the NXC. To access this screen, click **Monitor > Wireless > AP Information > Radio List**.

Figure 58 Monitor > Wireless > AP Information > Radio List



The following table describes the labels in this screen.

Table 44 Monitor > Wireless > AP Information > Radio List

LABEL	DESCRIPTION
Hide/Show Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Radio List	
Enable Column Freeze	Select the check box to freeze the first column (**#**) so it will be always visible when you scroll through the list. Clear the check box to unfreeze the column.
More Information	Click this to view additional information about the selected radio's SSID(s), wireless traffic and wireless clients. Information spans a 24 hour period.
Slot	This is the radio's index number in this list.
Loading	This indicates the AP's load balance status (**AP UnderLoaded** or **AP OverLoaded**) when load balancing is enabled on the AP. Otherwise, it shows **-** when load balancing is disabled or the radio is in monitor mode.
AP Description	This displays the description of the AP to which the radio belongs.
Frequency Band	This indicates the wireless frequency currently being used by the radio. This shows **-** when the radio is in monitor mode.

Table 44 Monitor > Wireless > AP Information > Radio List (continued)

LABEL	DESCRIPTION
Channel ID	This indicates the radio's channel ID.
Transmit Power	This shows the radio's output power (in dBm).
Station	This displays the number of stations (aka wireless clients) associated with the radio.
Upload	This displays the total number of bytes received by the radio.
Download	This displays the total number of bytes transmitted by the radio.
Model	This displays the model of the AP to which the radio belongs.
MAC Address	This displays the MAC address of the radio.
Radio	This indicates the radio number on the AP to which it belongs.
OP Mode	This indicates the radio's operating mode. Operating modes are **AP** (access point), **MON** (monitor), **Root AP** or **Repeater**.
AP / ZyMesh Profile	This indicates the AP radio and ZyMesh profile names to which the radio belongs.
Antenna	This indicates the antenna orientation for the radio (**Wall** or **Ceiling**). This shows **N/A** if the AP does not allow you to adjust coverage depending on the orientation of the antenna for each radio using the web configurator or a physical switch.
Channel Utilization	This indicates how much IEEE 802.11 traffic the AP radio can receive on the channel. It displays what percentage of the radio's channel is currently being used.
Refresh	Click this button to update the information in the screen.

The following table describes the icons in this screen.

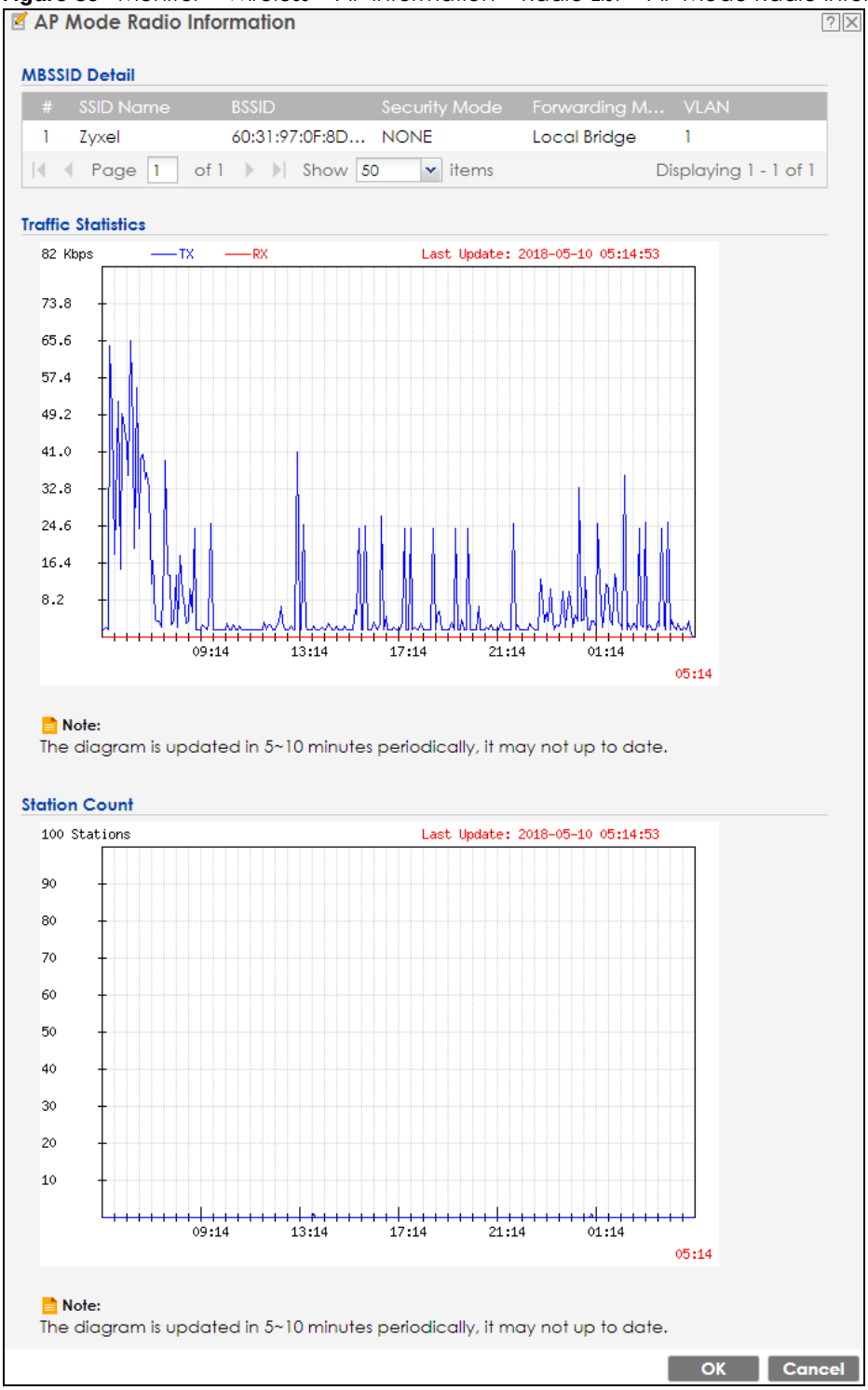
Table 45 Monitor > Wireless > AP Information > Radio List Icons

LABEL	DESCRIPTION
	When an AP is being load balanced, this icon means it is operating over the maximum allocated bandwidth.
	When an AP is being load balanced, this icon means it is operating under the maximum allocated bandwidth.

6.12.1 AP Mode Radio Information

This screen allows you to view detailed information about a selected radio's SSID(s), wireless traffic and wireless clients for the preceding 24 hours. To access this window, select an entry and click the **More Information** button in the **Radio List** screen.

Figure 59 Monitor > Wireless > AP Information > Radio List > AP Mode Radio Information



The following table describes the labels in this screen.

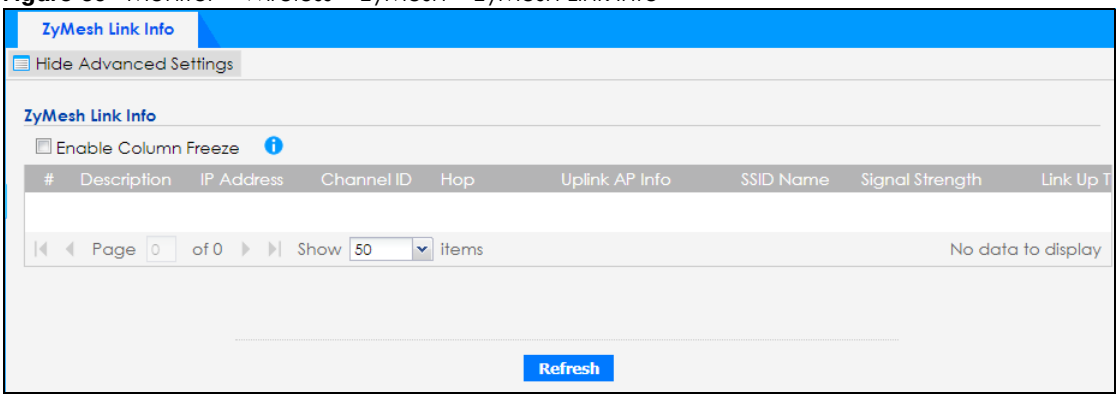
Table 46 Monitor > Wireless > AP Info > Radio List > AP Mode Radio Information

LABEL	DESCRIPTION
MBSSID Detail	This list shows information about the SSID(s) that is associated with the radio over the preceding 24 hours.
#	This is the items sequential number in the list. It has no bearing on the actual data in this list.
SSID Name	This displays an SSID associated with this radio. There can be up to eight maximum.
BSSID	This displays the MAC address associated with the SSID.
Security Mode	This displays the security mode in which the SSID is operating.
Forwarding Mode	This field indicates the forwarding mode (**Local Bridge** or **Tunnel**) associated with the SSID profile.
VLAN	This displays the VLAN ID associated with the SSID.
Traffic Statistics	This graph displays the overall traffic information about the radio over the preceding 24 hours.
y-axis	This axis represents the amount of data moved across this radio in megabytes per second.
x-axis	This axis represents the amount of time over which the data moved across this radio.
Station Count	This graph displays information about all the wireless clients that have connected to the radio over the preceding 24 hours.
y-axis	The y-axis represents the number of connected wireless clients.
x-axis	The x-axis shows the time over which a wireless client was connected.
Last Update	This field displays the date and time the information in the window was last updated.
OK	Click this to close this window.
Cancel	Click this to close this window.

6.13 ZyMesh Link Info

Use this screen to view the ZyMesh traffic statistics between the managed APs. Click **Monitor > Wireless > ZyMesh > ZyMesh Link Info** to access this screen.

Figure 60 Monitor > Wireless > ZyMesh > ZyMesh Link Info



The following table describes the labels in this screen.

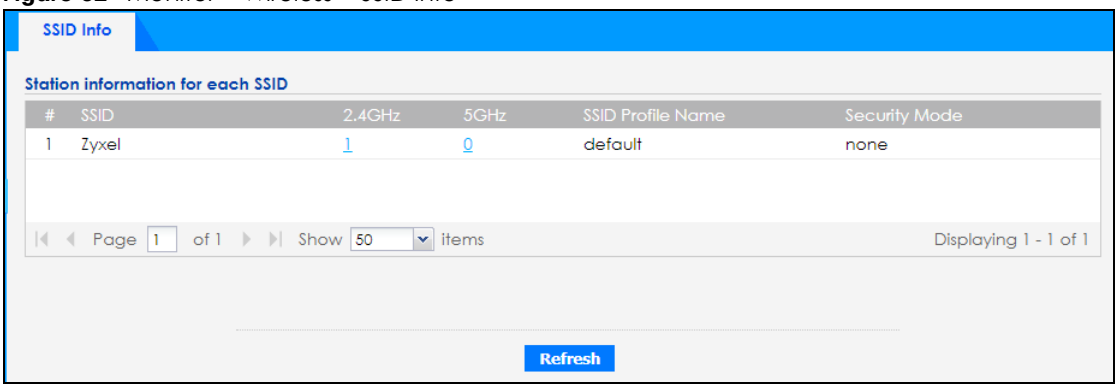
Table 47 Monitor > Wireless > ZyMesh > ZyMesh Link Info

LABEL	DESCRIPTION
Hide/Show Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
ZyMesh Link Info	
Enable Column Freeze	Select the check box to freeze the first column (**#**) so it will be always visible when you scroll through the list. Clear the check box to unfreeze the column.
#	This is the index number of the managed AP (in repeater mode) in this list.
Description	This is the descriptive name of the managed AP (in repeater mode).
IP Address	This is the IP address of the managed AP (in repeater mode).
Channel ID	This is the number of the channel used by the managed AP (in repeater mode).
Hop	This is the hop count of the managed AP. For example, "1" means the managed AP is connected to a root AP directly. "2" means there is another repeater AP between the managed AP and the root AP.
Uplink AP Info	This shows the role and descriptive name of the managed AP to which this managed AP is connected wirelessly.
SSID Name	This indicates the name of the wireless network (SSID) the managed AP uses to associated with another managed AP.
Signal Strength	Before the slash, this shows the signal strength the uplink AP (a root AP or a repeater) receives from this managed AP (in repeater mode). After the slash, this shows the signal strength this managed AP (in repeater mode) receives from the uplink AP.
Link Up Time	This displays the time the managed AP last associated with the root AP or repeater.
MAC Address	This is the MAC address of the managed AP (in repeater mode).
Transmit Power	This is the output power of the managed AP (in repeater mode).
Root AP	This is the descriptive name of the root AP to which the managed AP is connected wirelessly.
Rx Rate	This is the maximum reception rate of the root AP or repeater to which the managed AP is connected.
Tx Rate	This is the maximum transmission rate of the root AP or repeater to which the managed AP is connected.
Refresh	Click this button to update the information in the screen.

6.14 SSID Info

Use this screen to view the number of wireless clients currently connected to an SSID and the security type used by the SSID. Click **Monitor > Wireless > SSID Info** to access this screen.

Figure 61 Monitor > Wireless > SSID Info



The following table describes the labels in this screen.

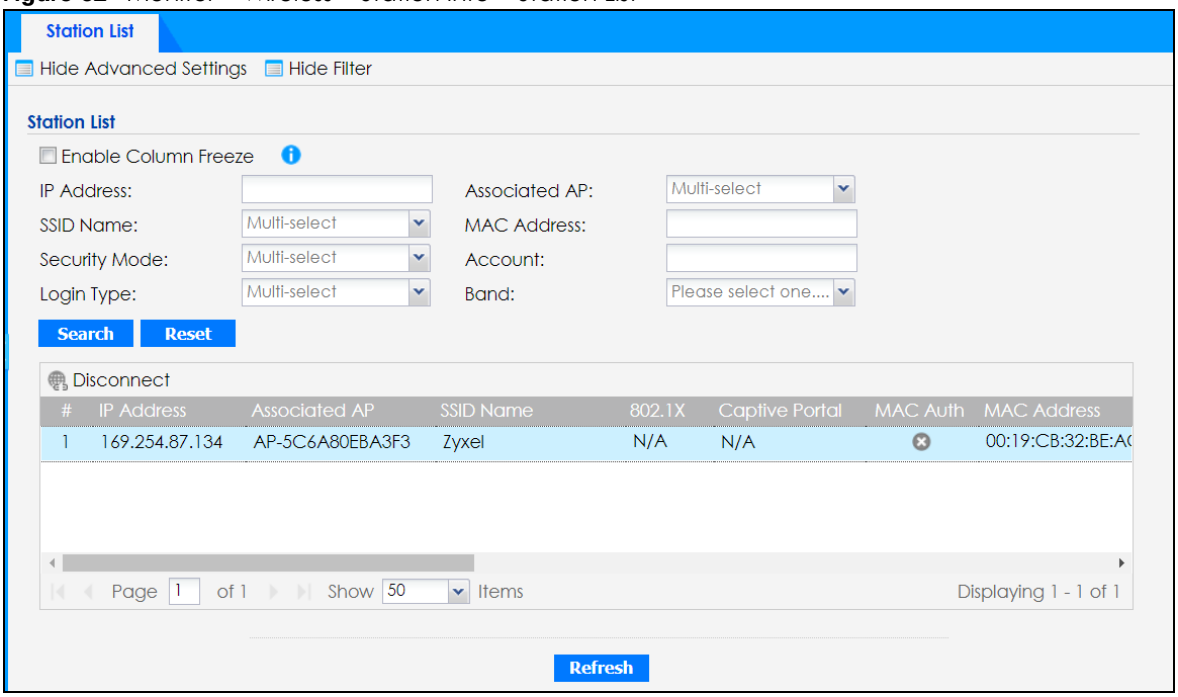
Table 48 Monitor > Wireless > SSID Info

LABEL	DESCRIPTION
#	This is the SSID's index number in this list.
SSID	This indicates the name of the wireless network to which the client is connected. A single AP can have multiple SSIDs or networks.
2.4GHz	This shows the number of wireless clients which are currently connected to the SSID using the 2.4 GHz frequency band, Click the number to go to the **Station Info > Station List** screen. See Section 6.15 on page 107.
5GHz	This shows the number of wireless clients which are currently connected to the SSID using the 5 GHz frequency band, Click the number to go to the **Station Info > Station List** screen. See Section 6.15 on page 107.
SSID Profile Name	This indicates the name of the SSID profile in which the SSID is defined,
Security Mode	This indicates which secure encryption methods is being used by the SSID.
Refresh	Click this to refresh the items displayed on this page.

6.15 Station List

Use this screen to view statistics pertaining to the associated stations (or "wireless clients"). Click **Monitor > Wireless > Station Info > Station List** to access this screen.

Figure 62 Monitor > Wireless > Station Info > Station List



The following table describes the labels in this screen.

Table 49 Monitor > Wireless > Station Info > Station List

LABEL	DESCRIPTION
Hide/Show Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Show Filter / Hide Filter	Click this button to show or hide the filter settings.
Station List	
Enable Column Freeze	Select the check box to freeze the first column (**#**) so it will be always visible when you scroll through the list. Clear the check box to unfreeze the column.
IP Address	Enter the IP address of the station you want to display. This field is case-sensitive
SSID Name	Select the SSID(s) to which the stations you want to display are connected.
Security Mode	Select the security mode(s) used by the stations you want to display.
Login Type	Select the login method(s) used by the stations you want to display.
Associated AP	Select the AP(s) with which the stations you want to display associate.
MAC Address	Enter the MAC address of the station you want to display. This field is case-sensitive
Account	Enter the user account name of the station you want to display. This field is case-sensitive
Band	Select the frequency band used by the stations you want to display.
Search	Click this to update the list of stations based on the search criteria. Your search criteria is retained when navigating between screens.
Reset	Click this to return the search criteria to the factory defaults and display all connected stations without a filter.
Disconnect	Select one or multiple stations and click this to disconnect the station(s) from the AP.
#	This is the station's index number in this list.

Table 49 Monitor > Wireless > Station Info > Station List (continued)

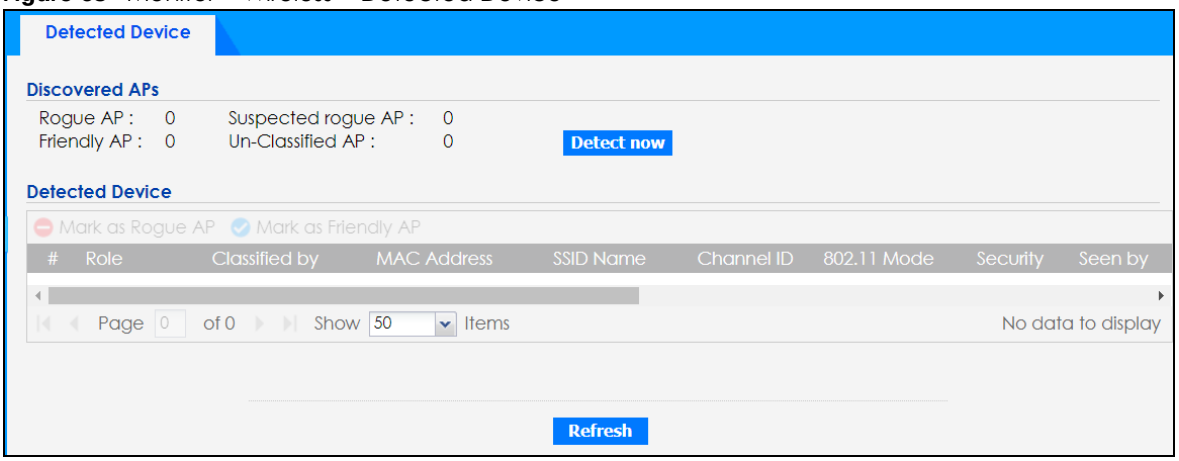
LABEL	DESCRIPTION
IP Address	This is the station's IP address. An 169.x.x.x IP address is a private IP address that means the station didn't get the IP address from a DHCP server.
Associated AP	This indicates the AP through which the station is connected to the network.
SSID Name	This indicates the name of the wireless network to which the station is connected. A single AP can have multiple SSIDs or networks.
802.1X	This displays whether the station logged into the network via 802.1x authentication.
Captive Portal	This displays whether the station logged into the network via the captive portal login page.
MAC Auth	This displays whether the station logged into the network via MAC authentication.
Rx Rate	This indicates the current data receiving rate of the station.
Tx Rate	This indicates the current data transmission rate of the station.
Association Time	This displays the time a wireless station first associated with the AP.
Capability	This displays the supported standard currently being used by the station or the standards supported by the station.
802.11 Features	This displays whether the station supports IEEE802.11r, IEEE 802.11k, IEEE 802.11v or none of the above (**N/A**).
MAC Address	This is the station's MAC address.
Security Mode	This indicates which secure encryption method is being used by the station to connect to the network.
Signal Strength	This indicates the strength of the signal. The signal strength mainly depends on the antenna output power and the distance between the station and the AP.
Channel	This indicates the number of the channel used by the station to connect to the network.
Band	This indicates the frequency band which is currently being used by the station.
Download	This field displays the number of bytes received by the station.
Upload	This field displays the number of bytes transmitted from the station.
Refresh	Click this to refresh the items displayed on this page.

6.16 Detected Device

Use this screen to view information about wireless devices detected by the AP. Click **Monitor > Wireless > Detected Device** to access this screen.

Note: Enable **Rogue AP Detection** in the **Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List** screen to detect other wireless devices in its vicinity. Or, if this feature is not supported by your AP, you could also set at least one radio of the AP connected to the NXC to monitor mode (in the **Configuration > Wireless > AP Management** screen).

Figure 63 Monitor > Wireless > Detected Device



The following table describes the labels in this screen.

Table 50 Monitor > Wireless > Detected Device

LABEL	DESCRIPTION
Discovered APs	
Rogue AP	This shows how many devices are detected as rogue APs.
Suspected rogue AP	This shows how many devices are detected as possible rogue APs by classification rule.
Friendly AP	This shows how many devices are detected as friendly APs.
Un-classified AP	This shows how many devices are detected, but have not been classified by the NXC.
Detect Now	Click this button for the NXC to scan for APs in the network.
Detected Device	
Mark as Rogue AP	Click this button to mark the selected AP as a rogue AP. A rogue AP can be contained in the **Configuration > Wireless > Rogue AP** screen (Chapter 8 on page 119).
Mark as Friendly AP	Click this button to mark the selected AP as a friendly AP. For more on managing friendly APs, see the **Configuration > Wireless > Rogue AP** screen (Chapter 8 on page 119).
#	This is the station's index number in this list.
Role	This indicates the detected device's role (such as rogue, friendly or suspected rogue).
Classified by	This indicates the detected device's classification rule.
MAC Address	This indicates the detected device's MAC address.
SSID Name	This indicates the detected device's SSID.
Channel ID	This indicates the detected device's channel ID.
802.11 Mode	This indicates the 802.11 mode (a/b/g/n/ac/ax) transmitted by the detected device.
Security	This indicates the encryption method (if any) used by the detected device.
Seen by	This indicates which AP detects the device. If an AP in monitor mode detected this AP, this column will show "N/A". If an AP using **Rogue AP Detection** detected this device, it will show the name of the AP and the signal strength from the detected device. If the wireless device is detected by more than one AP, only the top 5 APs with the highest signal strength will be shown.
Group	This indicates which group the detected device belongs.
Description	This displays the detected device's description. For more on managing friendly and rogue APs, see the **Configuration > Wireless > Rogue AP** screen (Chapter 8 on page 119).

Table 50 Monitor > Wireless > Detected Device (continued)

LABEL	DESCRIPTION
Last Seen	This indicates the last time the device was detected by the AP.
Refresh	Click this to refresh the items displayed on this page.

6.17 View Log

Log messages are stored in two separate logs, one for regular log messages and one for debugging messages. In the regular log, you can look at all the log messages by selecting **All Logs**, or you can select a specific category of log messages (for example, user). You can also look at the debugging log by selecting **Debug Log**. All debugging messages have the same priority.

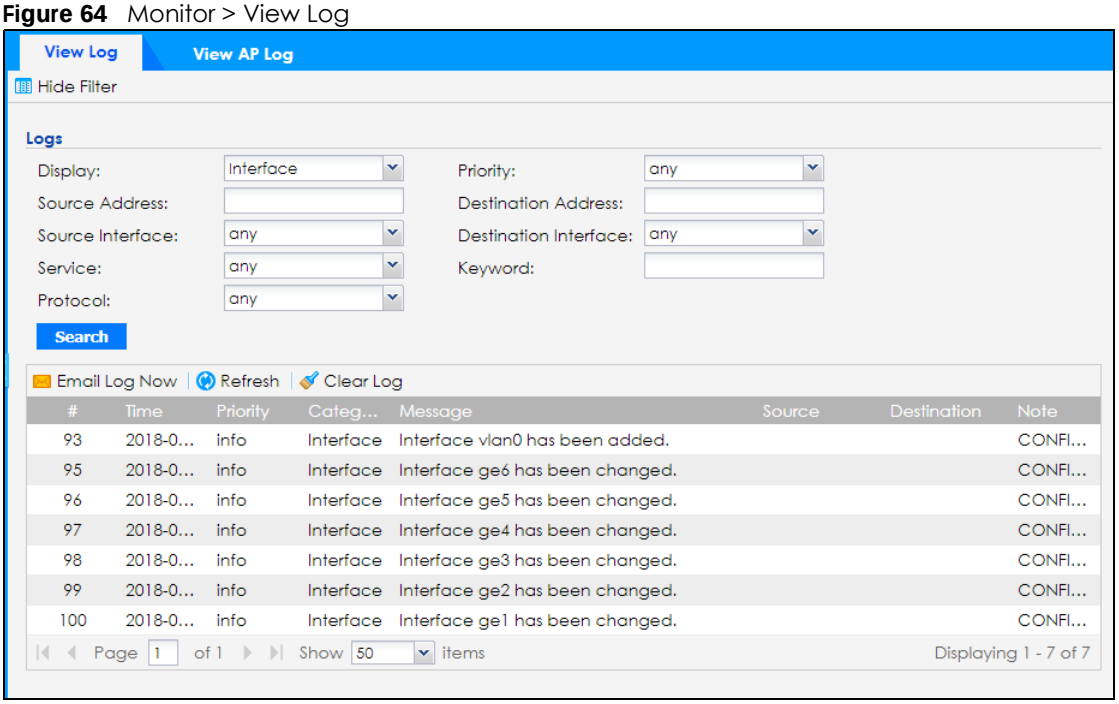
To access this screen, click **Monitor > Log**. The log is displayed in the following screen.

Note: When a log reaches the maximum number of log messages, new log messages automatically overwrite existing log messages, starting with the oldest existing log message first.

- For individual log descriptions, see Appendix A on page 436.
- For the maximum number of log messages in the NXC, see the datasheet.

Events that generate an alert (as well as a log message) display in red. Regular logs display in black. Click a column's heading cell to sort the table entries by that column's criteria. Click the heading cell again to reverse the sort order.

Figure 64 Monitor > View Log



The following table describes the labels in this screen.

Table 51 Monitor > View Log

LABEL	DESCRIPTION
Show Filter / Hide Filter	Click this button to show or hide the filter settings. If the filter settings are hidden, the **Display**, **Email Log Now**, **Refresh**, and **Clear Log** fields are available. If the filter settings are shown, the **Display**, **Priority**, **Source Address**, **Destination Address**, **Source Interface**, **Destination Interface**, **Service**, **Keyword**, **Protocol** and **Search** fields are available.
Display	Select the category of log message(s) you want to view. You can also view **All Logs** at one time, or you can view the **Debug Log**.
Priority	This displays when you show the filter. Select the priority of log messages to display. The log displays the log messages with this priority or higher. Choices are: **any**, **emerg**, **alert**, **crit**, **error**, **warn**, **notice**, and **info**, from highest priority to lowest priority. This field is read-only if the category is **Debug Log**.
Source Address	This displays when you show the filter. Type the source IP address of the incoming packet that generated the log message. Do not include the port in this filter.
Destination Address	This displays when you show the filter. Type the IP address of the destination of the incoming packet when the log message was generated. Do not include the port in this filter.
Source Interface	This displays when you show the filter. Select the source interface of the packet that generated the log message.
Destination Interface	This displays when you show the filter. Select the destination interface of the packet that generated the log message.
Service	This displays when you show the filter. Select the service whose log messages you would like to see. The Web Configurator uses the protocol and destination port number(s) of the service to select which log messages you see.
Keyword	This displays when you show the filter. Type a keyword to look for in the **Message**, **Source**, **Destination** and **Note** fields. If a match is found in any field, the log message is displayed. You can use up to 63 alphanumeric characters and the underscore, as well as punctuation marks ()' ,.:;?! +-*/= #$% @ ; the period, double quotes, and brackets are not allowed.
Protocol	This displays when you show the filter. Select a service protocol whose log messages you would like to see.
Search	This displays when you show the filter. Click this button to update the log using the current filter settings.
Email Log Now	Click this button to send log messages to the **Active** e-mail addresses specified in the **Send Log To** field on the **Log Settings** page.
Refresh	Click this button to update the log table.
Clear Log	Click this button to clear the whole log, regardless of what is currently displayed on the screen.
#	This field is a sequential value, and it is not associated with a specific log message.
Time	This field displays the time the log message was recorded.
Priority	This field displays the priority of the log message. It has the same range of values as the **Priority** field above.
Category	This field displays the log that generated the log message. It is the same value used in the **Display** and (other) **Category** fields.
Message	This field displays the reason the log message was generated. The text "[count=*x*]", where *x* is a number, appears at the end of the **Message** field if log consolidation is turned on and multiple entries were aggregated to generate into this one.
Source	This field displays the source IP address and the port number in the event that generated the log message.

Table 51 Monitor > View Log (continued)

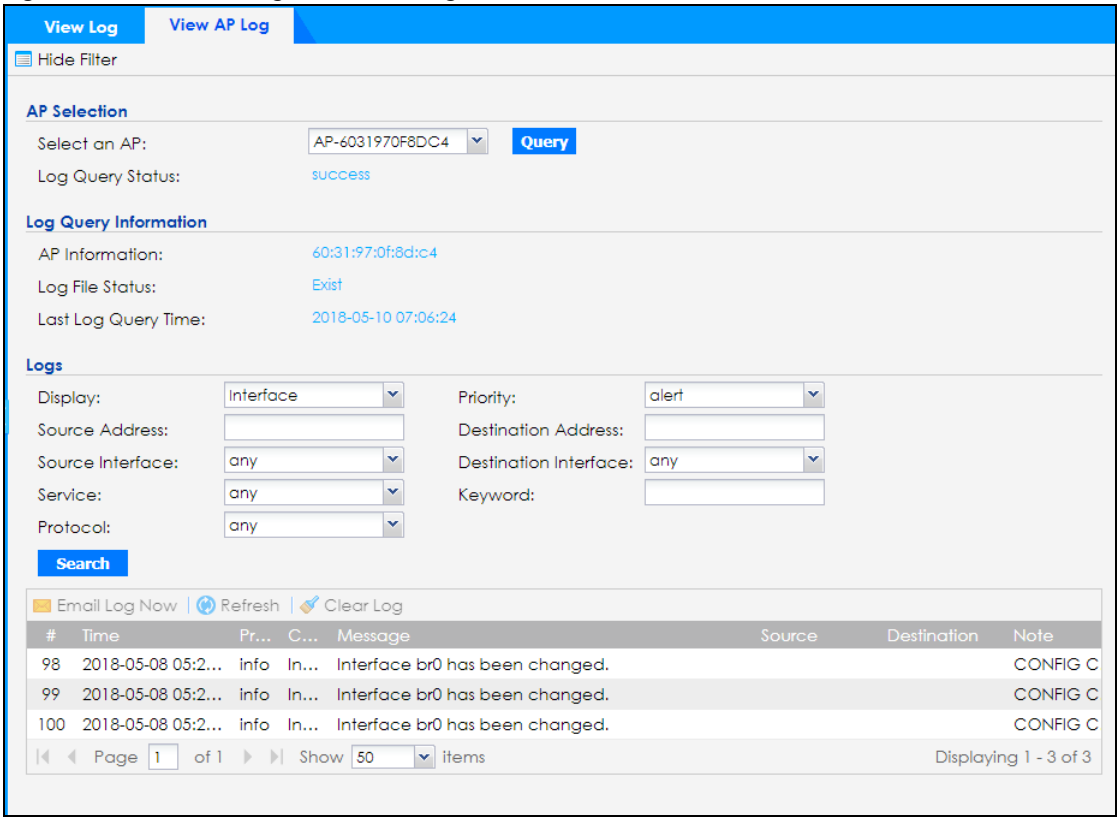
LABEL	DESCRIPTION
Destination	This field displays the destination IP address and the port number of the event that generated the log message.
Note	This field displays any additional information about the log message.

The Web Configurator saves the filter settings if you leave the **View Log** screen and return to it later.

6.18 View AP Log

Use this screen to view the NXC's current wireless AP log messages. Click **Monitor > Log > View AP Log** to access this screen.

Figure 65 Monitor > Log > View AP Log



The following table describes the labels in this screen.

Table 52 Monitor > Log > View AP Log

LABEL	DESCRIPTION
Show/Hide Filter	Click this to show or hide the AP log filter.
AP Selection	
Select an AP	Select an AP from the list and click **Query** to view its log messages.

Table 52 Monitor > Log > View AP Log

LABEL	DESCRIPTION
Log Query Status	This indicates the current log query status. **init** - Indicates the query has not been initialized. **querying** - Indicates the query is in process. **fail** - Indicates the query failed. **success** - Indicates the query succeeded.
Log Query Information	
AP Information	This displays the MAC address for the selected AP.
Log File Status	This indicates the status of the AP's log messages.
Last Log Query Time	This indicates the last time the AP was queried for its log messages.
Logs	
Display	Select the log file from the specified AP that you want displayed. Note: This criterion only appears when you **Show Filter**.
Priority	Select a priority level to use for filtering displayed log messages. Note: This criterion only appears when you **Show Filter**.
Source Address	Enter a source IP address to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Destination Address	Enter a destination IP address to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Source Interface	Enter a source interface to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Destination Interface	Enter a destination interface to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Service	Select a service type to display only the log messages related to it. Note: This criterion only appears when you **Show Filter**.
Keyword	Enter a keyword to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Protocol	Select a protocol to display only the log messages that include it. Note: This criterion only appears when you **Show Filter**.
Search	Click this to start the log query based on the selected criteria. If no criteria have been selected, then this displays all log messages for the specified AP regardless.
Email Log Now	Click this open a new e-mail in your default e-mail program with the selected log attached.
Refresh	Click this to refresh the log table.
Clear Log	Click this to clear the log on the specified AP.
#	This field is a sequential value, and it is not associated with a specific log message.
Time	This indicates the time that the log messages was created or recorded on the AP.
Priority	This indicates the selected log message's priority.

Table 52 Monitor > Log > View AP Log

LABEL	DESCRIPTION
Category	This indicates the selected log message's category.
Message	This displays content of the selected log message.
Source	This displays the source IP address of the selected log message.
Destination	This displays the source IP address of the selected log message.
Note	This displays any notes associated with the selected log message.

CHAPTER 7
Registration

7.1 Overview

Use the **Configuration > Licensing > Registration** screens to register your NXC and manage its service subscriptions.

7.1.1 What You Can Do in this Chapter

- The **Registration** screen (Section 7.2 on page 117) registers your NXC with myZyxel.com.
- The **Service** screen (Section 7.3 on page 117) displays the status of your service registrations and upgrade licenses.

7.1.2 What you Need to Know

This section introduces the topics covered in this chapter.

myZyxel.com

myZyxel.com is Zyxel's online service center where you can register your NXC and manage subscription services available for the NXC. To use a subscription service, you have to register the NXC and activate the corresponding service at myZyxel.com (through the NXC).

Note: You need to create a myZyxel.com account before you can register your device and activate the services at myZyxel.com.

Go to http://portal.myZyxel.com with the NXC's serial number and LAN MAC address to register it. Refer to the web site's on-line help for details.

Note: To activate a service on an NXC, you need to access myZyxel.com via that NXC.

Maximum Number of Managed APs

The NXC is configured to support a certain number of managed APs that can be increased by purchasing additional licenses. The number of APs that the NXC can support is shown on Table 1 on page 19.

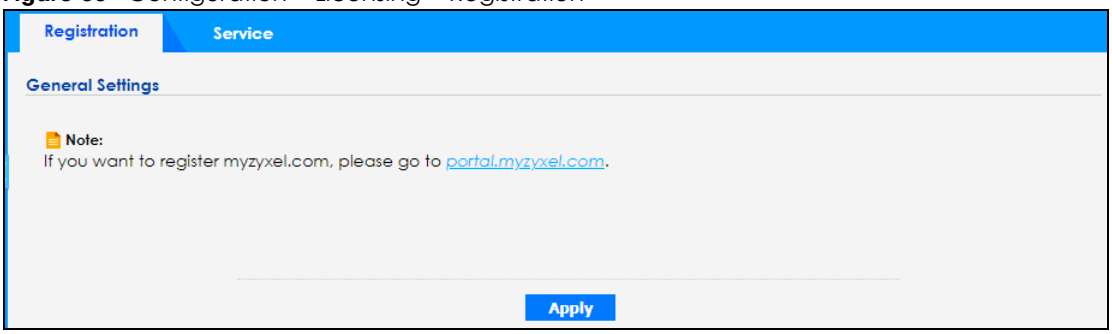
Maximum Number of ZyMesh Root APs

The NXC by default allows up to one ZyMesh root AP, which means only one radio of the managed AP can be set to root AP mode. Buy a ZyMesh license to have more root APs.

7.2 Registration

Click the link in this screen to register your NXC with myZyxel.com. The NXC should already have Internet access before you can register it. Click **Configuration > Licensing > Registration** in the navigation panel to open the screen as shown next.

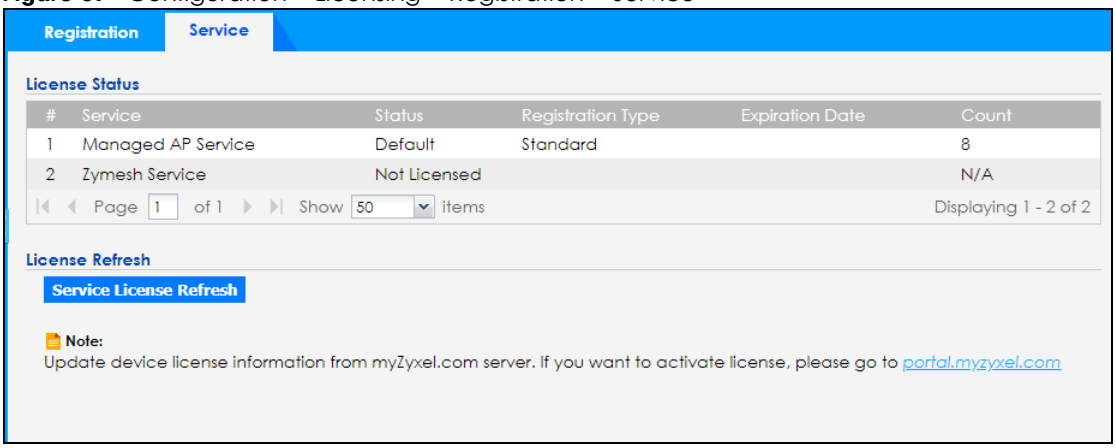
Figure 66 Configuration > Licensing > Registration



7.3 Service

Use this screen to display the status of your service registrations and upgrade licenses. To activate or extend a standard service subscription, purchase an iCard and enter the iCard's PIN number (license key) in this screen. Click **Configuration > Licensing > Registration** > **Service** to open the screen as shown next.

Figure 67 Configuration > Licensing > Registration > Service



The following table describes the labels in this screen.

Table 53 Configuration > Licensing > Registration > Service

LABEL	DESCRIPTION
License Status	
#	This is the entry's position in the list.
Service	This lists the services that are available on the NXC.
Status	This field displays whether this is a default service (**Default**) or an activated license upgrade (**Licensed**).

Table 53 Configuration > Licensing > Registration > Service (continued)

LABEL	DESCRIPTION
Registration Type	This field displays **standard** when you registered a service with your iCard's PIN number.
Expiration Date	This field displays the date your service expires.
Count	This field displays how many managed APs the NXC can support with your current license. This field does not apply to the other services.
License Refresh	
Service License Refresh	Click this button to renew service license information (such as the registration status and expiration day).

CHAPTER 8
Wireless

8.1 Overview

Use the **Wireless** screens to configure how the NXC manages the Access Point that are connected to it.

8.1.1 What You Can Do in this Chapter

- The **Controller** screen (Section 8.2 on page 120) sets how the NXC allows new APs to connect to the network.
- The **AP Management** screen (Section 8.3 on page 120) manages all of the APs connected to the NXC.
- The **Rogue AP** screen (Section 8.4 on page 140) allows you to assign APs either to the rogue AP list or the friendly AP list.
- The **Auto Healing** screen (Section 8.5 on page 142) turns on the auto healing feature to extend the wireless service coverage area of the managed APs when one of the APs fails.

8.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Station / Wireless Client

A station or wireless client is any wireless-capable device that can connect to an AP using a wireless signal.

Dynamic Channel Selection (DCS)

Dynamic Channel Selection (DCS) is a feature that allows an AP to automatically select the radio channel upon which it broadcasts by scanning the area around it and determining what channels are currently being used by other devices.

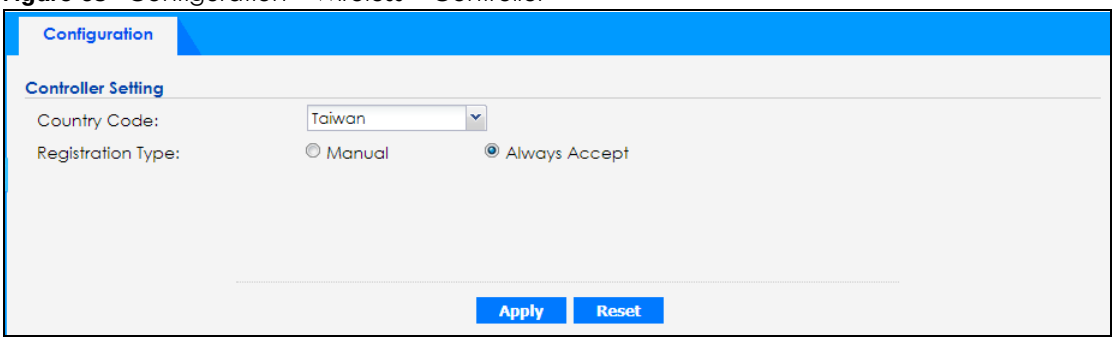
Load Balancing (Wireless)

Wireless load balancing is the process where you limit the number of connections allowed on an wireless access point (AP) or you limit the amount of wireless traffic transmitted and received on it so the AP does not become overloaded.

8.2 Controller

Use this screen to set how the NXC allows new APs to connect to the network. Click **Configuration > Wireless > Controller** to access this screen.

Figure 68 Configuration > Wireless > Controller



Each field is described in the following table.

Table 54 Configuration > Wireless > Controller

LABEL	DESCRIPTION
Controller Setting	
Country Code	Select the country where the NXC is located/installed.
Registration Type	Select **Manual** to add each AP to the NXC for management, or **Always Accept** to automatically add APs to the NXC for management. Note: Select the **Manual** option for managing a specific set of APs. This is recommended as the registration mechanism cannot automatically differentiate between friendly and rogue APs. For details on how to handle rogue APs, see Section 6.16 on page 109. APs must be connected to the NXC by a wired connection or network.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

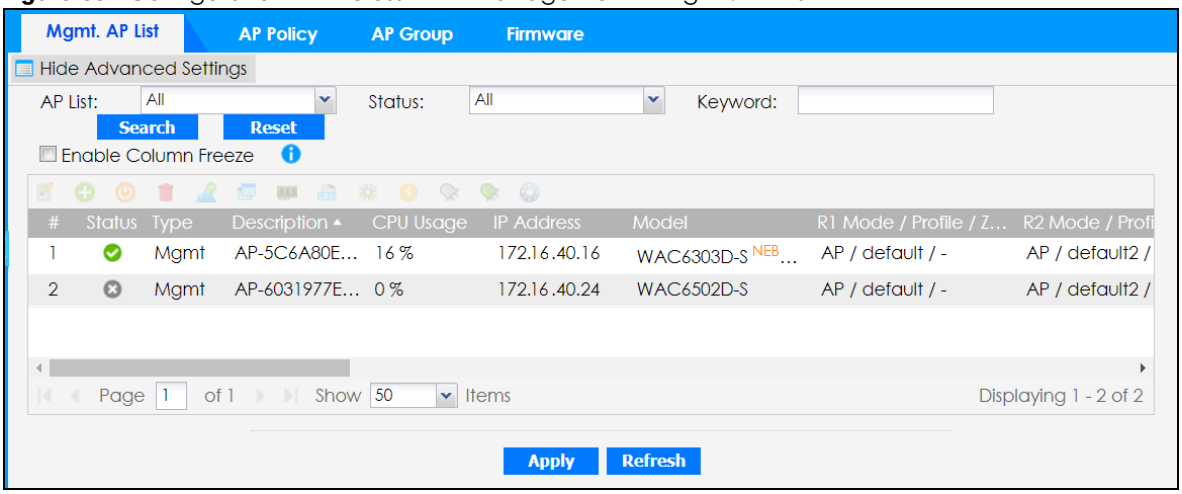
8.3 AP Management

Use the **AP Management** screens to manage all of the APs connected to the NXC.

8.3.1 Mgmt. AP List

This screen shows the APs that are connected to and can be managed by the NXC. Click **Configuration > Wireless > AP Management** to access this screen.

Figure 69 Configuration > Wireless > AP Management > Mgmt. AP List



Each field is described in the following table.

Table 55 Configuration > Wireless > AP Management > Mgmt. AP List

LABEL	DESCRIPTION
Hide/Show Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
AP List	Select the type of APs you want to display. Select **All** to show all kinds of APs that are currently or used to be connected to the NXC. Select **NebulaFlexPRO** to show the APs that can work in Nebula cloud management mode.
Status	Select the status of APs you want to display.
Keyword	Enter a keyword to display the APs that include it in their AP information, such as model number, firmware version, MAC address and so on. This field is case-sensitive.
Search	Click this to update the list of APs based on the search criteria. Your search criteria is retained when navigating between screens.
Reset	Click this to return the search criteria to the factory defaults and display all currently or previously connected APs without a filter.
Enable Column Freeze	Select the check box to freeze the first column (**#**) so it will be always visible when you scroll through the list. Clear the check box to unfreeze the column.
Edit the selected rule	Select an AP and click this to change the selected AP's properties, such as its group, radio, VLAN and port settings.
Add to Mgmt AP List	Select an AP and click this to add the selected AP to the managed AP list.
Reboot device	Select one or multiple APs and click this button to force the AP(s) to restart.
Remove the selected rule	Select one or multiple APs and click this button to remove the AP(s) from the manged AP list. Note: If in the **Configuration > Wireless > Controller** screen you set the **Registration Type** to **Always Accept**, then as soon as you remove an AP from this list it reconnects.

Table 55 Configuration > Wireless > AP Management > Mgmt. AP List (continued)

LABEL	DESCRIPTION
DCS Now	Select one or multiple APs and click this button to use DCS (Dynamic Channel Selection) to allow the AP to automatically find a less-used channel in an environment where there are many APs and there may be interference. Note: You should have enabled DCS in the applied AP radio profile before the APs can use DCS. Note: DCS is not supported on the radio which is working in repeater AP mode.
More Information	Select an AP and click this to view a daily station count about the selected AP. The count records station activity on the AP over a consecutive 24 hour period.
Radio Information	Select an online AP and click this button to go to the **Monitor > Wireless > AP Information > Radio List** screen to view detailed information about the AP's radios.
Query Controller Log	Select one or multiple APs and click this button to go to the **Monitor > Log > View Log** screen to view the selected AP's current log messages.
Nebula	Select an AP and click this to open a screen where you can set whether the AP's IP address and VLAN settings will be changed when it goes into Nebula cloud management mode. See Section 6.11.2.4 on page 100. Note: The AP will be set to Nebula cloud management mode and removed from the managed AP list right after you click **OK**.
Upgrade Firmware Now	Select one or more APs and click this button to update the APs' firmware version.
Suppression On	Select an AP and click this button to enable the AP's LED suppression mode. All the LEDs of the AP will turn off after the AP is ready. This button is not available if the selected AP doesn't support suppression mode.
Suppression Off	Select an AP and click this button to disable the AP's LED suppression mode. The AP LEDs stay lit after the AP is ready. This button is not available if the selected AP doesn't support suppression mode.
Locator On	Select an AP and click this button to run the locator feature. The AP's Locator LED will start to blink for 10 minutes by default. It will show the actual location of the AP between several devices in the network.
#	This field is a sequential value, and it is not associated with any interface.
Status	This visually displays the AP's connection status with icons. For details on the different **Status** states, see Table 37 on page 89.
Type	This indicates whether the AP is on the managed AP list (**Mgmt**) or not (**Un-Mgmt**). This displays **Limited** when the AP is configured by conflicted or unsupported setting(s).
Description	This field displays the AP's description, which you can configure by selecting the AP's entry and clicking the **Edit** button. The default description is "AP-" + the AP's MAC address.
CPU Usage	This displays what percentage of the AP's processing capability is currently being used.
IP Address	This field displays the IP address of the AP.
MAC Address	This field displays the MAC address of the AP.
Model	This field displays the AP's hardware model information. It displays **N/A** (not applicable) only when the AP disconnects from the NXC and the information is unavailable as a result.
R1 Mode / Profile / ZyMesh Profile	This field displays the operating mode (**AP**, **MON**, **root**, or **repeater**), AP radio profile name and ZyMesh profile name for Radio 1. It displays **n/a** for the AP profile for a radio not using an AP profile or **-** for the ZyMesh profile for a radio not using a ZyMesh profile.
R2 Mode / Profile / ZyMesh Profile	This field displays the operating mode (**AP**, **MON**, **root**, or **repeater**), AP radio profile name and ZyMesh profile name for Radio 2. It displays **n/a** for the AP radio profile for a radio not using an AP radio profile or **-** for the ZyMesh profile for a radio not using a ZyMesh profile.
Version	This displays the AP's current firmware version.

Table 55 Configuration > Wireless > AP Management > Mgmt. AP List (continued)

LABEL	DESCRIPTION
Group	This field displays the name of the AP group to which the AP belongs. The group becomes editable immediately upon clicking.
Station 2.4G	This displays the number of stations (aka wireless clients) associated with the AP's 2.4 GHz WiFi network.
Station 5G	This displays the number of stations (aka wireless clients) associated with the AP's 5 GHz WiFi network.
Recent On-line Time	This displays the most recent time the AP came on-line. **N/A** displays if the AP has not come on-line since the NXC last started up.
Mgmt. VLAN ID(AC/ AP)	This displays the Access Controller (the NXC) management VLAN ID setting for the AP and the runtime management VLAN ID setting on the AP. **VLAN Conflict** displays if the AP's management VLAN ID does not match the NXC's management VLAN ID setting for the AP. This field displays **n/a** if the NXC cannot get VLAN information from the AP.
Last Off-line Time	This displays the most recent time the AP went off-line. **N/A** displays if the AP has either not come on-line or gone off-line since the NXC last started up.
LED Status	This displays the AP LED status. **N/A** displays if the AP does not support LED suppression mode and/or have a locator LED to show the actual location of the AP. A gray LED icon signifies that the AP LED suppression mode is enabled. All the LEDs of the AP will turn off after the AP is ready. A green LED icon signifies that the AP LED suppression mode is disabled and the AP LEDs stay lit after the AP is ready. A sun icon signifies that the AP's locator LED is blinking. A circle signifies that the AP's locator LED is extinguished.
Ethernet Uplink	This field displays the AP's uplink port speed and duplex mode (**Full** or **Half**).
Power	This displays the AP's power status. (Full power) - the AP receives optimal power from the power sourcing equipment. (Force Full Power- the power sourcing equipment provides full power to the AP even in cases where a PoE injector that does not support PoE negotiation is used. (Limited power) - the AP receives less than optimal power from the power sourcing equipment. This may be due to the PoE switch/injector using an earlier PoE standard. This may impact wireless transmission throughput or disable a radio transmitter, depending on the AP's power requirements. (Off-Line) - the AP is not receiving power.
Bluetooth	This field displays the AP's Bluetooth Low Energy (BLE) capability. Bluetooth Low Energy, which is also known as Bluetooth Smart, transmits less data over a shorter distance and consumes less power than classic Bluetooth. APs communicate with other BLE enabled devices using advertisements. **N/A** displays if the AP does not support BLE. **Unavailable** displays if the AP supports Bluetooth, but there is no BLE USB dongle connected to the USB port of the AP. **Available** displays if the AP supports Bluetooth, detects a BLE device and advertising is inactive. Some APs, such as the WAC5302D-S. need to have a supported BLE USB dongle attached to act as a beacon to broadcast packets. **Advertising** displays if the AP supports Bluetooth, detects a BLE device and advertising is activated, which means the BLE device can broadcasts packets to every device around it.

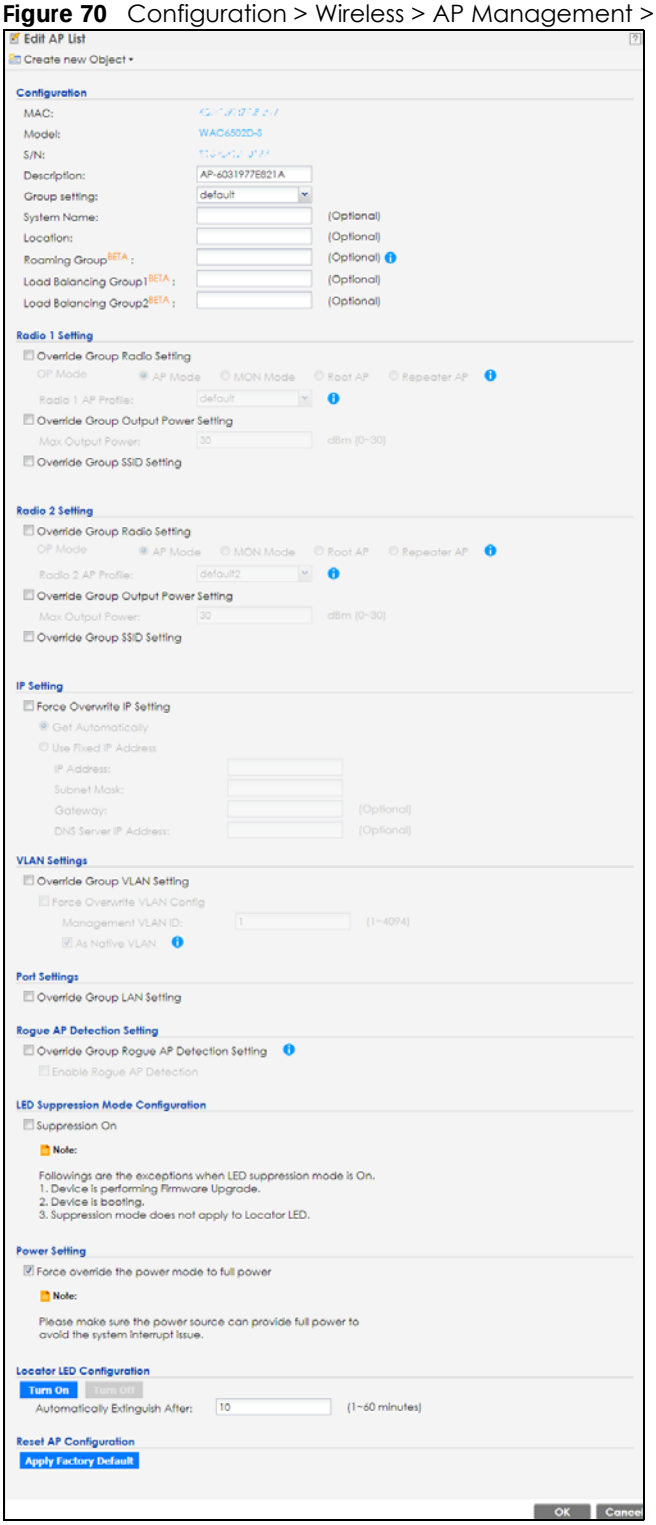
Table 55 Configuration > Wireless > AP Management > Mgmt. AP List (continued)

LABEL	DESCRIPTION
Location	This field displays the AP's location you configured.
Roaming Group	This field displays the name of roaming group to which the AP belongs.
S/N	This field displays the serial number of the AP.
System Name	This field displays the system name to identify the AP on a network.
Load Balancing Group	This field displays the load balancing group(s) to which the AP belongs.
Apply	Click **Apply** to save your changes back to the NXC.
Refresh	Click **Refresh** to update the information in this screen.

8.3.1.1 Edit AP List

Select an AP and click the **Edit the selected rule** button or double-click an entry in the **Configuration > Wireless > AP Management > Mgmt. AP List** table to display this screen.

Figure 70 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List



Each field is described in the following table.

Table 56 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List

LABEL	DESCRIPTION
Create new Object	Use this menu to create a new **Radio Profile**, **MON Profile** or **ZyMesh Profile** object to associate with this AP.
Configuration	
MAC	This displays the MAC address of the selected AP.
Model	This field displays the AP's hardware model information. It displays **N/A** (not applicable) only when the AP disconnects from the NXC and the information is unavailable as a result.
S/N	This displays the serial number of the selected AP.
Description	Enter a description for this AP. You can use up to 31 characters, spaces and underscores allowed. The system automatically generates a default name in the format of AP-xxxxxxxxxxxx (where xxxxxxxxxxxx is the AP's MAC address).
Group Setting	Select an AP group to which you want this AP to belong.
System Name	Enter a name to identify the AP on a network. This is usually the AP's fully qualified domain name.
Location	Specify the name of the place where the AP is located.
Roaming Group	Specify the name of the roaming group to which the AP belongs. You can use up to 31 alphanumeric and @# characters. Dashes and underscores are also allowed. The name should start with a letter or digit. The 802.11k neighbor list a client requests from the AP is generated according to the roaming group and RCPI (Received Channel Power Indicator) value of its neighbor APs. When a client wants to roam from the current AP to another, other APs in the same roaming group or not in a roaming group will be candidates for roaming. Neighbor APs in a different roaming group will be excluded from the 802.11k neighbor lists even when the neighbor AP has the best signal strength. If the AP's roaming group is not configured, any neighbor APs can be candidates for roaming.
Load Balancing Group 1/2	Load balancing is only applied to APs within the same group. If a load balancing group is not assigned to an AP, it will belong to a default group. See Table 59 on page 135. Each AP can belong to up to two groups.
Radio 1/2 Setting	
Override Group Radio Setting	Select this option to overwrite the AP radio settings with the settings you configure here.

Table 56 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List (continued)

LABEL	DESCRIPTION
OP Mode	Select the operating mode for radio 1 or radio 2. **AP Mode** means the AP can receive connections from wireless clients and pass their data traffic through to the NXC to be managed (or subsequently passed on to an upstream gateway for managing). **MON Mode** means the AP monitors the broadcast area for other APs, then passes their information on to the NXC where it can be determined if those APs are friendly or rogue. If an AP is set to this mode it cannot receive connections from wireless clients. **Root AP** means the radio acts as an AP and also supports the wireless connections with other APs (in repeater mode) to form a ZyMesh to extend its wireless network. **Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode). Note: To prevent bridge loops, do NOT set both radios on a managed AP to **Repeater AP** mode. Note: The root AP and repeater AP(s) in a ZyMesh must use the same country code and AP radio profile settings in order to communicate with each other. Note: Ensure you restart the managed AP after you change its operating mode.
Radio 1/2 AP Profile	Select an AP profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 Profile	Select a monitor profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 ZyMesh Profile	This field is available only when the radio is in **Root AP** or **Repeater AP** mode. Select the ZyMesh profile the radio uses to connect to a root AP or repeater.
Enable Wireless Bridging	This field is available only when the radio is in **Repeater AP** mode. Select this option to enable wireless bridging on the radio. The managed AP must support LAN provision and the radio should be in repeater mode. VLAN and bridge interfaces are created automatically according to the LAN port's VLAN settings. When wireless bridging is enabled, the managed repeater AP can still transmit data through its Ethernet port(s) after the ZyMesh link is up. Be careful to avoid bridge loops. The managed APs in the same ZyMesh must use the same static VLAN ID.
Override Group Output Power Setting	Select this option to overwrite the AP output power setting with the setting you configure here.
Max Output Power	Set the maximum output power of the AP.
Override Group SSID Setting	Select this option to overwrite the AP SSID profile setting with the setting you configure here. This section allows you to associate an SSID profile with the radio.
Edit	Select an SSID and click this button to reassign it. The selected SSID becomes editable immediately upon clicking.
#	This is the index number of the SSID profile. You can associate up to eight SSID profiles with an AP radio.
SSID Profile	Indicates which SSID profile is associated with this radio profile.
Bluetooth Advertising Setting This section is available only when the AP supports Bluetooth Low Energy (BLE).	
Edit	Click this to edit the selected entry. See Section 6.11.2.1 on page 98.

Table 56 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List (continued)

LABEL	DESCRIPTION
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This field is a sequential value, and it is not associated with a specific entry.
Status	This field shows whether or not the entry is activated. A yellow bulb signifies that this rule is active. A gray bulb signifies that this rule is not active.
UUID	This field indicates the UUID to be included in the Bluetooth advertising packets.
Major	This field indicates the major number to be included in the Bluetooth advertising packets.
Minor	This field indicates the minor number to be included in the Bluetooth advertising packets.
IP Setting	
Force Overwrite IP Setting	Select this to have the NXC change the AP's IP address setting to match the configuration in this screen.
Get Automatically	Select this to have the AP act as a DHCP client and automatically get the IP address, subnet mask, and gateway address from a DHCP server.
Use Fixed IP Address	Select this if you want to specify the IP address, subnet mask, gateway and DNS server address manually.
IP Address	Enter the IP address for the AP.
Subnet Mask	Enter the subnet mask of the AP in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all devices in the network.
Gateway	Enter the IP address of the gateway. The AP sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the AP.
DNS Server IP Address	Enter the IP address of the DNS server.
VLAN Settings	
Override Group VLAN Setting	Select this option to overwrite the AP VLAN setting with the setting you configure here.
Force Overwrite VLAN Config	Select this to have the NXC change the AP's management VLAN to match the configuration in this screen.
Management VLAN ID	Enter a VLAN ID for this AP.
As Native VLAN	Select this option to treat this VLAN ID as a VLAN created on the NXC and not one assigned to it from outside the network.
Port Settings	
Override Group LAN Setting	Select this option to overwrite the AP LAN port settings with the settings you configure here.
Port Setting	This section displays only when you select **Override Group LAN Setting**.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings. See Section 6.11.2.2 on page 99.
Activate/Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the port's index number in this list.
Status	This displays whether or not the port is activated.
Port	This shows the name of the physical Ethernet port on the managed AP.
PVID	This shows the port's PVID. A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines.

Table 56 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List (continued)

LABEL	DESCRIPTION
VLAN Configuration	This section displays only when you select **Override Group LAN Setting**.
Add	Click this to create a new entry. See Section 6.11.2.3 on page 99.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings. See Section 6.11.2.3 on page 99.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate/Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the VLAN's index number in this list.
Status	This displays whether or not the VLAN is activated.
Name	This shows the name of the VLAN.
VID	This shows the VLAN ID number.
Member	This field displays the Ethernet port(s) that is a member of this VLAN.
Storm Control Setting	
Broadcast Storm Control	Enabling this will drop ingress broadcast traffic in the physical Ethernet port if it exceeds the maximum traffic rate. The maximum traffic rate can be changed using the CLI (see CLI Reference Guide).
Multicast Storm Control	Enabling this will drop ingress multicast traffic in the physical Ethernet port if it exceeds the maximum traffic rate. The maximum traffic rate can be changed using the CLI (see CLI Reference Guide).
Rogue AP Detection Setting	
Override Group Rogue AP Detection Setting	Select this option to overwrite the AP Rogue Detection Settings with the settings you configure here.
Enable Rogue AP Detection	Select this option to detect Rogue APs in the network.
LED Suppression Mode Configuration This section is available only when the AP supports LED suppression mode.	
Suppression On	Select this option to enable the AP's LED suppression mode. All the LEDs of the AP will turn off after the AP is ready. If the check box is unchecked, it means the LEDs will stay lit after the AP is ready.
Power Setting	Enable **Force override the power mode to full power** if you are using a PoE injector that does not support PoE negotiation. Otherwise, the AP cannot draw full power from the power sourcing equipment. Enable this power mode to improve the AP's performance in this situation. Note: Ensure that the power sourcing equipment can supply enough power to the AP to avoid abnormal system reboots. Note: Only enable this if you are using a passive PoE injector that is not IEEE 802.3at/bt compliant but can still provide full power.
Locator LED Configuration This section is available only when the AP has a locator LED.	
Turn On/Turn Off	When the locator LED is off, click the **Turn On** button to activate the locator function. It will show the actual location of the AP between several devices in the network. If the locator LED is blinking, click the **Turn Off** button to stop the locator LED from blinking immediately.

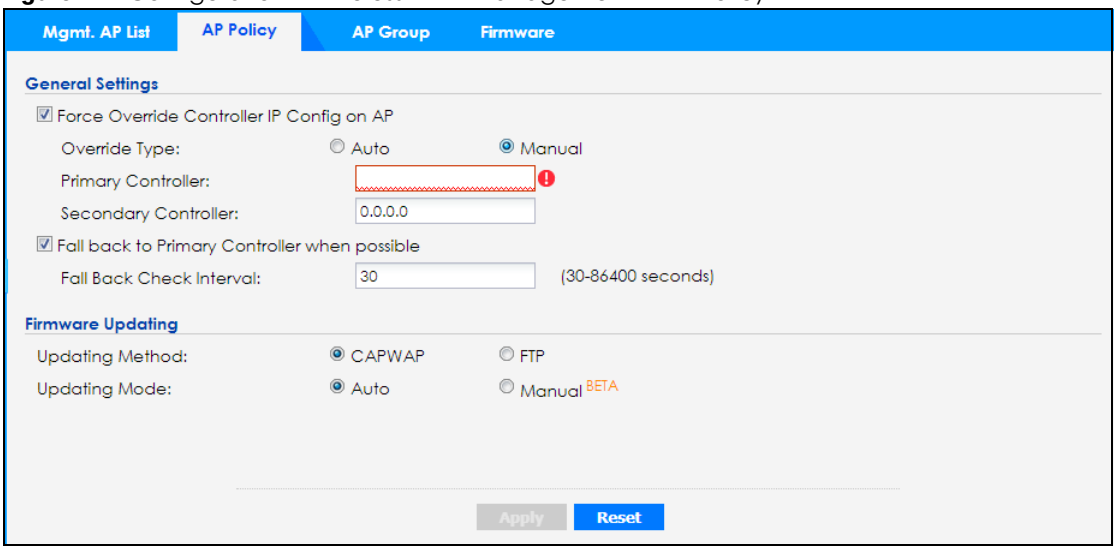
Table 56 Configuration > Wireless > AP Management > Mgmt. AP List > Edit AP List (continued)

LABEL	DESCRIPTION
Automatically Extinguish After	Enter a time interval between 1 and 60 minutes to stop the locator LED from blinking. The locator LED will start to blink for the number of minutes set here. If you make changes to the time default setting, it will be stored as the default when the AP restarts.
Reset AP Configuration This section is available only when the AP is online.	
Apply Factory Default	Click the button to reset all of the AP settings to the factory defaults.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

8.3.2 AP Policy

Use this screen to configure the AP controller's IP address on the managed APs and determine the action the managed APs take if the current AP controller fails. Click **Configuration > Wireless > AP Management > AP Policy** to access this screen.

Figure 71 Configuration > Wireless > AP Management > AP Policy



Each field is described in the following table.

Table 57 Configuration > Wireless > AP Management > AP Policy

LABEL	DESCRIPTION
General Settings	
Force Override Controller IP Config on AP	Select this to have the NXC change the AP controller's IP address on the managed AP(s) to match the configuration in this screen.
Override Type	Select **Auto** to have the managed AP(s) automatically send broadcast packets to find any other available AP controllers. Select **Manual** to replace the AP controller's IP address configured on the managed AP(s) with the one(s) you specified below.

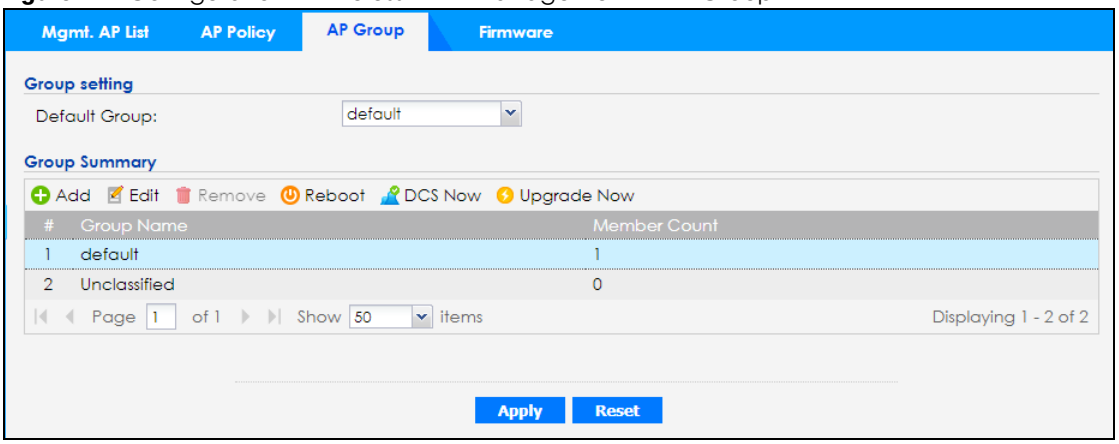
Table 57 Configuration > Wireless > AP Management > AP Policy (continued)

LABEL	DESCRIPTION
Primary Controller	Specify the IP address of the primary AP controller if you set **Override Type** to **Manual**.
Secondary Controller	Specify the IP address of the secondary AP controller if you set **Override Type** to **Manual**.
Fall back to Primary Controller when possible	Select this option to have the managed AP(s) change back to associate with the primary AP controller as soon as the primary AP controller is available.
Fall Back Check Interval	Set how often the managed AP(s) check whether the primary AP controller is available.
Firmware Updating	
Updating Method	Specify how you want the NXC to upgrade AP firmware. Select **CAPWAP** to have the NXC use CAPWAP to automatically update firmware on the managed APs. Select **FTP** to allow the managed APs to download the latest firmware from the NXC using FTP.
Updating Mode	Select **Auto** so the NXC checks the AP's firmware version and updates it automatically to the NXC's latest supported version. Select **Manual** so you update the AP firmware manually.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

8.3.3 AP Group

Use this screen to configure AP groups, which define the radio, port, VLAN and load balancing settings and apply the settings to all APs in the group. An AP can belong to one AP group at a time. Click **Configuration > Wireless > AP Management > AP Group** to access this screen.

Figure 72 Configuration > Wireless > AP Management > AP Group



Each field is described in the following table.

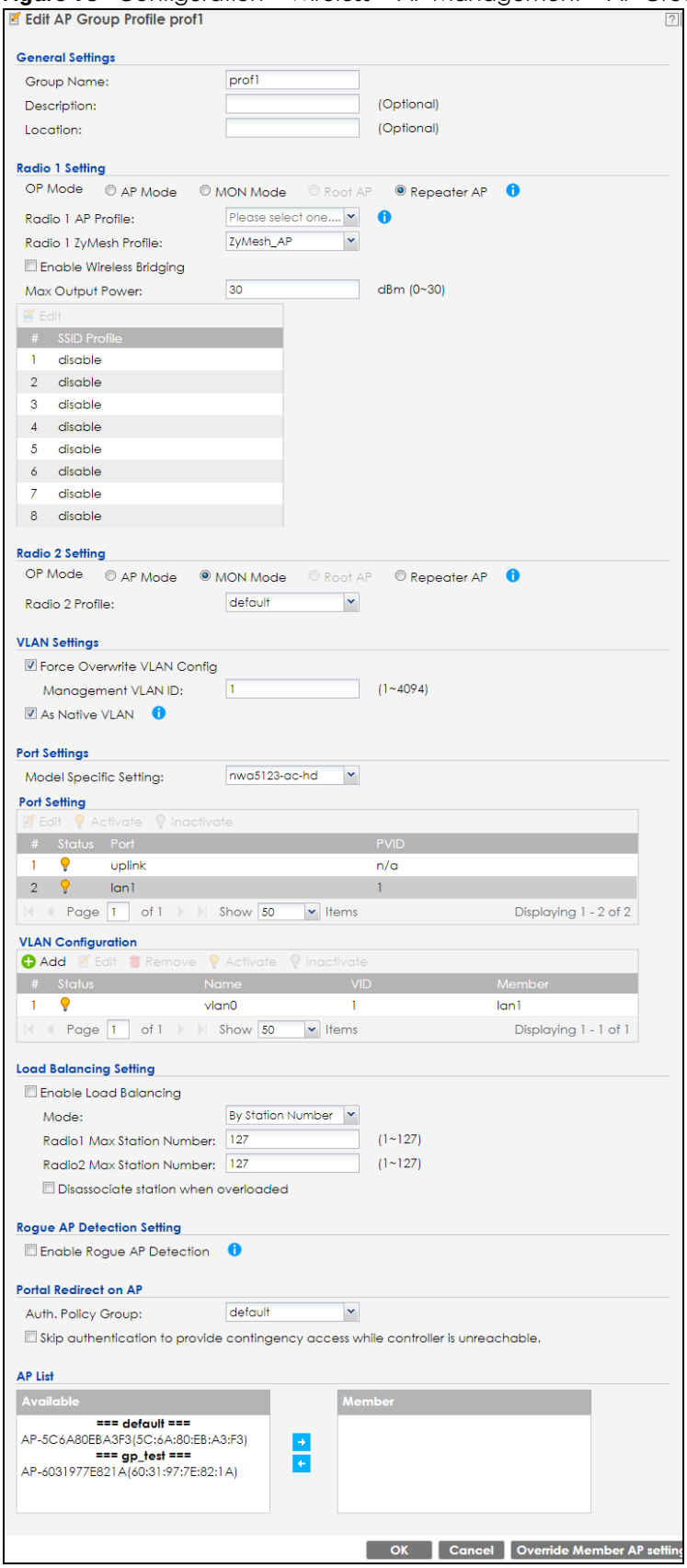
Table 58 Configuration > Wireless > AP Management > AP Group

LABEL	DESCRIPTION
Group Setting	
Default Group	Select a group that is used as the default group. Any AP that is not configured to associate with a specific AP group belongs to the default group automatically.
Group Summary	
Add	Click this button to create a new AP group.
Edit	Select an AP group and click this button to edit its properties.
Remove	Select an AP group and click this button to remove it from the list. Note: You cannot remove a group with which an AP is associated.
Reboot	Select an AP group and click this button to force the AP(s) in this group to restart.
DCS Now	Select one or multiple groups and click this button to use DCS (Dynamic Channel Selection) to allow the APs in the group(s) to automatically find a less-used channel in an environment where there are many APs and there may be interference. Note: You should have enabled DCS in the applied AP radio profile before the APs can use DCS. Note: DCS is not supported on the radio which is working in repeater AP mode.
Upgrade Now	Select an AP group and click this button to upgrade the firmware of the APs to the NXC's latest supported version.
#	This is the index number of the group in the list.
Group Name	This is the name of the group.
Member Count	This is the total number of APs which belong to this group.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

8.3.3.1 Add/Edit AP Group

Click **Add** or select an AP group and click the **Edit** button in the **Configuration > Wireless > AP Management > AP Group** table to display this screen.

Figure 73 Configuration > Wireless > AP Management > AP Group > Add/Edit



Each field is described in the following table.

Table 59 Configuration > Wireless > AP Management > AP Group > Add/Edit

LABEL	DESCRIPTION
General Settings	
Group Name	Enter a name for this group. You can use up to 31 alphanumeric characters. Dashes and underscores are also allowed. The name should start with a letter.
Description	Enter a description for this group. You can use up to 31 characters, spaces and underscores allowed.
Location	Specify the name of the place where the AP group is located.
Radio 1/2 Setting	
OP Mode	Select the operating mode for radio 1 or radio 2. **AP Mode** means the AP can receive connections from wireless clients and pass their data traffic through to the NXC to be managed (or subsequently passed on to an upstream gateway for managing). **MON Mode** means the AP monitors the broadcast area for other APs, then passes their information on to the NXC where it can be determined if those APs are friendly or rogue. If an AP is set to this mode it cannot receive connections from wireless clients. **Root AP** means the radio acts as an AP and also supports the wireless connections with other APs (in repeater mode) to form a ZyMesh to extend its wireless network. Note: You can select **Root AP** in an AP group only when the ZyMesh license is activated. **Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode). Note: To prevent bridge loops, do NOT set both radios on a managed AP to **Repeater AP** mode. Note: Ensure you restart the managed AP after you change its operating mode.
Radio 1/2 AP Profile	Select an AP profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 Profile	Select a monitor mode profile from the list. If no profile exists, you can create a new one through the **Create new Object** menu.
Radio 1/2 ZyMesh Profile	This field is available only when the radio is in **Root AP** or **Repeater AP** mode. Select the ZyMesh profile the radio uses to connect to a root AP or repeater.
Enable Wireless Bridging	This field is available only when the radio is in **Repeater AP** mode. Select this option to enable wireless bridging on the radio. The managed AP must support LAN provision and the radio should be in repeater mode. VLAN and bridge interfaces are created automatically according to the LAN port's VLAN settings. When wireless bridging is enabled, the managed repeater AP can still transmit data through its Ethernet port(s) after the ZyMesh link is up. Be careful to avoid bridge loops. The managed APs in the same ZyMesh must use the same static VLAN ID.
Max Output Power	Set the maximum output power of the AP. If there is a high density of APs in an area, decrease the output power of the managed AP to reduce interference with other APs. Note: Reducing the output power also reduces the NXC's effective broadcast radius.

Table 59 Configuration > Wireless > AP Management > AP Group > Add/Edit (continued)

LABEL	DESCRIPTION
Edit	Select an SSID and click this button to reassign it. The selected SSID becomes editable immediately upon clicking.
#	This is the index number of the SSID profile. You can associate up to eight SSID profiles with an AP group.
SSID Profile	Indicates which SSID profile is associated with this AP group.
VLAN Settings	
Force Overwrite VLAN Config	Select this to have the NXC change the management VLAN of the APs in this group to match the configuration in this screen.
Management VLAN ID	Enter a VLAN ID for the APs that belong to this AP group.
As Native VLAN	Select this option to treat this VLAN ID as a VLAN created on the NXC and not one assigned to it from outside the network.
Port Settings	
Model Specific Setting	Select the model of the managed AP to display the model-specific port and VLAN settings in the tables below.
Port Setting	
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Activate/Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the port's index number in this list.
Status	This displays whether or not the port is activated.
Port	This shows the name of the physical Ethernet port on the managed AP.
PVID	This shows the port's PVID. A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines.
VLAN Configuration	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate/Inactivate	To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**.
#	This is the VLAN's index number in this list.
Status	This displays whether or not the VLAN is activated.
Name	This shows the name of the VLAN.
VID	This shows the VLAN ID number.
Member	This field displays the Ethernet port(s) that is a member of this VLAN.
Load Balancing Setting	

Table 59 Configuration > Wireless > AP Management > AP Group > Add/Edit (continued)

LABEL	DESCRIPTION
Enable Load Balancing	Select this to enable load balancing on the NXC. Use this section to configure wireless network traffic load balancing between the managed APs in this group. Load balancing only works between APs in the same group. An overloaded AP will not kick out clients or delay connections if it does not detect another underloaded AP assigned to the same group (see Table 56 on page 126). Note: Load balancing is not supported on the radio which is working in root AP or repeater AP mode.
Mode	Select a mode by which load balancing is carried out. Select **By Station Number** to balance network traffic based on the number of specified stations connected to an AP. Select **By Traffic Level** to balance network traffic based on the volume generated by the stations connected to an AP. Select **By Smart Classroom** to balance network traffic based on the number of specified stations connected to an AP. The AP ignores association request and authentication request packets from any new station when the maximum number of stations is reached. If you select **By Station Number** or **By Traffic Level**, once the threshold is crossed (either the maximum station numbers or with network traffic), the AP delays association request and authentication request packets from any new station that attempts to make a connection. This allows the station to automatically attempt to connect to another, less burdened AP if one is available.
Radio1/2 Max Station Number	Enter the threshold number of stations connected to the radio slot at which an AP begins load balancing its connections.
Radio1/2 Traffic Level	Select the threshold traffic level of the radio slot at which the AP begins load balancing its connections (**Low**, **Medium**, **High**). The maximum bandwidth allowed for each level is: • **Low** - 11 Mbps, • **Medium** - 23 Mbps • **High** - 35 Mbps
Disassociate station when overloaded	This function is enabled by default and the disassociation priority is always **Signal Strength** when you set **Mode** to **By Smart Classroom**. Select this option to disassociate wireless clients connected to the AP when it becomes overloaded. If you do not enable this option, then the AP simply delays the connection until it can afford the bandwidth it requires, or it transfers the connection to another AP within its broadcast radius. The disassociation priority is determined automatically by the NXC and is as follows: • **Idle Timeout** - Devices that have been idle the longest will be disassociated first. If none of the connected devices are idle, then the priority shifts to **Signal Strength**. • **Signal Strength** - Devices with the weakest signal strength will be disassociated first. Note: If you enable this function, you should ensure that there are multiple APs within the broadcast radius that can accept any rejected or kicked wireless clients; otherwise, a wireless client attempting to connect to an overloaded AP will be kicked continuously and never be allowed to connect.
Rogue AP Detection Setting	
Enable Rogue AP Detection	Select this option to detect Rogue APs in the network.
Portal Redirect on AP	

Table 59 Configuration > Wireless > AP Management > AP Group > Add/Edit (continued)

LABEL	DESCRIPTION
Auth. Policy Group	Select a pre-defined authentication policy group to specify how captive portal interception is implemented. You can configure the authentication policy groups in the **Configuration > Captive Portal > Redirect on AP** screen. See Section 15.5 on page 221 for more information.
Skip authentication to provide contingency access while controller is unreachable.	Select this option to allow wireless clients connected to the AP to access the network without authentication through the NXC captive portal page when the connected AP controller (the NXC) is not reachable.
AP List	
Available	This lists the APs that do not belong to this group. Select the APs that you want to add to the group you are editing, and click the right arrow button to add them.
Member	This lists the APs that belong to this group. Select any APs that you want to remove from the group, and click the left arrow button to remove them.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.
Override Member AP Setting	Click this button to overwrite the settings of all managed APs in this group with the settings you configure here. All **Override Group** check boxes on the **AP Management** > **Edit AP List** screen for the APs in this group will be deselected.

8.3.4 Firmware

The NXC stores an AP firmware in order to manage supported APs. This screen allows the NXC to check for and download new AP firmware when it becomes available on the firmware server.

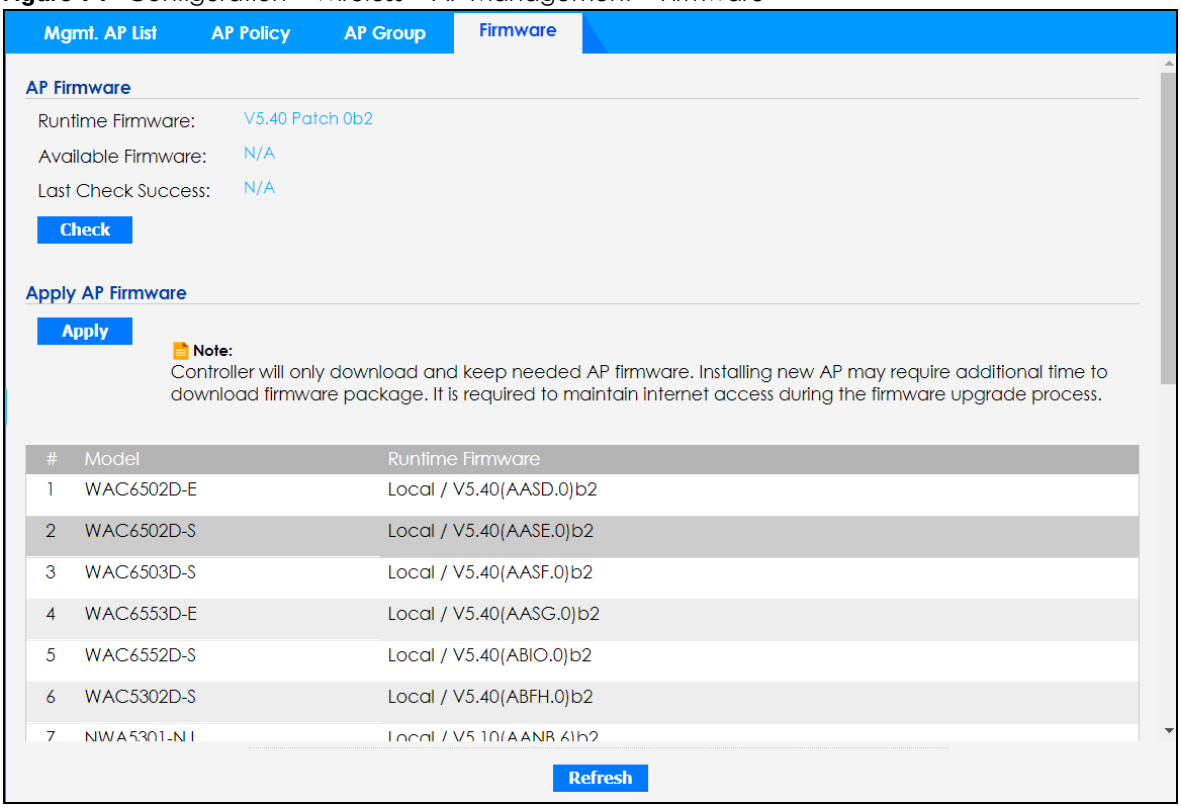
When an AP connects to the NXC wireless controller, the NXC will check if the AP has the same firmware version as the AP firmware on the NXC. If no and **Firmware Updating Mode** is set to **Auto** in the **AP Policy** screen, the NXC automatically updates the AP's firmware to the latest AP firmware version on the NXC. If **Firmware Updating Mode** is set to **Manual,** you need to select the AP and click **Upgrade Now** in the **Monitor > Wireless > AP Information > AP List** screen to update it manually.

The NXC should always have the latest AP firmware so that new APs can be managed successfully.

Use **Check** to see if the NXC has the latest AP firmware. Use **Apply** to have the NXC download the latest AP firmware from the firmware server. If the NXC does not have enough space for the latest AP firmware, then the NXC will delete an existing firmware that no AP is using before downloading the new AP firmware.

Click **Configuration > Wireless > AP Management > Firmware** to access this screen.

Figure 74 Configuration > Wireless > AP Management > Firmware



Each field is described in the following table.

Table 60 Configuration > Wireless > AP Management > Firmware

LABEL	DESCRIPTION
AP Firmware	
Runtime Firmware	This displays the latest AP firmware version currently on the NXC. The NXC must have the latest AP firmware to manage all supported APs.
Available Firmware	This field displays if there is a later AP firmware version available on the firmware server. It displays **N/A** if the NXC cannot connect with the firmware server. Check that the NXC has Internet access if **N/A** displays and then click the **Check** button below. If a newer NXC AP firmware is available, its version number displays here.
Last Check Success	This displays the date and time the last check for new firmware was made and whether the check is in progress (**Checking**), was successful (**Success**), or has failed (**Fail**).
Check	Click this button to have the NXC display the latest AP firmware version available on the firmware server.
Apply AP Firmware	Due to space limitations, the NXC only downloads and keeps AP firmware for APs that are already in the firmware list below. If you connect a new AP to the NXC, the NXC may need to download a new AP firmware. Please wait while downloading new firmware as the speed depends on your Internet connection speed. Make sure to maintain the Internet connection while downloading new firmware.
Apply	Click this to download newer **Available Firmware** from the firmware server and update the **Runtime Firmware** version.
#	This is an index number of a managed AP.
Model	This displays the name of all manageable AP models.

Table 60 Configuration > Wireless > AP Management > Firmware (continued)

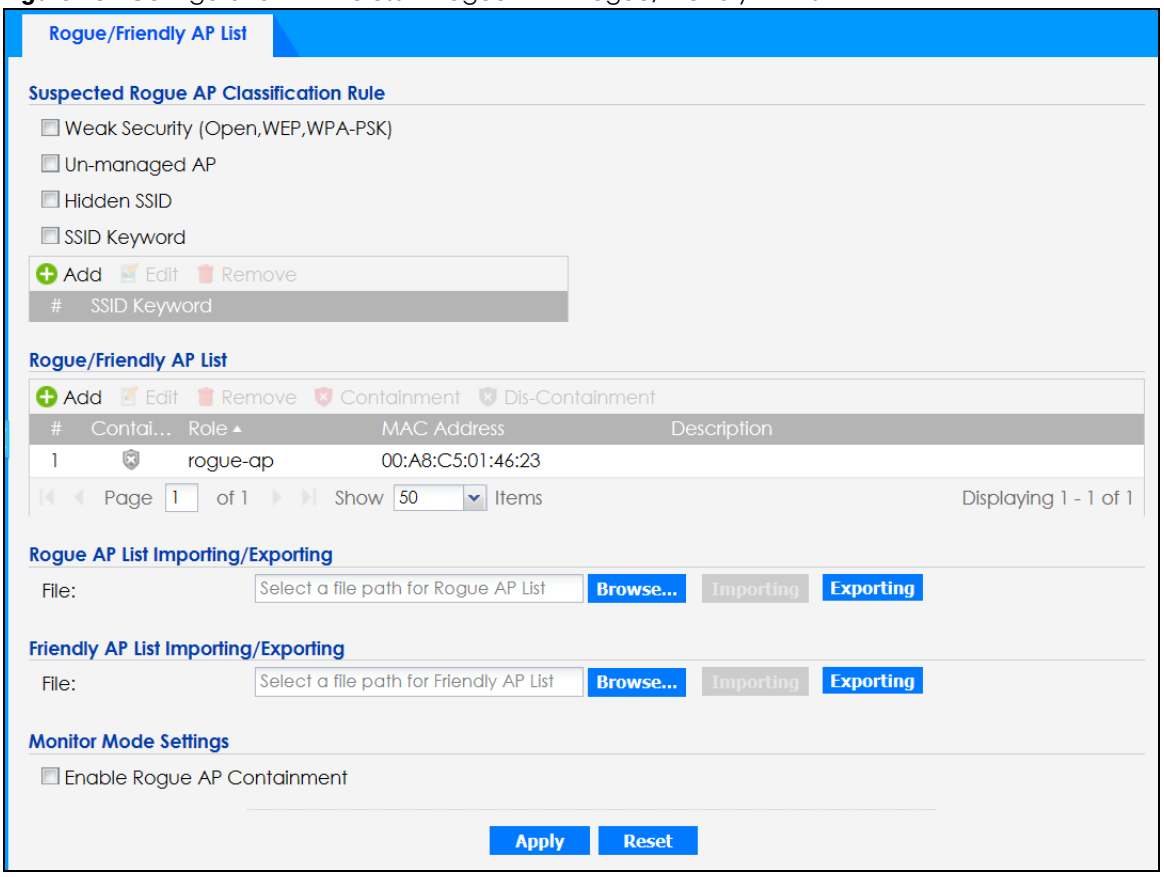
LABEL	DESCRIPTION
Runtime Firmware	This displays the firmware version of the managed AP the NXC currently has. Firmware for APs that the NXC already has displays in bold; firmware that the NXC doesn't have or is still downloading is grayed out. Firmware that is in the download queue will show **To be downloaded**.
Refresh	Click this to update the model firmware table.

8.4 Rogue AP

Use this screen to assign APs either to the rogue AP list or the friendly AP list. A rogue AP is a wireless access point operating in a network's coverage area that is not under the control of the network administrator, and which can potentially open up holes in a network's security.

Click **Configuration > Wireless > Rogue AP > Rogue/Friendly AP List** to access this screen.

Figure 75 Configuration > Wireless > Rogue AP > Rogue/Friendly AP List



Each field is described in the following table.

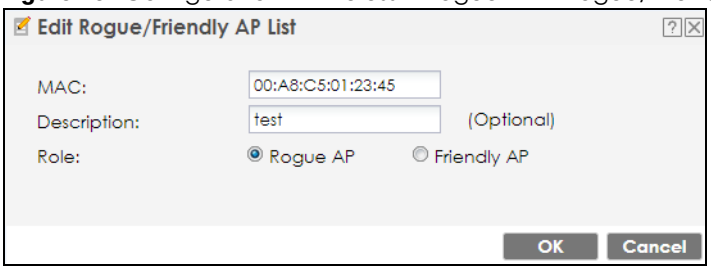
Table 61 Configuration > Wireless > Rogue AP > Rogue/Friendly AP List

LABEL	DESCRIPTION
Suspected Rogue AP Classification Rule	Click the check boxes (**Weak Security (Open, WEP, WPA-PSK), Un-managed AP, Hidden SSID, SSID Keyword**) of the characteristics an AP should have for the NXC to rule it as a Rogue AP.
Add	Click this to add an SSID Keyword. You can only enter ASCII characters in this field.
Edit	Select an SSID Keyword and click this button to modify it.
Remove	Select an existing SSID keyword and click this button to delete it.
#	This is the SSID Keyword's index number in this list.
SSID Keyword	This field displays the SSID Keyword added to the classification rule.
Rogue/Friendly AP List	
Add	Click this button to add an AP to the list and assign it either friendly or rogue status.
Edit	Select an AP in the list to edit and reassign its status.
Remove	Select an AP in the list to remove.
Containment	Click this button to quarantine the selected AP. This only takes effect if **Enable Rogue AP Containment** is selected. A quarantined AP cannot grant access to any network services. Any stations that attempt to connect to a quarantined AP are disconnected automatically.
Dis-Containment	Click this button to take the selected AP out of quarantine. An unquarantined AP has normal access to the network.
#	This field is a sequential value, and it is not associated with any interface.
Containment	This field indicates the selected AP's containment status.
Role	This field indicates whether the selected AP is a **rogue-ap** or a **friendly-ap**. To change the AP's role, click the **Edit** button.
MAC Address	This field indicates the AP's radio MAC address.
Description	This field displays the AP's description. You can modify this by clicking the **Edit** button.
Rogue/Friendly AP List Importing/Exporting	These controls allow you to export the current list of rogue and friendly APs or import existing lists.
File Path / Browse / Importing	Enter the file name and path of the list you want to import or click the **Browse** button to locate it. Once the **File Path** field has been populated, click **Importing** to bring the list into the NXC.
Exporting	Click this button to export the current list of either rogue APs or friendly APS.
Monitor Mode Settings	
Enable Rogue AP Containment	Click this to quarantine the selected rogue AP(s). A quarantined AP cannot grant access to any network services. Any stations that attempt to connect to a quarantined AP are disconnected automatically. Note: This feature only works when the AP is in monitor mode.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

8.4.1 Add/Edit Rogue/Friendly List

Click **Add** or select an AP and click the **Edit** button in the **Configuration > Wireless > Rogue AP > Rogue/Friendly AP List** table to display this screen.

Figure 76 Configuration > Wireless > Rogue AP > Rogue/Friendly AP List: Add/Edit Rogue/Friendly AP List



Each field is described in the following table.

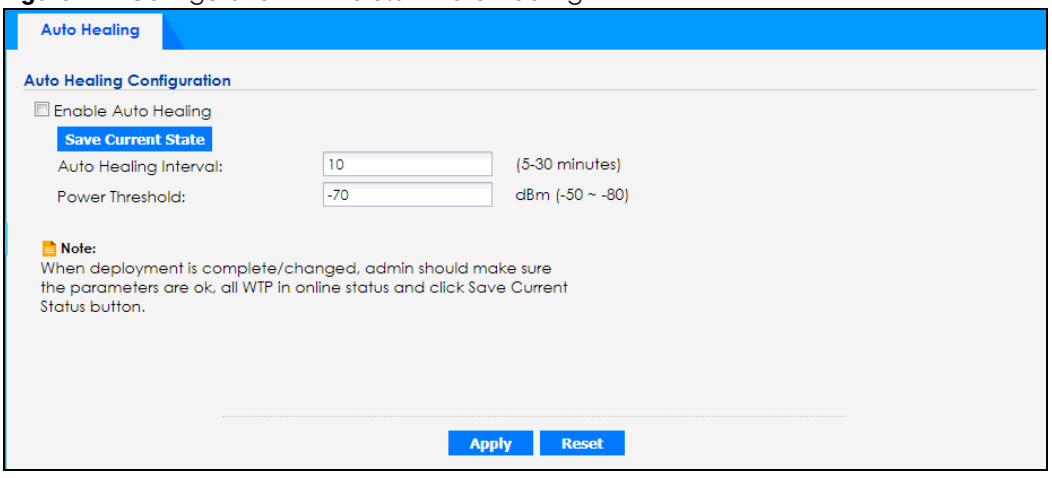
Table 62 Configuration > Wireless > Rogue AP > Rogue/Friendly AP List: Add/Edit Rogue/Friendly AP List

LABEL	DESCRIPTION
MAC	Enter the MAC address of the AP you want to add to the list. A MAC address is a unique hardware identifier in the following hexadecimal format: xx:xx:xx:xx:xx:xx where xx is a hexadecimal number separated by colons.
Description	Enter up to 60 characters for the AP's description. Spaces and underscores are allowed.
Role	Select either **Rogue AP** or **Friendly AP** for the AP's role.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to close the window with changes unsaved.

8.5 Auto Healing

Use this screen to enable auto healing, which allows you to extend the wireless service coverage area of the managed APs when one of the APs fails. Click **Configuration > Wireless > Auto Healing** to access this screen.

Figure 77 Configuration > Wireless > Auto Healing



Each field is described in the following table.

Table 63 Configuration > Wireless > Auto Healing

LABEL	DESCRIPTION
Enable Auto Healing	Select this option to turn on the auto healing feature.
Save Current State	Click this button to have all manged APs immediately scan their neighborhoods three times in a row and update their neighbor lists to the AP controller (NXC).
Auto Healing Interval	Set the time interval (in minutes) at which the managed APs scan their neighborhoods and report the status of neighbor APs to the AP controller (NXC). An AP is considered "failed" if the AP controller obtains the same scan result that the AP is missing from the neighbor list of other APs three times.
Power Threshold	Set the power level (in dBm) to which the neighbor APs of the failed AP increase their output power in order to extend their wireless service coverage areas. When the failed AP is working again, its neighbor APs return their output power to the original level.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

8.6 Technical Reference

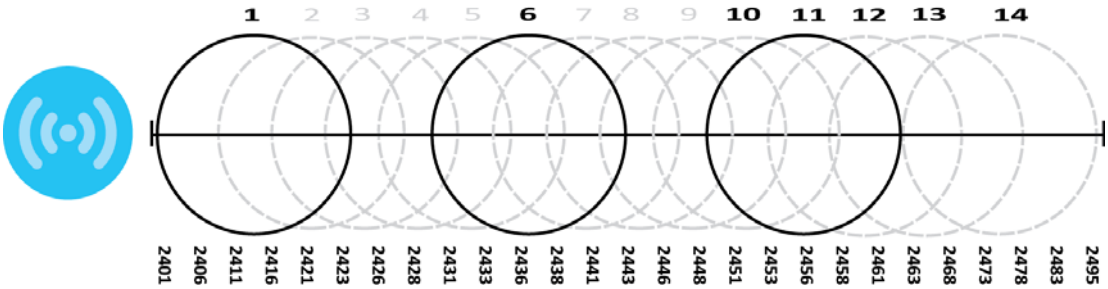
The following section contains additional technical information about the features described in this chapter.

8.6.1 Dynamic Channel Selection

When numerous APs broadcast within a given area, they introduce the possibility of heightened radio interference, especially if some or all of them are broadcasting on the same radio channel. If the interference becomes too great, then the network administrator must open his AP configuration options and manually change the channel to one that no other AP is using (or at least a channel that has a lower level of interference) in order to give the connected stations a minimum degree of interference. Dynamic channel selection frees the network administrator from this task by letting the AP do it automatically. The AP can scan the area around it looking for the channel with the least amount of interference.

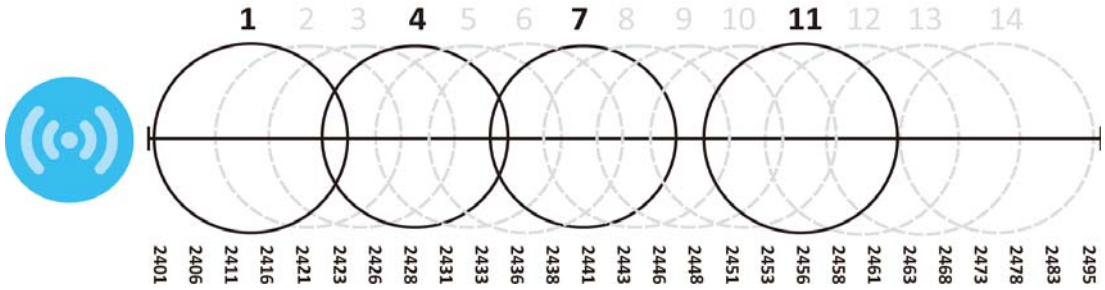
In the 2.4 GHz spectrum, each channel from 1 to 13 is broken up into discrete 22 MHz segments that are spaced 5 MHz apart. Channel 1 is centered on 2.412 GHz while channel 13 is centered on 2.472 GHz.

Figure 78 An Example Three-Channel Deployment



Three channels are situated in such a way as to create almost no interference with one another if used exclusively: 1, 6 and 11. When an AP broadcasts on any of these three channels, it should not interfere with neighboring APs as long as they are also limited to same trio.

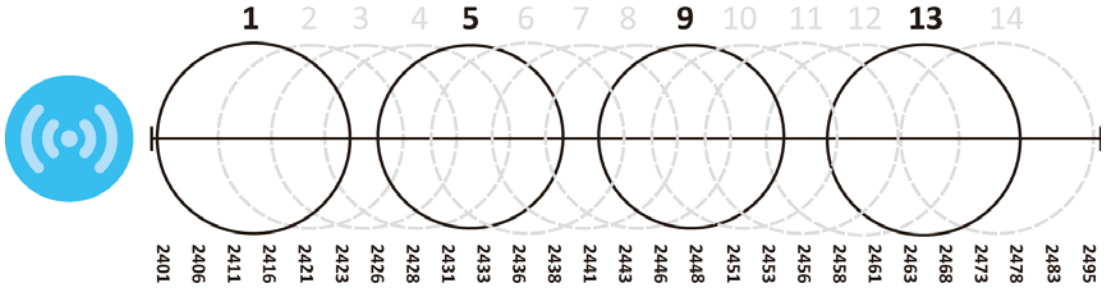
Figure 79 An Example Four-Channel Deployment



However, some regions require the use of other channels and often use a safety scheme with the following four channels: 1, 4, 7 and 11. While they are situated sufficiently close to both each other and the three so-called "safe" channels (1,6 and 11) that interference becomes inevitable, the severity of it is dependent upon other factors: proximity to the affected AP, signal strength, activity, and so on.

Finally, there is an alternative four channel scheme for ETSI, consisting of channels 1, 5, 9, 13. This offers significantly less overlap that the other one.

Figure 80 An Alternative Four-Channel Deployment



8.6.2 Load Balancing

Because there is a hard upper limit on an AP's wireless bandwidth, load balancing can be crucial in areas crowded with wireless users. Rather than let every user connect and subsequently dilute the available bandwidth to the point where each connecting device receives a meager trickle, the load balanced AP instead limits the incoming connections as a means to maintain bandwidth integrity.

There are three kinds of wireless load balancing available on the NXC:

Load balancing by station number limits the number of devices allowed to connect to your AP. If you know exactly how many stations you want to let connect, choose this option.

For example, if your company's graphic design team has their own AP and they have 10 computers, you can load balance for 10. Later, if someone from the sales department visits the graphic design team's offices for a meeting and he tries to access the network, his computer's connection is delayed, giving it the opportunity to connect to a different, neighboring AP. If he still connects to the AP regardless of the delay, then the AP may boot other people who are already connected in order to associate with the new connection.

Load balancing by smart classroom also limits the number of devices allowed to connect to your AP. But any new connections will be just rejected when the AP is overloaded.

Load balancing by traffic level limits the number of connections to the AP based on maximum bandwidth available. If you are uncertain as to the exact number of wireless connections you will have then choose this option. By setting a maximum bandwidth cap, you allow any number of devices to connect as long as their total bandwidth usage does not exceed the configured bandwidth cap associated with this setting. Once the cap is hit, any new connections are rejected or delayed provided that there are other APs in range.

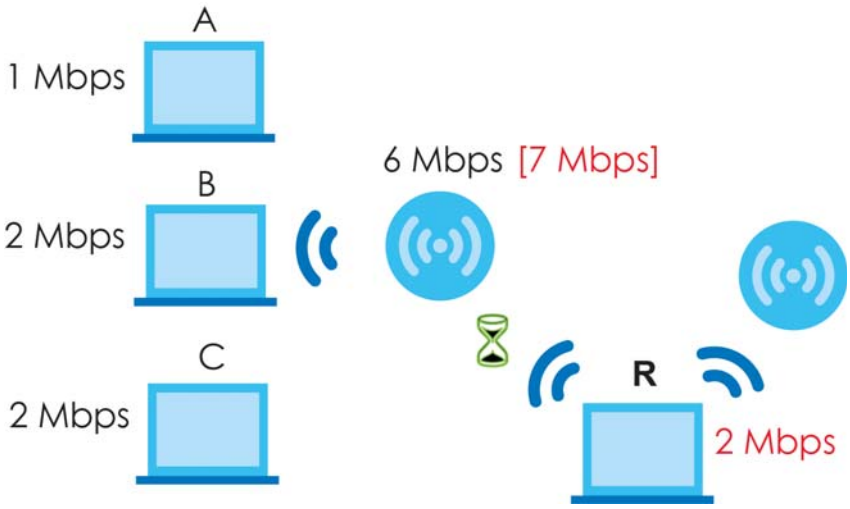
Imagine a coffee shop in a crowded business district that offers free wireless connectivity to its customers. The coffee shop owner can't possibly know how many connections his AP will have at any given moment. As such, he decides to put a limit on the bandwidth that is available to his customers but not on the actual number of connections he allows. This means anyone can connect to his wireless network as long as the AP has the bandwidth to spare. If too many people connect and the AP hits its bandwidth cap then all new connections must basically wait for their turn or get shunted to the nearest identical AP.

8.6.3 Disassociating and Delaying Connections

When your AP becomes overloaded, there are two basic responses it can take. The first one is to "delay" a client connection. This means that the AP withholds the connection until the data transfer throughput is lowered or the client connection is picked up by another AP. If the client is picked up by another AP then the original AP cannot resume the connection.

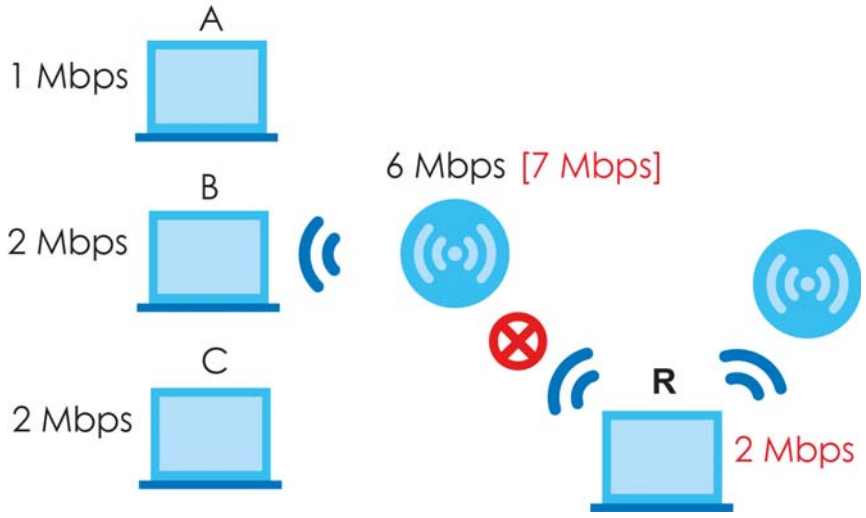
For example, here the AP has a balanced bandwidth allotment of 6 Mbps. If laptop **R** connects and it pushes the AP over its allotment, say to 7 Mbps, then the AP delays the red laptop's connection until it can afford the bandwidth or the laptop is picked up by a different AP with bandwidth to spare.

Figure 81 Delaying a Connection



The second response your AP can take is to kick the connections that are pushing it over its balanced bandwidth allotment.

Figure 82 Kicking a Connection



Connections are kicked based on either **idle timeout** or **signal strength**. The NXC first looks to see which devices have been idle the longest, then starts kicking them in order of highest idle time. If no connections are idle, the next criteria the NXC analyzes is signal strength. Devices with the weakest signal strength are kicked first.

CHAPTER 9
Interfaces

9.1 Interface Overview

Use these screens to configure the NXC's interfaces.

- **Ports** are the physical ports to which you connect cables.
- **Interfaces** are used within the system operationally. You use them in configuring various features. An interface also describes a network that is directly connected to the NXC. For example, You connect the LAN network to the interface.
- **Zones** are groups of interfaces used to ease security policy configuration.

9.1.1 What You Can Do in this Chapter

- The **Ethernet** screens (Section 9.2 on page 148) configure the Ethernet interfaces. Ethernet interfaces are the foundation for defining other interfaces and network policies.
- The **VLAN** screens (Section 9.3 on page 159) divide the physical network into multiple logical networks. VLAN interfaces receive and send tagged frames. The NXC automatically adds or removes the tags as needed.
- The **LAG** screens (Section 9.4 on page 167) combine multiple physical Ethernet interfaces into a single logical interface.

9.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Interface Characteristics

Interfaces generally have the following characteristics (although not all characteristics apply to each type of interface).

- An interface is a logical entity through which (layer-3) packets pass.
- An interface is bound to a physical port or another interface.
- Many interfaces can share the same physical port.
- An interface belongs to at most one zone.
- Many interfaces can belong to the same zone.

Types of Interfaces

You can create several types of interfaces in the NXC.

- **Ethernet interfaces** are the foundation for defining other interfaces and network policies.

- **VLAN interfaces** receive and send tagged frames. The NXC automatically adds or removes the tags as needed.

9.2 Ethernet Summary

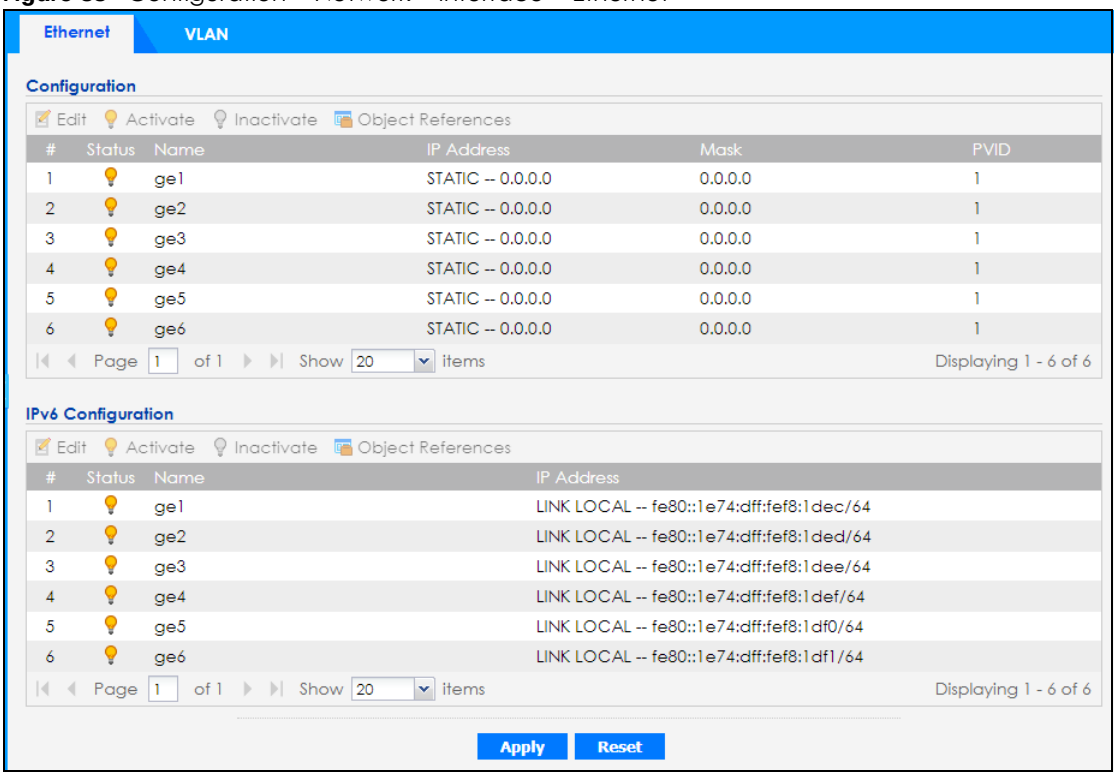
This screen lists every Ethernet interface. If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also configure VLAN interfaces used for your IPv6 networks on this screen. To access this screen, click **Configuration > Network** > **Interface**.

Unlike other types of interfaces, you cannot create new Ethernet interfaces nor can you delete any of them. If an Ethernet interface does not have any physical ports assigned to it, it is effectively removed from the NXC even though you can still configure it.

Ethernet interfaces are similar to other types of interfaces in many ways. They have an IP address, subnet mask, and gateway used to make routing decisions. They restrict the amount of bandwidth and packet size. They can provide DHCP services, and they can verify the gateway is available.

Use Ethernet interfaces to control which physical ports exchange routing information with other routers and how much information is exchanged through each one. The more routing information is exchanged, the more efficient the routers should be. However, the routers also generate more network traffic, and some routing protocols require a significant amount of configuration and management.

Figure 83 Configuration > Network > Interface > Ethernet



Each field is described in the following table.

Table 64 Configuration > Network > Interface > Ethernet

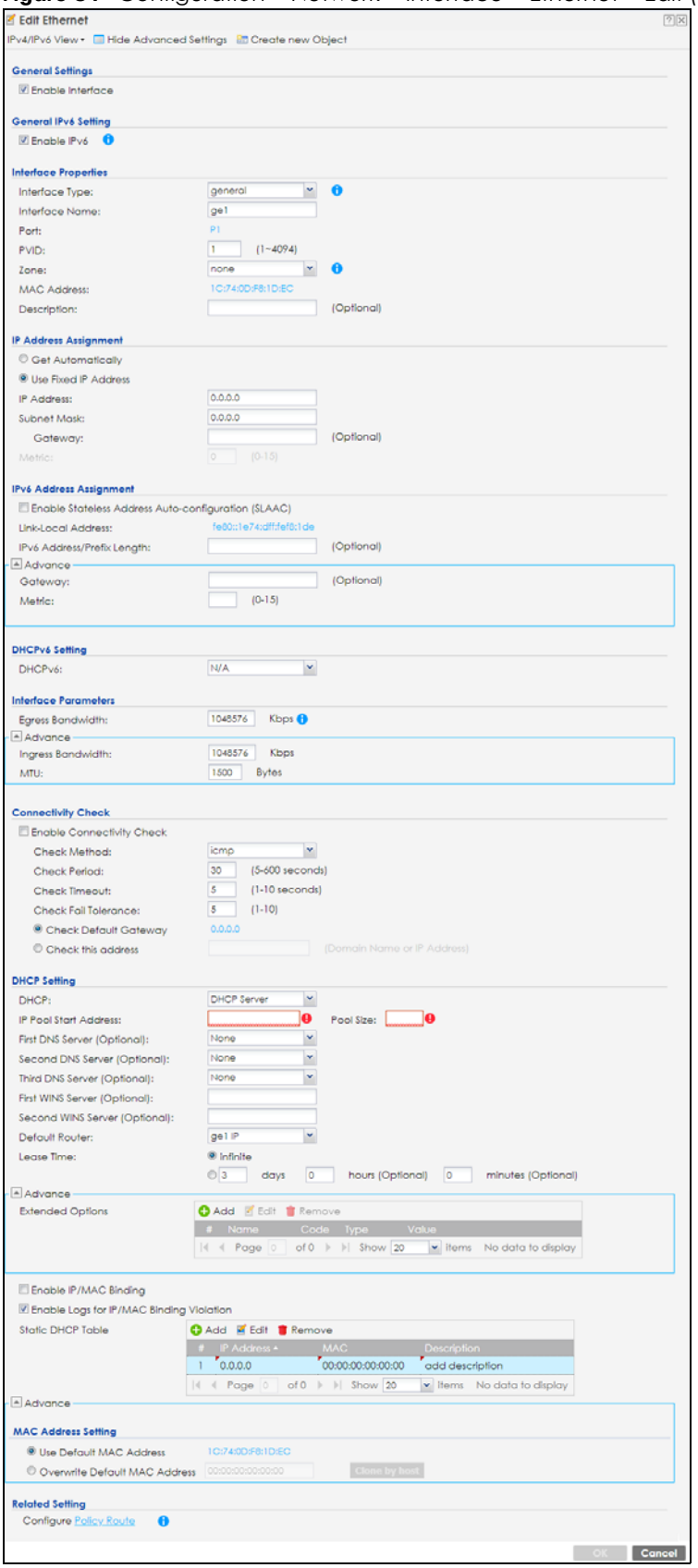
LABEL	DESCRIPTION
Configuration/IPv6 Configuration	Use the **Configuration** section for IPv4 network settings. Use the **IPv6 Configuration** section for IPv6 network settings if you connect your NXC to an IPv6 network. Both sections have similar fields as described below.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Activate	To turn on an interface, select it and click **Activate**.
Inactivate	To turn off an interface, select it and click **Inactivate**.
Object Reference	Select an entry and click **Object Reference** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with any interface.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Name	This field displays the name of the interface.
IP Address	This field displays the current IP address of the interface. If the IP address is 0.0.0.0 (in the IPv4 network) or :: (in the IPv6 network), the interface does not have an IP address yet. In the IPv4 network, this screen also shows whether the IP address is a static IP address (**STATIC**) or dynamically assigned (**DHCP**). In the IPv6 network, this screen also shows whether the IP address is a static IP address (**STATIC**), link-local IP address (**LINK LOCAL**), dynamically assigned (**DHCP**), or an IPv6 StateLess Address AutoConfiguration IP address (**SLAAC**). See Appendix E on page 502 for more information about IPv6.
Mask	This field displays the interface's subnet mask in dot decimal notation.
PVID	This field indicates the interface's PVID.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

9.2.1 Edit Ethernet

This screen lets you configure IP address assignment and interface parameters. To access this screen, select an interface and click its **Edit** icon in the **Ethernet** screen.

Note: If you create IP address objects based on an interface's IP address, subnet, or gateway, the NXC automatically updates every rule or setting that uses the object whenever the interface's IP address settings change. For example, if you change LAN's IP address, the NXC automatically updates the corresponding interface-based, LAN subnet address object.

Figure 84 Configuration > Network > Interface > Ethernet > Edit (general)



This screen's fields are described in the table below.

Table 65 Configuration > Network > Interface > Ethernet > Edit

LABEL	DESCRIPTION
IPv4/IPv6 View / IPv4 View / IPv6 View	Use this button to display both IPv4 and IPv6, IPv4-only, or IPv6-only configuration fields.
Show / Hide Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Create New Object	Click this button to create a DHCPv6 request object that you may use for the DHCPv6 settings in this screen.
General Settings	
Enable Interface	Select this to enable this interface. Clear this to disable this interface.
General IPv6 Setting	
Enable IPv6	Select this to enable IPv6 on this interface. Clear this to disable it.
Interface Properties	
Interface Type	Select to which type of network you will connect this interface. When you select **internal** or **external** the rest of the screen's options automatically adjust to correspond. The NXC automatically adds default route and SNAT settings for traffic it routes from internal interfaces to external interfaces; for example LAN to WAN traffic. Select **internal** to connect to a local network. Other corresponding configuration options: DHCP server and DHCP relay. The NXC automatically adds default SNAT settings for traffic flowing from this interface to an external interface. Select **external** to connect to an external network (like the Internet). If you select **general**, the rest of the screen's options do not automatically adjust and you must manually configure a policy route to add routing and SNAT settings for the interface.
Interface Name	Specify a name for the interface. It can use alphanumeric characters, hyphens, and underscores, and it can be up to 11 characters long.
Port	This indicates the port that you are currently editing.
PVID	A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines. Enter the PVID for this port (1~4094).
Zone	Select a zone with which to associate this port.
MAC Address	This field is read-only. This is the MAC address that the Ethernet interface uses.
Description	Enter a description of this interface. It is not used elsewhere. You can use alphanumeric and `()+/:=?!*#@$_%-` characters, and it can be up to 60 characters long.
IP Address Assignment	These IP address fields configure an IP address on the interface itself. If you change this IP address on the interface, you may also need to change a related address object for the network connected to the interface. For example, if you use this screen to change the IP address of your LAN interface, you should also change the corresponding LAN subnet address object.
Get Automatically	This option appears when you set the **Interface Type** to **external** or **general**. Select this to make the interface a DHCP client and automatically get the IP address, subnet mask, and gateway address from a DHCP server.
Use Fixed IP Address	This option appears when you set the **Interface Type** to **external** or **general**. Select this if you want to specify the IP address, subnet mask, and gateway manually.
IP Address	This field is enabled if you set the **Interface Type** to **internal** or you select **Use Fixed IP Address**. Enter the IP address for this interface.

Table 65 Configuration > Network > Interface > Ethernet > Edit (continued)

LABEL	DESCRIPTION
Subnet Mask	This field is enabled if you set the **Interface Type** to **internal** or you select **Use Fixed IP Address**. Enter the subnet mask of this interface in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all computers in the network.
Gateway	This field is enabled if you select **Use Fixed IP Address**. Enter the IP address of the gateway. The NXC sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the interface.
Metric	This field is enabled if you set the **Interface Type** to **external** or **general** and select **Get Automatically**. Enter the priority of the gateway (if any) on this interface. The NXC decides which gateway to use based on this priority. The lower the number, the higher the priority. If two or more gateways have the same priority, the NXC uses the one that was configured first.
IPv6 Address Assignment	These IP address fields configure an IPv6 address on the interface itself.
Enable Stateless Address Auto-configuration (SLAAC)	Select this to enable IPv6 stateless auto-configuration on this interface. The interface will generate an IPv6 address itself from a prefix obtained from an IPv6 router in the network.
Link-Local Address	This displays the IPv6 link-local address and the network prefix that the NXC generates itself for the interface.
IPv6 Address/ Prefix Length	Enter the IPv6 address and the prefix length for this interface if you want to use a static IP address. This field is optional. The prefix length indicates what the left-most part of the IP address is the same for all computers in the network, that is, the network address.
Gateway	Enter the IPv6 address of the default outgoing gateway using colon (:) hexadecimal notation.
Metric	Enter the priority of the gateway (if any) on this interface. The NXC decides which gateway to use based on this priority. The lower the number, the higher the priority. If two or more gateways have the same priority, the NXC uses the one that was configured first.
DHCPv6 Setting	
DHCPv6	Select **N/A** to not use DHCPv6. Select **Client** to set this interface to act as a DHCPv6 client.
DUID	This field displays the DHCP Unique IDentifier (DUID) of the interface, which is unique and used for identification purposes when the interface is exchanging DHCPv6 messages with others. See Appendix E on page 502 for more information.
DUID as MAC	Select this if you want the DUID to be generated from the interface's default MAC address.
Customized DUID	If you want to use a customized DUID, enter it here for the interface.
Enable Rapid Commit	Select this to shorten the DHCPv6 message exchange process from four to two steps. This function helps reduce heavy network traffic load. Note: Make sure you also enable this option in the DHCPv6 server to make rapid commit work.
Request Address	Select this to get an IPv6 address for this interface from the DHCP server. Clear this to not get any IP address information through DHCPv6.
DHCPv6 Request Options	If this interface is a DHCPv6 client, use this section to configure DHCPv6 request settings that determine what additional information to get from the DHCPv6 server.
Add	Click this to create an entry in this table. See Section 9.2.3 on page 156 for more information.

Table 65 Configuration > Network > Interface > Ethernet > Edit (continued)

LABEL	DESCRIPTION
Remove	Select an entry and click this to delete it from this table.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry. See Section 9.2.2 on page 156 for an example.
#	This field is a sequential value, and it is not associated with any entry.
Name	This field displays the name of the DHCPv6 request object.
Type	This field displays the type of the object.
Value	This field displays the IPv6 address that the NXC obtained from an uplink router.
Interface Parameters	
Egress Bandwidth	Enter the maximum amount of traffic, in kilobits per second, the NXC can send through the interface to the network. Allowed values are 0 - 1048576.
Ingress Bandwidth	This is reserved for future use. Enter the maximum amount of traffic, in kilobits per second, the NXC can receive from the network through the interface. Allowed values are 0 - 1048576.
MTU	Maximum Transmission Unit. Type the maximum size of each data packet, in bytes, that can move through this interface. If a larger packet arrives, the NXC divides it into smaller fragments. Allowed values are 1280 - 1500. Usually, this value is 1500.
Connectivity Check	These fields appear when you set the **Interface Type** to **External** or **General**. The interface can regularly check the connection to the gateway you specified to make sure it is still available. You specify how often the interface checks the connection, how long to wait for a response before the attempt is a failure, and how many consecutive failures are required before the NXC stops routing to the gateway. The NXC resumes routing to the gateway the first time the gateway passes the connectivity check.
Enable Connectivity Check	Select this to turn on the connection check.
Check Method	Select the method that the gateway allows. Select **icmp** to have the NXC regularly ping the gateway you specify to make sure it is still available. Select **tcp** to have the NXC regularly perform a TCP handshake with the gateway you specify to make sure it is still available.
Check Period	Enter the number of seconds between connection check attempts.
Check Timeout	Enter the number of seconds to wait for a response before the attempt is a failure.
Check Fail Tolerance	Enter the number of consecutive failures before the NXC stops routing through the gateway.
Check Default Gateway	Select this to use the default gateway for the connectivity check.
Check this address	Select this to specify a domain name or IP address for the connectivity check. Enter that domain name or IP address in the field next to it.
Check Port	This field only displays when you set the **Check Method** to **tcp**. Specify the port number to use for a TCP connectivity check.
DHCP Setting	These fields appear when you set the **Interface Type** to **Internal** or **General**.

Table 65 Configuration > Network > Interface > Ethernet > Edit (continued)

LABEL	DESCRIPTION
DHCP	Select what type of DHCP service the NXC provides to the network. Choices are: **None** - the NXC does not provide any DHCP services. There is already a DHCP server on the network. **DHCP Relay** - the NXC routes DHCP requests to one or more DHCP servers you specify. The DHCP server(s) may be on another network. **DHCP Server** - the NXC assigns IP addresses and provides subnet mask, gateway, and DNS server information to the network. The NXC is the DHCP server for the network.
	These fields appear if the NXC is a **DHCP Relay**.
Relay Server 1	Enter the IP address of a DHCP server for the network.
Relay Server 2	This field is optional. Enter the IP address of another DHCP server for the network.
	These fields appear if the NXC is a **DHCP Server**.
IP Pool Start Address	Enter the IP address from which the NXC begins allocating IP addresses. If you want to assign a static IP address to a specific computer, use the **Static DHCP Table**. If this field is blank, the **Pool Size** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
Pool Size	Enter the number of IP addresses to allocate. This number must be at least one and is limited by the interface's **Subnet Mask**. For example, if the **Subnet Mask** is 255.255.255.0 and **IP Pool Start Address** is 10.10.10.10, the NXC can allocate 10.10.10.10 to 10.10.10.254, or 245 IP addresses. If this field is blank, the **IP Pool Start Address** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
First DNS Server, Second DNS Server, Third DNS Server	Specify the IP addresses up to three DNS servers for the DHCP clients to use. Use one of the following ways to specify these IP addresses. **Custom Defined** - enter a static IP address. **From ISP** - select the DNS server that another interface received from its DHCP server. **EnterpriseWLAN** - the DHCP clients use the IP address of this interface and the NXC works as a DNS relay.
First WINS Server, Second WINS Server	Type the IP address of the WINS (Windows Internet Naming Service) server that you want to send to the DHCP clients. The WINS server keeps a mapping table of the computer names on your network and the IP addresses that they are currently using.
Default Router	If you set this interface to **DHCP Server**, you can either select **gex IP** (where x is the interface number) to use the interface's IP address or use another IP address as the default router. This default router will become the DHCP clients' default gateway. To use another IP address as the default router, select **Custom Defined** and enter the IP address.
Lease time	Specify how long each computer can use the information (especially the IP address) before it has to request the information again. Choices are: **infinite** - select this if IP addresses never expire. **days**, **hours**, and **minutes** - select this to enter how long IP addresses are valid.
Extended Options	This table is available if you selected **DHCP server**. Configure this table if you want to send more information to DHCP clients through DHCP packets.
Add	Click this to create an entry in this table. See Section 9.2.4 on page 157.

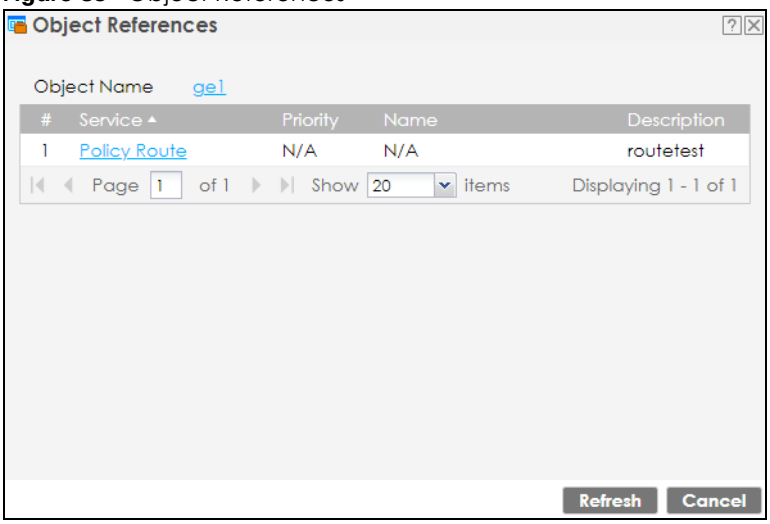
Table 65 Configuration > Network > Interface > Ethernet > Edit (continued)

LABEL	DESCRIPTION
Edit	Select an entry in this table and click this to modify it.
Remove	Select an entry in this table and click this to delete it.
#	This field is a sequential value, and it is not associated with any entry.
Name	This is the name of the DHCP option.
Code	This is the code number of the DHCP option.
Type	This is the type of the set value for the DHCP option.
Value	This is the value set for the DHCP option.
Enable IP/MAC Binding	Select this option to have this interface enforce links between specific IP addresses and specific MAC addresses. This stops anyone else from manually using a bound IP address on another device connected to this interface. Use this to make use only the intended users get to use specific IP addresses.
Enable Logs for IP/MAC Binding Violation	Select this option to have the NXC generate a log if a device connected to this interface attempts to use an IP address that is bound to another device's MAC address.
Static DHCP Table	Configure a list of static IP addresses the NXC assigns to computers connected to the interface. Otherwise, the NXC assigns an IP address dynamically using the interface's **IP Pool Start Address** and **Pool Size**.
Add	Click this to create a new entry.
Edit	Select an entry and click this to be able to modify it.
Remove	Select an entry and click this to delete it.
#	This field is a sequential value, and it is not associated with a specific entry.
IP Address	Enter the IP address to assign to a device with this entry's MAC address.
MAC	Enter the MAC address to which to assign this entry's IP address.
Description	Enter a description to help identify this static DHCP entry. You can use alphanumeric and `()+/:=?!*#@$_%-` characters, and it can be up to 60 characters long.
MAC Address Setting	These fields appear when you set the **Interface Type** to **External** or **General**. Have the interface use either the factory assigned default MAC address, a manually specified MAC address, or clone the MAC address of another device or computer.
Use Default MAC Address	Select this option to have the interface use the factory assigned default MAC address. By default, the NXC uses the factory assigned MAC address to identify itself.
Overwrite Default MAC Address	Select this option to have the interface use a different MAC address. Either enter the MAC address in the fields or click **Clone by host** and enter the IP address of the device or computer whose MAC you are cloning. Once it is successfully configured, the address will be copied to the configuration file. It will not change unless you change the setting or upload a different configuration file.
Related Setting	
Configure Policy Route	Click **Policy Route** to go to the policy route summary screen where you can manually associate traffic with this interface. You must manually configure a policy route to add routing and SNAT settings for an interface with the **Interface Type** set to **General**. You can also configure a policy route to override the default routing and SNAT behavior for an interface with the **Interface Type** set to **Internal** or **External**.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

9.2.2 Object References

When a configuration screen includes an **Object References** icon, select a configuration object and click **Object References** to open the **Object References** screen. This screen displays which configuration settings reference the selected object. The fields shown vary with the type of object.

Figure 85 Object References



The following table describes labels that can appear in this screen.

Table 66 Object References

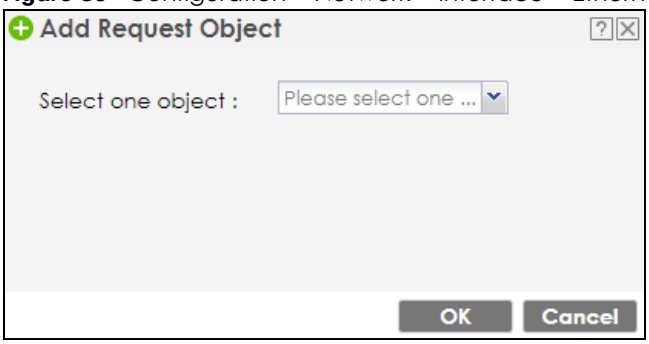
LABEL	DESCRIPTION
Object Name	This identifies the object for which the configuration settings that use it are displayed. Click the object's name to display the object's configuration screen in the main window.
#	This field is a sequential value, and it is not associated with any entry.
Service	This is the type of setting that references the selected object. Click a service's name to display the service's configuration screen in the main window.
Priority	If it is applicable, this field lists the referencing configuration item's position in its list, otherwise **N/A** displays.
Name	This field identifies the configuration item that references the object.
Description	If the referencing configuration item has a description configured, it displays here.
Refresh	Click this to update the information in this screen.
Cancel	Click **Cancel** to close the screen.

9.2.3 Add DHCPv6 Request Options

When you configure an interface as a DHCPv6 client, you can additionally add DHCPv6 request options which have the NXC to add more information in the DHCPv6 packets. To open the screen, click **Configuration > Network > Interface > Ethernet > Edit**, set **DHCPv6** to **Client** in the **DHCPv6 Setting** section, and then click **Add** in the **DHCPv6 Request Options** table.

Select a DHCPv6 request object in the **Select one object** field and click **OK** to save it. Click **Cancel** to exit without saving the setting.

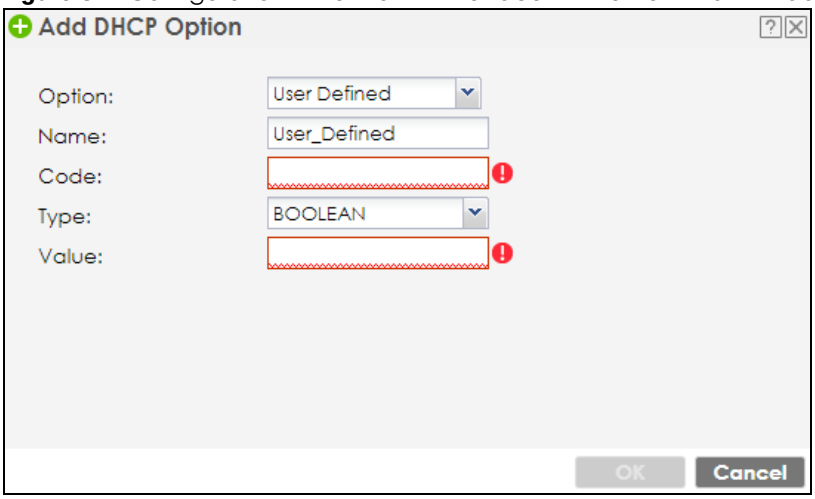
Figure 86 Configuration > Network > Interface > Ethernet > Edit > Add DHCPv6 Request Options



9.2.4 Add/Edit DHCP Extended Options

When you configure an interface as a DHCPv4 server, you can additionally add DHCP extended options which have the NXC to add more information in the DHCP packets. The available fields vary depending on the DHCP option you select in this screen. To open the screen, click **Configuration > Network > Interface > Ethernet > Edit**, select **DHCP Server** in the **DHCP Setting** section, and then click **Add** or **Edit** in the **Extended Options** table.

Figure 87 Configuration > Network > Interface > Ethernet > Edit > Add/Edit Extended Options



The following table describes labels that can appear in this screen.

Table 67 Configuration > Network > Interface > Ethernet > Edit > Add/Edit Extended Options

LABEL	DESCRIPTION
Option	Select which DHCP option that you want to add in the DHCP packets sent through the interface. See Table 68 on page 158 for more information.
Name	This field displays the name of the selected DHCP option. If you selected **User Defined** in the **Option** field, enter a descriptive name to identify the DHCP option. You can enter up to 16 characters ("a-z", "A-Z, "0-9", "-", and "_") with no spaces allowed. The first character must be alphabetical (a-z, A-Z).
Code	This field displays the code number of the selected DHCP option. If you selected **User Defined** in the **Option** field, enter a number for the option. This field is mandatory.
Type	This is the type of the selected DHCP option. If you selected **User Defined** in the **Option** field, select an appropriate type for the value that you will enter in the next field. Only advanced users should configure **User Defined**. Misconfiguration could result in interface lockout.

Table 67 Configuration > Network > Interface > Ethernet > Edit > Add/Edit Extended Options

LABEL	DESCRIPTION
Value	Enter the value for the selected DHCP option. For example, if you selected **TFTP Server Name (66)** and the type is **TEXT**, enter the DNS domain name of a TFTP server here. This field is mandatory.
First IP Address, Second IP Address, Third IP Address	If you selected **Time Server (4)**, **NTP Server (42)**, **SIP Server (120)**, **CAPWAP AC (138)**, or **TFTP Server (150)**, you have to enter at least one IP address of the corresponding servers in these fields. The servers should be listed in order of your preference.
First Enterprise ID, Second Enterprise ID	If you selected **VIVC (124)** or **VIVS (125)**, you have to enter at least one vendor's 32-bit enterprise number in these fields. An enterprise number is a unique number that identifies a company.
First Class, Second Class	If you selected **VIVC (124)**, enter the details of the hardware configuration of the host on which the client is running, or of industry consortium compliance.
First Information, Second Information	If you selected **VIVS (125)**, enter additional information for the corresponding enterprise number in these fields.
OK	Click this to close this screen and update the settings to the previous Edit screen.
Cancel	Click **Cancel** to close the screen.

The following table lists the available DHCP extended options (defined in RFCs) on the NXC. See RFCs for more information.

Table 68 DHCP Extended Options

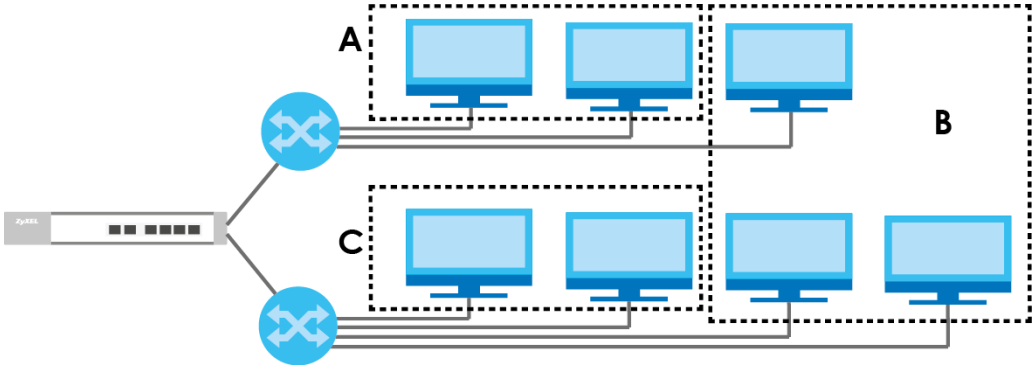
OPTION NAME	CODE	DESCRIPTION
Time Offset	2	This option specifies the offset of the client's subnet in seconds from Coordinated Universal Time (UTC).
Time Server	4	This option specifies a list of Time servers available to the client.
NTP Server	42	This option specifies a list of the NTP servers available to the client by IP address.
TFTP Server Name	66	This option is used to identify a TFTP server when the "sname" field in the DHCP header has been used for DHCP options. The minimum length of the value is 1.
Bootfile	67	This option is used to identify a bootfile when the "file" field in the DHCP header has been used for DHCP options. The minimum length of the value is 1.
SIP Server	120	This option carries either an IPv4 address or a DNS domain name to be used by the SIP client to locate a SIP server.
VIVC	124	Vendor-Identifying Vendor Class option A DHCP client may use this option to unambiguously identify the vendor that manufactured the hardware on which the client is running, the software in use, or an industry consortium to which the vendor belongs.
VIVS	125	Vendor-Identifying Vendor-Specific option DHCP clients and servers may use this option to exchange vendor-specific information.
CAPWAP AC	138	CAPWAP Access Controller addresses option The Control And Provisioning of Wireless Access Points Protocol allows a Wireless Termination Point (WTP) to use DHCP to discover the Access Controllers to which it is to connect. This option carries a list of IPv4 addresses indicating one or more CAPWAP ACs available to the WTP.
TFTP Server	150	The option contains one or more IPv4 addresses that the client may use. The current use of this option is for downloading configuration from a VoIP server via TFTP; however, the option may be used for purposes other than contacting a VoIP configuration server.

9.3 VLAN Interfaces

A Virtual Local Area Network (VLAN) divides a physical network into multiple logical networks. The standard is defined in IEEE 802.1q.

Note: By default, the NXC acts a bridge device. This means all interfaces (ge1~g6) are grouped together into a single VID, vlan0. Also note that vlan0 cannot be removed and the VID cannot be changed.

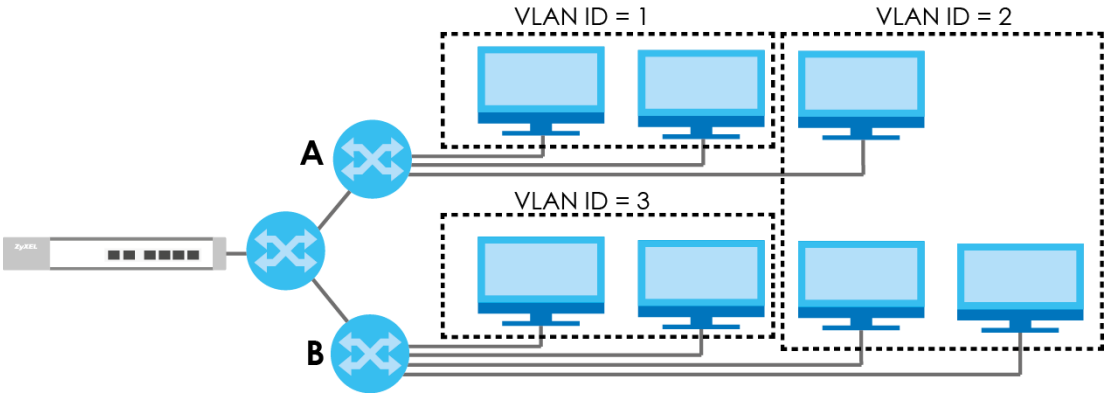
Figure 88 Example: Before VLAN



In this example, there are two physical networks and three departments **A**, **B**, and **C**. The physical networks are connected to hubs, and the hubs are connected to the router.

Alternatively, you can divide the physical networks into three VLANs.

Figure 89 Example: After VLAN



Each VLAN is a separate network with separate IP addresses, subnet masks, and gateways. Each VLAN also has a unique identification number (ID). The ID is a 12-bit value that is stored in the MAC header. The VLANs are connected to switches, and the switches are connected to the router. (If one switch has enough connections for the entire network, the network does not need switches **A** and **B**.)

- Traffic inside each VLAN is layer-2 communication (data link layer, MAC addresses). It is handled by the switches. As a result, the new switch is required to handle traffic inside VLAN 2. Traffic is only broadcast inside each VLAN, not each physical network.
- Traffic between VLANs (or between a VLAN and another type of network) is layer-3 communication (network layer, IP addresses). It is handled by the router.

This approach provides a few advantages.

- Increased performance - In VLAN 2, the extra switch should route traffic inside the sales department faster than the router does. In addition, broadcasts are limited to smaller, more logical groups of users.
- Higher security - If each computer has a separate physical connection to the switch, then broadcast traffic in each VLAN is never sent to computers in another VLAN.
- Better manageability - You can align network policies more appropriately for users. For example, you can create different policy route rules for each VLAN (each department in the example above), and you can set different bandwidth limits for each VLAN. These rules are also independent of the physical network, so you can change the physical network without changing policies.

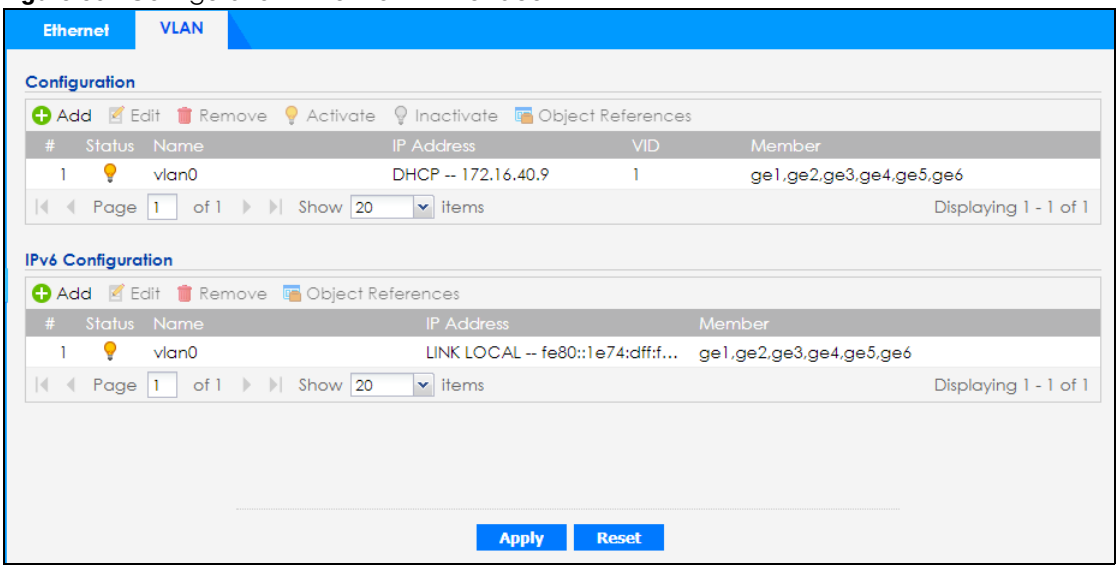
In this example, the new switch handles the following types of traffic:

- Inside VLAN 2.
- Between the router and VLAN 1.
- Between the router and VLAN 2.
- Between the router and VLAN 3.

9.3.1 VLAN Summary

This screen lists every VLAN interface. If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also configure VLAN interfaces used for your IPv6 networks on this screen. To access this screen, click **Configuration > Network > Interface** > **VLAN**.

Figure 90 Configuration > Network > Interface > VLAN



Each field is explained in the following table.

Table 69 Configuration > Network > Interface > VLAN

LABEL	DESCRIPTION
Configuration / IPv6 Configuration	Use the **Configuration** section for IPv4 network settings. Use the **IPv6 Configuration** section for IPv6 network settings if you connect your NXC to an IPv6 network. Both sections have similar fields as described below.
Add	Click this to create a new VLAN.

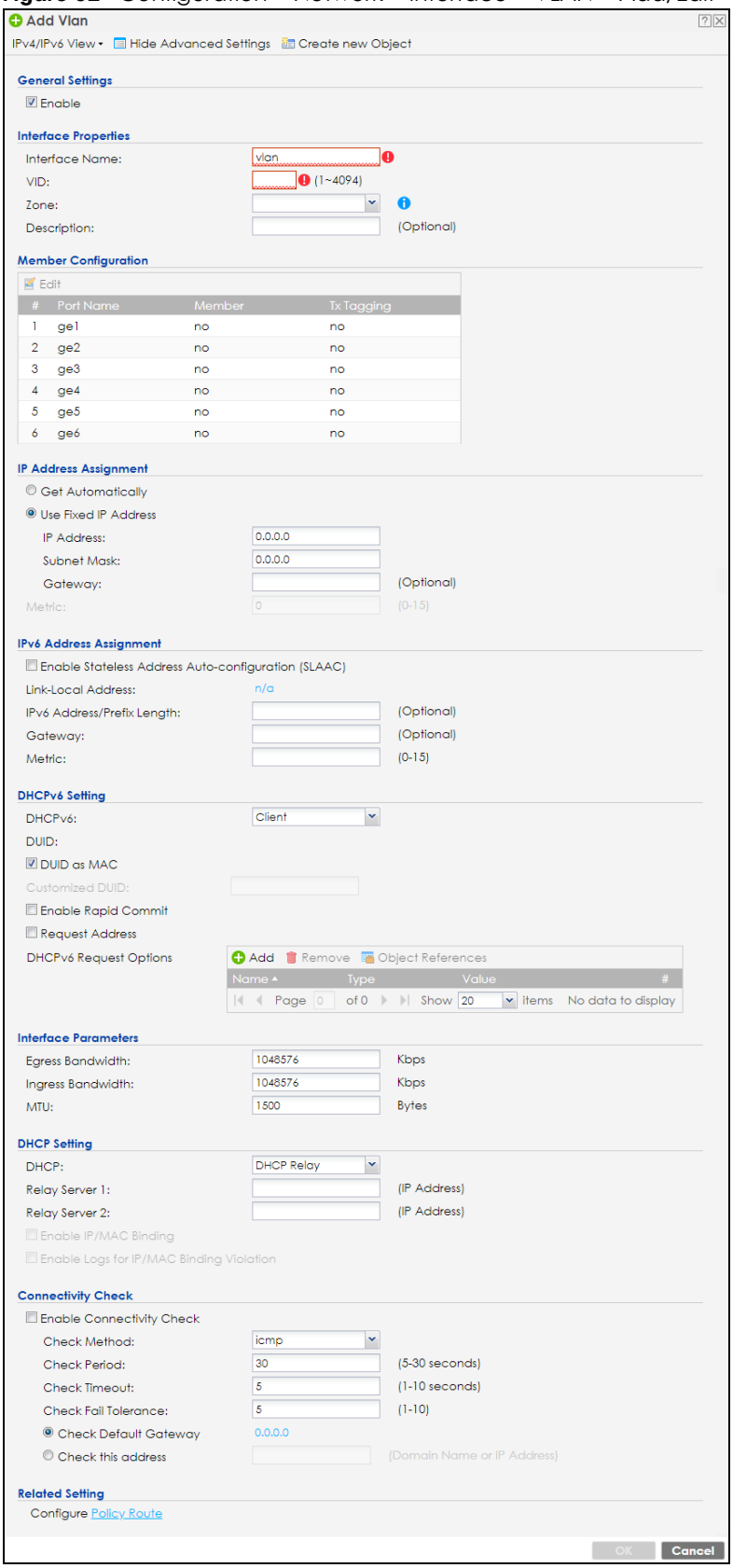
Table 69 Configuration > Network > Interface > VLAN (continued)

LABEL	DESCRIPTION
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with any interface.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Name	This field displays the name of the interface.
IP Address	This field displays the current IP address of the interface. If the IP address is 0.0.0.0 (in the IPv4 network) or :: (in the IPv6 network), the interface does not have an IP address yet. In the IPv4 network, this screen also shows whether the IP address is a static IP address (**STATIC**) or dynamically assigned (**DHCP**). In the IPv6 network, this screen also shows whether the IP address is a static IP address (STATIC), link-local IP address (LINK LOCAL), dynamically assigned (DHCP), or an IPv6 StateLess Address AutoConfiguration IP address (SLAAC). See Appendix E on page 502 for more information about IPv6.
VID	This field displays the VLAN ID number.
Member	This field displays the Ethernet interface(s) that is a member of this VLAN.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

9.3.2 Add/Edit VLAN

This screen lets you configure IP address assignment, interface bandwidth parameters, DHCP settings, and connectivity check for each VLAN interface. To access this screen, click the **Add** icon at the top of the **Add** column or click an **Edit** icon next to a VLAN interface in the **VLAN Summary** screen. The following screen appears.

Figure 91 Configuration > Network > Interface > VLAN > Add/Edit



Each field is explained in the following table.

Table 70 Configuration > Network > Interface > VLAN > Add/Edit

LABEL	DESCRIPTION
IPv4/IPv6 View / IPv4 View / IPv6 View	Use this button to display both IPv4 and IPv6, IPv4-only, or IPv6-only configuration fields.
Show / Hide Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Create New Object	Click this button to create a DHCPv6 request object that you may use for the DHCPv6 settings in this screen.
General Settings	
Enable	Select this to turn this interface on. Clear this to disable this interface.
Interface Properties	
Interface Name	This field is read-only if you are editing an existing VLAN interface. Enter the number of the VLAN interface. You can use a number from 0~4094. For example, vlan0, vlan8, and so on.
VID	Enter the VLAN ID. This 12-bit number uniquely identifies each VLAN. Allowed values are 1 - 4094. (0 and 4095 are reserved.)
Zone	Select the zone to which the VLAN interface belongs.
Description	Enter a description of this interface. It is not used elsewhere. You can use alphanumeric and ( ) + / : = ? ! * # @ $ _ % - characters, and it can be up to 60 characters long.
Member Configuration	Use these settings to assign interfaces to this VLAN as members.
Edit	Click this to edit the selected interface's membership values.
#	This is sequential indicator of the interface number.
Port Name	This indicates the interface name.
Member	This indicates whether the selected interface is a member or not of the VLAN which is currently being edited. Click this field to edit the value.
Tx Tagging	This indicates whether the selected interface tags outbound traffic with this VLAN's ID. Click this field to edit the value.
IP Address Assignment	
Get Automatically	Select this if this interface is a DHCP client. In this case, the DHCP server configures the IP address, subnet mask, and gateway automatically.
Use Fixed IP Address	Select this if you want to specify the IP address, subnet mask, and gateway manually.
IP Address	This field is enabled if you select **Use Fixed IP Address**. Enter the IP address for this interface.
Subnet Mask	This field is enabled if you select **Use Fixed IP Address**. Enter the subnet mask of this interface in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all computers in the network.
Gateway	This field is enabled if you select **Use Fixed IP Address**. Enter the IP address of the gateway. The NXC sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the interface.
Metric	Enter the priority of the gateway (if any) on this interface. The NXC decides which gateway to use based on this priority. The lower the number, the higher the priority. If two or more gateways have the same priority, the NXC uses the one that was configured first.

Table 70 Configuration > Network > Interface > VLAN > Add/Edit (continued)

LABEL	DESCRIPTION
IPv6 Address Assignment	These IP address fields configure an IPv6 address on the interface itself.
Enable Stateless Address Auto-configuration (SLAAC)	Select this to enable IPv6 stateless auto-configuration on this interface. The interface will generate an IPv6 address itself from a prefix obtained from an IPv6 router in the network.
Link-Local Address	This displays the IPv6 link-local address and the network prefix that the NXC generates itself for the interface.
IPv6 Address/ Prefix Length	Enter the IPv6 address and the prefix length for this interface if you want to use a static IP address. This field is optional. The prefix length indicates what the left-most part of the IP address is the same for all computers in the network, that is, the network address.
Gateway	Enter the IPv6 address of the default outgoing gateway using colon (:) hexadecimal notation.
Metric	Enter the priority of the gateway (if any) on this interface. The NXC decides which gateway to use based on this priority. The lower the number, the higher the priority. If two or more gateways have the same priority, the NXC uses the one that was configured first.
DHCPv6 Setting	
DHCPv6	Select **N/A** to not use DHCPv6. Select **Client** to set this interface to act as a DHCPv6 client.
DUID	This field displays the DHCP Unique IDentifier (DUID) of the interface, which is unique and used for identification purposes when the interface is exchanging DHCPv6 messages with others. See Appendix E on page 502 for more information.
DUID as MAC	Select this if you want the DUID to be generated from the interface's default MAC address.
Customized DUID	If you want to use a customized DUID, enter it here for the interface.
Enable Rapid Commit	Select this to shorten the DHCPv6 message exchange process from four to two steps. This function helps reduce heavy network traffic load. Note: Make sure you also enable this option in the DHCPv6 server to make rapid commit work.
Request Address	Select this to get an IPv6 address for this interface from the DHCP server. Clear this to not get any IP address information through DHCPv6.
DHCPv6 Request Options	If this interface is a DHCPv6 client, use this section to configure DHCPv6 request settings that determine what additional information to get from the DHCPv6 server.
Add	Click this to create an entry in this table. See Section 9.2.3 on page 156 for more information.
Remove	Select an entry and click this to delete it from this table.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry. See Section 9.2.2 on page 156 for an example.
#	This field is a sequential value, and it is not associated with any entry.
Name	This field displays the name of the DHCPv6 request object.
Type	This field displays the type of the object.
Value	This field displays the IPv6 address that the NXC obtained from an uplink router.
Interface Parameters	
Egress Bandwidth	Enter the maximum amount of traffic, in kilobits per second, the NXC can send through the interface to the network. Allowed values are 0 - 1048576.

Table 70 Configuration > Network > Interface > VLAN > Add/Edit (continued)

LABEL	DESCRIPTION
Ingress Bandwidth	This is reserved for future use. Enter the maximum amount of traffic, in kilobits per second, the NXC can receive from the network through the interface. Allowed values are 0 - 1048576.
MTU	Maximum Transmission Unit. Type the maximum size of each data packet, in bytes, that can move through this interface. If a larger packet arrives, the NXC divides it into smaller fragments. Allowed values are 1280 - 1500. Usually, this value is 1500.
DHCP Setting	
DHCP	Select what type of DHCP service the NXC provides to the network. Choices are: **None** - the NXC does not provide any DHCP services. There is already a DHCP server on the network. **DHCP Relay** - the NXC routes DHCP requests to one or more DHCP servers you specify. The DHCP server(s) may be on another network. **DHCP Server** - the NXC assigns IP addresses and provides subnet mask, gateway, and DNS server information to the network. The NXC is the DHCP server for the network.
	These fields appear if the NXC is a **DHCP Relay**.
Relay Server 1	Enter the IP address of a DHCP server for the network.
Relay Server 2	This field is optional. Enter the IP address of another DHCP server for the network.
	These fields appear if the NXC is a **DHCP Server**.
IP Pool Start Address	Enter the IP address from which the NXC begins allocating IP addresses. If you want to assign a static IP address to a specific computer, click **Add Static DHCP**. If this field is blank, the **Pool Size** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
Pool Size	Enter the number of IP addresses to allocate. This number must be at least one and is limited by the interface's **Subnet Mask**. For example, if the **Subnet Mask** is 255.255.255.0 and **IP Pool Start Address** is 10.10.10.10, the NXC can allocate 10.10.10.10 to 10.10.10.254, or 245 IP addresses. If this field is blank, the **IP Pool Start Address** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
First DNS Server Second DNS Server Third DNS Server	Specify the IP addresses up to three DNS servers for the DHCP clients to use. Use one of the following ways to specify these IP addresses. **Custom Defined** - enter a static IP address. **From ISP** - select the DNS server that another interface received from its DHCP server. **EnterpriseWLAN** - the DHCP clients use the IP address of this interface and the NXC works as a DNS relay.
First WINS Server, Second WINS Server	Type the IP address of the WINS (Windows Internet Naming Service) server that you want to send to the DHCP clients. The WINS server keeps a mapping table of the computer names on your network and the IP addresses that they are currently using.
Lease time	Specify how long each computer can use the information (especially the IP address) before it has to request the information again. Choices are: **infinite** - select this if IP addresses never expire **days**, **hours**, and **minutes** - select this to enter how long IP addresses are valid.

Table 70 Configuration > Network > Interface > VLAN > Add/Edit (continued)

LABEL	DESCRIPTION
Extended Options	This table is available if you selected **DHCP server**. Configure this table if you want to send more information to DHCP clients through DHCP packets.
Add	Click this to create an entry in this table. See Section 9.2.4 on page 157.
Edit	Select an entry in this table and click this to modify it.
Remove	Select an entry in this table and click this to delete it.
#	This field is a sequential value, and it is not associated with any entry.
Name	This is the name of the DHCP option.
Code	This is the code number of the DHCP option.
Type	This is the type of the set value for the DHCP option.
Value	This is the value set for the DHCP option.
Enable IP/MAC Binding	Select this option to have the NXC enforce links between specific IP addresses and specific MAC addresses for this VLAN. This stops anyone else from manually using a bound IP address on another device connected to this interface. Use this to make use only the intended users get to use specific IP addresses.
Enable Logs for IP/MAC Binding Violation	Select this option to have the NXC generate a log if a device connected to this VLAN attempts to use an IP address that is bound to another device's MAC address.
Static DHCP Table	Configure a list of static IP addresses the NXC assigns to computers connected to the interface. Otherwise, the NXC assigns an IP address dynamically using the interface's **IP Pool Start Address** and **Pool Size**.
Add	Click this to create a new entry.
Edit	Select an entry and click this to be able to modify it.
Remove	Select an entry and click this to delete it.
#	This field is a sequential value, and it is not associated with a specific entry.
IP Address	Enter the IP address to assign to a device with this entry's MAC address.
MAC Address	Enter the MAC address to which to assign this entry's IP address.
Description	Enter a description to help identify this static DHCP entry. You can use alphanumeric and `()+/:=?!*#@$_%-` characters, and it can be up to 60 characters long.
Connectivity Check	The NXC can regularly check the connection to the gateway you specified to make sure it is still available. You specify how often to check the connection, how long to wait for a response before the attempt is a failure, and how many consecutive failures are required before the NXC stops routing to the gateway. The NXC resumes routing to the gateway the first time the gateway passes the connectivity check.
Enable Connectivity Check	Select this to turn on the connection check.
Check Method	Select the method that the gateway allows. Select **icmp** to have the NXC regularly ping the gateway you specify to make sure it is still available. Select **tcp** to have the NXC regularly perform a TCP handshake with the gateway you specify to make sure it is still available.
Check Period	Enter the number of seconds between connection check attempts.
Check Timeout	Enter the number of seconds to wait for a response before the attempt is a failure.
Check Fail Tolerance	Enter the number of consecutive failures before the NXC stops routing through the gateway.
Check Default Gateway	Select this to use the default gateway for the connectivity check.

Table 70 Configuration > Network > Interface > VLAN > Add/Edit (continued)

LABEL	DESCRIPTION
Check this address	Select this to specify a domain name or IP address for the connectivity check. Enter that domain name or IP address in the field next to it.
Check Port	This field only displays when you set the **Check Method** to **tcp**. Specify the port number to use for a TCP connectivity check.
Related Setting	
Configure Policy Route	Click **Policy Route** to go to the screen where you can manually configure a policy route to associate traffic with this VLAN.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

9.4 LAG

Link Aggregation Group (LAG) is a way to combine multiple physical Ethernet interfaces into a single logical interface. This increases uplink bandwidth. It also increases availability as even if a member link goes down, LAG can continue to transmit and receive traffic over the remaining links.

To configure LAG, configure a link number and specify the member ports in the link. All ports must have the same speed and be in full-duplex mode. You must configure the LAG on both sides of the link and you must set the interfaces on either side of the link to be the same speed.

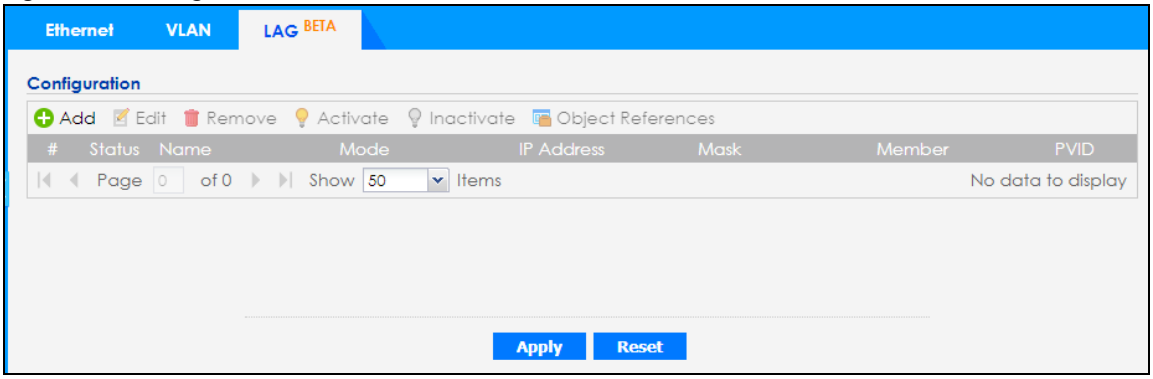
At the time of writing, up to 4 ports can be grouped into a LAG and up to 3 LAGs can be configured on a NXC.

See Section 1.1 on page 19 to see which models support Link Aggregation Group (LAG).

9.4.1 LAG Summary Screen

This screen lists every LAG created on the NXC. To access this screen, click **Configuration** > **Network** > **Interface** > **LAG**.

Figure 92 Configuration > Network > Interface > LAG



Each field is described in the following table.

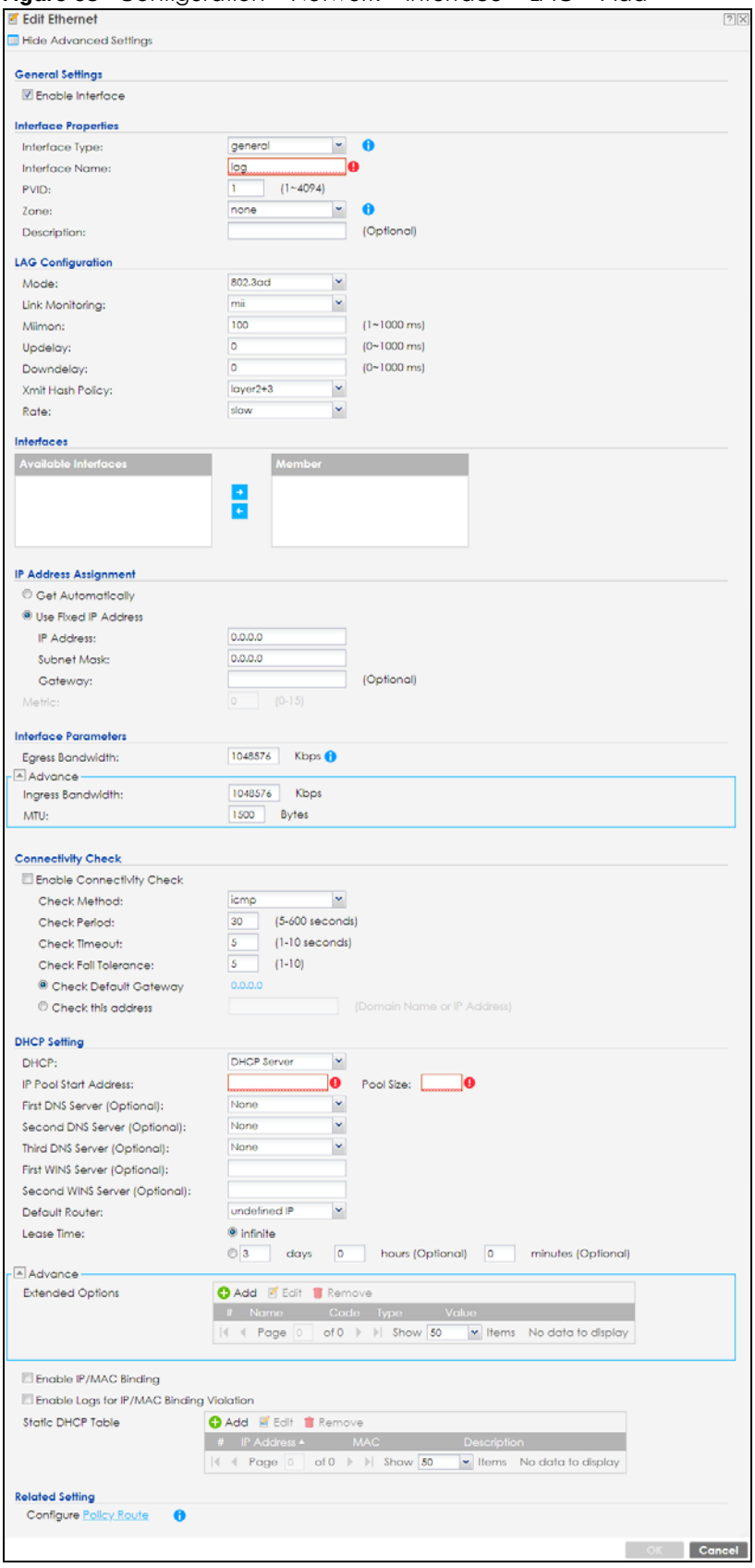
Table 71 Configuration > Network > Interface > LAG

LABEL	DESCRIPTION
Configuration	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Create Virtual Interface	To open the screen where you can create a virtual interface, select an interface and click **Create Virtual Interface**.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with any interface.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Name	This field displays the name of the LAG interface.
Mode	Mode refers to whether the LAG is acting as follows: • **active-backup** where only one slave in the LAG interface is active and another slave becomes active only if the active slave fails. • **802.3ad** (IEEE 802.3ad Dynamic link aggregation) where Link Aggregation Control Protocol (LACP) negotiates automatic combining of links and balances the traffic load across the LAG link by sending LACP packets to the directly connected device that also implements LACP. The slaves must have the same speed and duplex settings. • **balance-alb** (adaptive load balancing) where traffic is distributed according to the current load on each slave by ARP negotiation. Incoming traffic is received by the current slave. If the receiving slave fails, another slave takes over the MAC address of the failed receiving slave.
IP Address	This field displays the current IP address of the LAG interface. If the IP address is 0.0.0.0, the interface does not have an IP address yet. This screen also shows whether the IP address is a static IP address (**STATIC**) or dynamically assigned (**DHCP**). IP addresses are always static in virtual interfaces.
Mask	This field displays the interface's subnet mask in dot decimal notation.
Member	This field displays the physical Ethernet interface that is a member of this LAG. Members do not have an IP Address and in some cases share the same MAC address.
PVID	This field indicates the interface's PVID.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

9.4.2 LAG Add/Edit

This screen lets you configure Interface and LAG parameters for each LAG interface. To access this screen, click the **Add** or **Edit** icon in the **LAG** screen. The following screen appears.

Figure 93 Configuration > Network > Interface > LAG > Add



Each field is described in the following table.

Table 72 Configuration > Network > Interface > LAG > Add/Edit

LABEL	DESCRIPTION
General Settings	
Enable Interface	Select this to enable this interface. Clear this to disable this interface.
Interface Properties	
Interface Type	Select one of the following option depending on the type of network to which the NXC is connected or if you want to additionally manually configure some related settings. **internal** is for connecting to a local network. Other corresponding configuration options: DHCP server and DHCP relay. The NXC automatically adds default SNAT settings for traffic flowing from this interface to an external interface. **external** is for connecting to an external network (like the Internet). The NXC automatically adds this interface to the default WAN trunk. For **general**, the rest of the screen's options do not automatically adjust and you must manually configure a policy route to add routing and SNAT settings for the interface.
Interface Name	This field is read-only if you are editing the interface. Enter the name of the LAG interface. The format is lag*x*, where *x* is 0 - 3. For example, lag0, lag1, and so on.
PVID	A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines. Enter the PVID for this port (1~4094).
Zone	Select the zone to which the interface is to belong. You use zones to apply security settings such as security policy, IDP, remote management, anti-virus, and application patrol.
Description	Enter a description of this interface. It is not used elsewhere. You can use alphanumeric and `( ) + / : = ? ! * # @ $ _ % -` characters, and it can be up to 60 characters long.
LAG Configuration	
Mode	Select a Mode for this LAG interface. Choices are as follows: • **active-backup** where only one slave in the LAG interface is active and another slave becomes active only if the active slave fails. • **802.3ad** (IEEE 802.3ad Dynamic link aggregation) where Link Aggregation Control Protocol (LACP) negotiates automatic combining of links and balances the traffic load across the LAG link by sending LACP packets to the directly connected device that also implements LACP. The slaves must have the same speed and duplex settings. • **balance-alb** (adaptive load balancing) where traffic is distributed according to the current load on each slave by ARP negotiation. Incoming traffic is received by the current slave. If the receiving slave fails, another slave takes over the MAC address of the failed receiving slave.
Link Monitoring	Select from **mii** or **arp**. **mii** monitoring monitors the state of the local interface; it can't tell if the link can transmit or receive packets. **arp** monitoring sends ARP queries and uses the reply to know if the link is up and that traffic is flowing over the link.
Miimom	This field displays for **mii** Link Monitoring. Set the link check interval in milliseconds that the system polls the Media Independent Interface (MII) to get status.
Updelay	This field displays for **mii** Link Monitoring. Set the waiting time in milliseconds to confirm the slave interface status is up.
Downdelay	This field displays for **mii** Link Monitoring. Set the waiting time in milliseconds to confirm the slave interface status is down.
Xmit Hash Policy	This field displays in **802.3ad** Mode. This field sets the algorithm for slave selection according to the selected TCP/IP layer.
Rate	This field displays in **802.3ad** Mode. Select the preferred LACPDU packet transmission rate (**slow**/**fast**) to request from 802.3ad partner.

Table 72 Configuration > Network > Interface > LAG > Add/Edit (continued)

LABEL	DESCRIPTION
ARP Interval	This field displays for **arp** Link Monitoring. Select the frequency of ARP requests sent to confirm a that slave interface is up.
ARP IP Target	This field displays for **arp** Link Monitoring. Set the IP address of the link to send ARP queries.
Available Interfaces	This field displays Ethernet interfaces that can become part of the LAG interface. An interface is not available in the following situations: • There is a interface on top of it. • It is already used in a different LAG interface. Select one, and click the **>>** arrow to add it to the LAG interface.
Member	This field displays the interfaces that are part of the LAG interface. Select one, and click the **<<** arrow to remove it from the LAG interface.
IP Address Assignment	
Get Automatically	Select this if this interface is a DHCP client. In this case, the DHCP server configures the IP address, subnet mask, and gateway automatically.
Use Fixed IP Address	Select this if you want to specify the IP address, subnet mask, and gateway manually.
IP Address	This field is enabled if you select **Use Fixed IP Address**. Enter the IP address for this interface.
Subnet Mask	This field is enabled if you select **Use Fixed IP Address**. Enter the subnet mask of this interface in dot decimal notation. The subnet mask indicates what part of the IP address is the same for all computers in the network.
Gateway	This field is enabled if you select **Use Fixed IP Address**. Enter the IP address of the gateway. The NXC sends packets to the gateway when it does not know how to route the packet to its destination. The gateway should be on the same network as the interface.
Metric	Enter the priority of the gateway (if any) on this interface. The NXC decides which gateway to use based on this priority. The lower the number, the higher the priority. If two or more gateways have the same priority, the NXC uses the one that was configured first.
Interface Parameters	
Egress Bandwidth	Enter the maximum amount of traffic, in kilobits per second, the NXC can send through the interface to the network. Allowed values are 0 - 1048576.
Ingress Bandwidth	This is reserved for future use. Enter the maximum amount of traffic, in kilobits per second, the NXC can receive from the network through the interface. Allowed values are 0 - 1048576.
MTU	Maximum Transmission Unit. Type the maximum size of each data packet, in bytes, that can move through this interface. If a larger packet arrives, the NXC divides it into smaller fragments. Allowed values are 1280 - 1500. Usually, this value is 1500.
Connectivity Check	These fields appear when you set the **Interface Type** to **External** or **General**. The interface can regularly check the connection to the gateway you specified to make sure it is still available. You specify how often the interface checks the connection, how long to wait for a response before the attempt is a failure, and how many consecutive failures are required before the NXC stops routing to the gateway. The NXC resumes routing to the gateway the first time the gateway passes the connectivity check.
Enable Connectivity Check	Select this to turn on the connection check.

Table 72 Configuration > Network > Interface > LAG > Add/Edit (continued)

LABEL	DESCRIPTION
Check Method	Select the method that the gateway allows. Select **icmp** to have the NXC regularly ping the gateway you specify to make sure it is still available. Select **tcp** to have the NXC regularly perform a TCP handshake with the gateway you specify to make sure it is still available.
Check Period	Enter the number of seconds between connection check attempts.
Check Timeout	Enter the number of seconds to wait for a response before the attempt is a failure.
Check Fail Tolerance	Enter the number of consecutive failures before the NXC stops routing through the gateway.
Check Default Gateway	Select this to use the default gateway for the connectivity check.
Check this address	Select this to specify a domain name or IP address for the connectivity check. Enter that domain name or IP address in the field next to it.
Check Port	This field only displays when you set the **Check Method** to **tcp**. Specify the port number to use for a TCP connectivity check.
DHCP Setting	
DHCP	Select what type of DHCP service the NXC provides to the network. Choices are: **None** - the NXC does not provide any DHCP services. There is already a DHCP server on the network. **DHCP Relay** - the NXC routes DHCP requests to one or more DHCP servers you specify. The DHCP server(s) may be on another network. **DHCP Server** - the NXC assigns IP addresses and provides subnet mask, gateway, and DNS server information to the network. The NXC is the DHCP server for the network.
	These fields appear if the NXC is a **DHCP Relay**.
Relay Server 1	Enter the IP address of a DHCP server for the network.
Relay Server 2	This field is optional. Enter the IP address of another DHCP server for the network.
	These fields appear if the NXC is a **DHCP Server**.
IP Pool Start Address	Enter the IP address from which the NXC begins allocating IP addresses. If you want to assign a static IP address to a specific computer, click **Add Static DHCP**. If this field is blank, the **Pool Size** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
Pool Size	Enter the number of IP addresses to allocate. This number must be at least one and is limited by the interface's **Subnet Mask**. For example, if the **Subnet Mask** is 255.255.255.0 and **IP Pool Start Address** is 10.10.10.10, the NXC can allocate 10.10.10.10 to 10.10.10.254, or 245 IP addresses. If this field is blank, the **IP Pool Start Address** must also be blank. In this case, the NXC can assign every IP address allowed by the interface's IP address and subnet mask, except for the first address (network address), last address (broadcast address) and the interface's IP address.
First DNS Server Second DNS Server Third DNS Server	Specify the IP addresses up to three DNS servers for the DHCP clients to use. Use one of the following ways to specify these IP addresses. **Custom Defined** - enter a static IP address. **From ISP** - select the DNS server that another interface received from its DHCP server. **EnterpriseWLAN** - the DHCP clients use the IP address of this interface and the NXC works as a DNS relay.

Table 72 Configuration > Network > Interface > LAG > Add/Edit (continued)

LABEL	DESCRIPTION
First WINS Server, Second WINS Server	Type the IP address of the WINS (Windows Internet Naming Service) server that you want to send to the DHCP clients. The WINS server keeps a mapping table of the computer names on your network and the IP addresses that they are currently using.
Default Router	If you set this interface to **DHCP Server**, you can select to use either the interface's IP address or another IP address as the default router. This default router will become the DHCP clients' default gateway. To use another IP address as the default router, select **Custom Defined** and enter the IP address.
Lease time	Specify how long each computer can use the information (especially the IP address) before it has to request the information again. Choices are: **infinite** - select this if IP addresses never expire **days, hours, and minutes** - select this to enter how long IP addresses are valid.
Extended Options	This table is available if you selected **DHCP server**. Configure this table if you want to send more information to DHCP clients through DHCP packets.
Add	Click this to create an entry in this table. See Section 9.2.4 on page 157.
Edit	Select an entry in this table and click this to modify it.
Remove	Select an entry in this table and click this to delete it.
#	This field is a sequential value, and it is not associated with any entry.
Name	This is the option's name.
Code	This is the option's code number.
Type	This is the option's type.
Value	This is the option's value.
Enable IP/MAC Binding	Select this option to have this interface enforce links between specific IP addresses and specific MAC addresses. This stops anyone else from manually using a bound IP address on another device connected to this interface. Use this to make use only the intended users get to use specific IP addresses.
Enable Logs for IP/MAC Binding Violation	Select this option to have the NXC generate a log if a device connected to this interface attempts to use an IP address that is bound to another device's MAC address.
Static DHCP Table	Configure a list of static IP addresses the NXC assigns to computers connected to the interface. Otherwise, the NXC assigns an IP address dynamically using the interface's **IP Pool Start Address** and **Pool Size**.
Add	Click this to create a new entry.
Edit	Select an entry and click this to be able to modify it.
Remove	Select an entry and click this to delete it.
#	This field is a sequential value, and it is not associated with a specific entry.
IP Address	Enter the IP address to assign to a device with this entry's MAC address.
MAC	Enter the MAC address to which to assign this entry's IP address.
Description	Enter a description to help identify this static DHCP entry. You can use alphanumeric and `()+/:=?!*#@$_%-` characters, and it can be up to 60 characters long.
Related Setting	
Configure Policy Route	Click **Policy Route** to go to the screen where you can manually configure a policy route to associate traffic with this bridge interface.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

9.5 Technical Reference

The following section contains additional technical information about the features described in this chapter.

IP Address Assignment

Most interfaces have an IP address and a subnet mask. This information is used to create an entry in the routing table.

In most interfaces, you can enter the IP address and subnet mask manually.

In many interfaces, you can also let the IP address and subnet mask be assigned by an external DHCP server on the network. In this case, the interface is a DHCP client.

In general, the IP address and subnet mask of each interface should not overlap, though it is possible for this to happen with DHCP clients.

In the example above, if the NXC gets a packet with a destination address of 5.5.5.5, it might not find any entries in the routing table. In this case, the packet is dropped. However, if there is a default router to which the NXC should send this packet, you can specify it as a gateway in one of the interfaces. For example, if there is a default router at 200.200.200.100, you can create a gateway at 200.200.200.100 on ge2. In this case, the NXC creates the following entry in the routing table.

Table 73 Example: Routing Table Entry for a Gateway

IP ADDRESS(ES)	DESTINATION
0.0.0.0/0	200.200.200.100

The gateway is an optional setting for each interface. If there is more than one gateway, the NXC uses the gateway with the lowest metric, or cost. If two or more gateways have the same metric, the NXC uses the one that was set up first (the first entry in the routing table).

If the interface gets its IP address and subnet mask from a DHCP server, the DHCP server also specifies the gateway, if any.

Interface Parameters

The NXC restricts the amount of traffic into and out of the NXC through each interface.

- Egress bandwidth sets the amount of traffic the NXC sends out through the interface to the network.
- Ingress bandwidth sets the amount of traffic the NXC allows in through the interface from the network.[1]

If you set the bandwidth restrictions very high, you effectively remove the restrictions.

The NXC also restricts the size of each data packet. The maximum number of bytes in each packet is called the maximum transmission unit (MTU). If a packet is larger than the MTU, the NXC divides it into smaller fragments. Each fragment is sent separately, and the original packet is re-assembled later. The smaller the MTU, the more fragments sent, and the more work required to re-assemble packets correctly.

1. At the time of writing, the NXC does not support ingress bandwidth management.

On the other hand, some communication channels, such as Ethernet over ATM, might not be able to handle large data packets.

DHCP Settings

Dynamic Host Configuration Protocol (DHCP, RFC 2131, RFC 2132) provides a way to automatically set up and maintain IP addresses, subnet masks, gateways, and some network information (such as the IP addresses of DNS servers) on computers in the network. This reduces the amount of manual configuration you have to do and usually uses available IP addresses more efficiently.

In DHCP, every network has at least one DHCP server. When a computer (a DHCP client) joins the network, it submits a DHCP request. The DHCP servers get the request; assign an IP address; and provide the IP address, subnet mask, gateway, and available network information to the DHCP client. When the DHCP client leaves the network, the DHCP servers can assign its IP address to another DHCP client.

In the NXC, some interfaces can provide DHCP services to the network. In this case, the interface can be a DHCP relay or a DHCP server.

As a DHCP relay, the interface routes DHCP requests to DHCP servers on different networks. You can specify more than one DHCP server. If you do, the interface routes DHCP requests to all of them. It is possible for an interface to be a DHCP relay and a DHCP client simultaneously.

As a DHCP server, the interface provides the following information to DHCP clients.

- IP address - If the DHCP client's MAC address is in the NXC's static DHCP table, the interface assigns the corresponding IP address. If not, the interface assigns IP addresses from a pool, defined by the starting address of the pool and the pool size.

Table 74 Example: Assigning IP Addresses from a Pool

START IP ADDRESS	POOL SIZE	RANGE OF ASSIGNED IP ADDRESS
50.50.50.33	5	50.50.50.33 - 50.50.50.37
75.75.75.1	200	75.75.75.1 - 75.75.75.200
99.99.1.1	1023	99.99.1.1 - 99.99.4.255
120.120.120.100	100	120.120.120.100 - 120.120.120.199

  The NXC cannot assign the first address (network address) or the last address (broadcast address) in the subnet defined by the interface's IP address and subnet mask. For example, in the first entry, if the subnet mask is 255.255.255.0, the NXC cannot assign 50.50.50.0 or 50.50.50.255. If the subnet mask is 255.255.0.0, the NXC cannot assign 50.50.0.0 or 50.50.255.255. Otherwise, it can assign every IP address in the range, except the interface's IP address.

  If you do not specify the starting address or the pool size, the interface the maximum range of IP addresses allowed by the interface's IP address and subnet mask. For example, if the interface's IP address is 9.9.9.1 and subnet mask is 255.255.255.0, the starting IP address in the pool is 9.9.9.2, and the pool size is 253.

- Subnet mask - The interface provides the same subnet mask you specify for the interface.
- Gateway - The interface provides the same gateway you specify for the interface.
- DNS servers - The interface provides IP addresses for up to three DNS servers that provide DNS services for DHCP clients. You can specify each IP address manually (for example, a company's own DNS server), or you can refer to DNS servers that other interfaces received from DHCP servers (for example, a DNS server at an ISP). These other interfaces have to be DHCP clients.

It is not possible for an interface to be the DHCP server and a DHCP client simultaneously.

WINS

WINS (Windows Internet Naming Service) is a Windows implementation of NetBIOS Name Server (NBNS) on Windows. It keeps track of NetBIOS computer names. It stores a mapping table of your network's computer names and IP addresses. The table is dynamically updated for IP addresses assigned by DHCP. This helps reduce broadcast traffic since computers can query the server instead of broadcasting a request for a computer name's IP address. In this way WINS is similar to DNS, although WINS does not use a hierarchy (unlike DNS). A network can have more than one WINS server. Samba can also serve as a WINS server.

CHAPTER 10
Policy and Static Routes

10.1 Overview

Use policy routes and static routes to override the NXC's default routing behavior in order to send packets through the appropriate interface.

10.1.1 What You Can Do in this Chapter

- The **Policy Route** screens (Section 10.2 on page 178) list and configure policy routes.
- The **Static Route** screens (Section 10.3 on page 183) list and configure static routes.

10.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Policy Routing

Traditionally, routing is based on the destination address only and the NXC takes the shortest path to forward a packet. IP Policy Routing (IPPR) provides a mechanism to override the default routing behavior and alter the packet forwarding based on the policy defined by the network administrator. Policy-based routing is applied to incoming packets on a per interface basis, prior to the normal routing.

How You Can Use Policy Routing

- Source-Based Routing – Network administrators can use policy-based routing to direct traffic from different users through different connections.
- Cost Savings – IPPR allows organizations to distribute interactive traffic on high-bandwidth, high-cost paths while using low-cost paths for batch traffic.
- Load Sharing – Network administrators can use IPPR to distribute traffic among multiple paths.

Static Routes

The NXC usually uses the default gateway to route outbound traffic from computers on the LAN to the Internet. To have the NXC send data to devices not reachable through the default gateway, use static routes.

Policy Routes Versus Static Routes

- Policy routes are more flexible than static routes. You can select more criteria for the traffic to match and can also use schedules and NAT.
- Policy routes are only used within the NXC itself. Static routes can be propagated to other routers.
- Policy routes take priority over static routes. If you need to use a routing policy on the NXC and propagate it to other routers, you could configure a policy route and an equivalent static route.

DiffServ

QoS is used to prioritize source-to-destination traffic flows. All packets in the same flow are given the same priority. CoS (class of service) is a way of managing traffic in a network by grouping similar types of traffic together and treating each type as a class. You can use CoS to give different priorities to different packet types.

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

DSCP Marking and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP (6 bits)	Unused (2 bits)

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

10.2 Policy Route

Click **Configuration > Network > Routing** to open this screen. Use this screen to see the configured policy routes and turn policy routing based bandwidth management on or off.

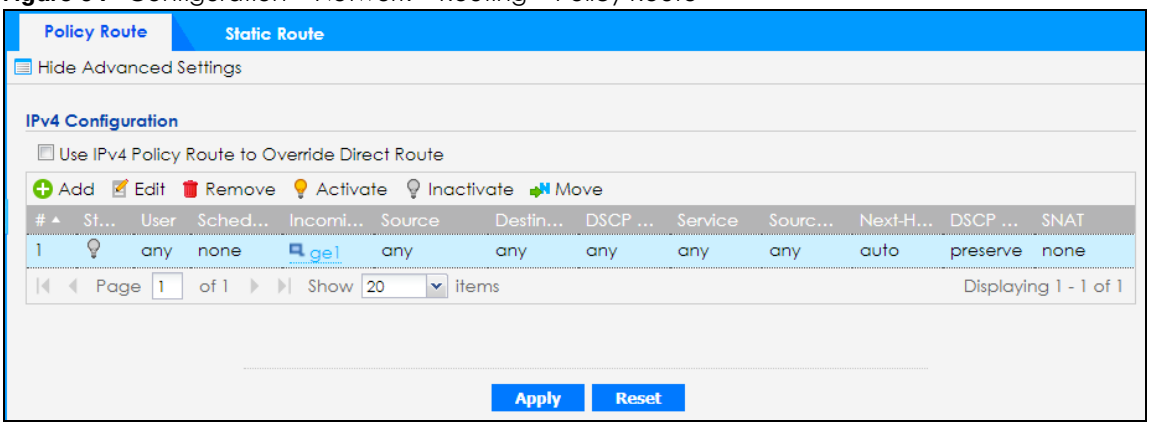
A policy route defines the matching criteria and the action to take when a packet meets the criteria. The action is taken only when all the criteria are met. The criteria can include the user name, source address and incoming interface, destination address, schedule, IP protocol (ICMP, UDP, TCP, etc.) and port.

The actions that can be taken include:

- Routing the packet to a different gateway or outgoing interface.
- Limiting the amount of bandwidth available and setting a priority for traffic.

IPPR follows the existing packet filtering facility of RAS in style and in implementation.

Figure 94 Configuration > Network > Routing > Policy Route



The following table describes the labels in this screen.

Table 75 Configuration > Network > Routing > Policy Route

LABEL	DESCRIPTION
Show / Hide Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Use IPv4 Policy Route to Override Direct Route	Select this to have the NXC forward packets that match a policy route according to the policy route instead of sending the packets directly to a connected network.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Move	To change a rule's position in the numbered list, select the rule and click **Move** to display a field to type a number for where you want to put that rule and press [ENTER] to move the rule to the number that you typed. The ordering of your rules is important as they are applied in order of their numbering.
#	This is the number of an individual policy route.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Description	This is the descriptive name of the policy route.
User	This is the name of the user (group) object from which the packets are sent. **any** means all users.
Schedule	This is the name of the schedule object. **none** means the route is active at all times if enabled.
Incoming	This is the interface on which the packets are received.
Source	This is the name of the source IP address (group) object. **any** means all IP addresses.
Destination	This is the name of the destination IP address (group) object. **any** means all IP addresses.

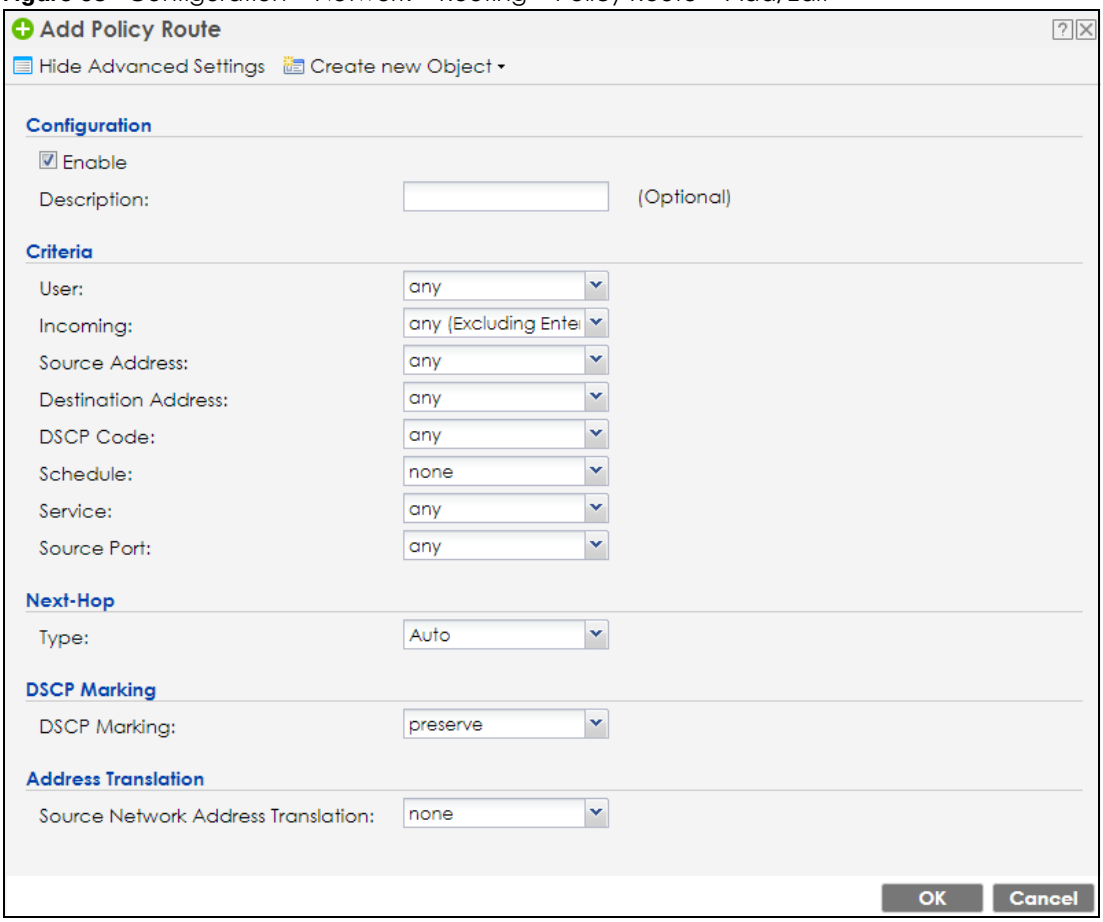
Table 75 Configuration > Network > Routing > Policy Route (continued)

LABEL	DESCRIPTION
DSCP Code	This is the DSCP value of incoming packets to which this policy route applies. **any** means all DSCP values or no DSCP marker. **default** means traffic with a DSCP value of 0. This is usually best effort traffic The "**af**" entries stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences. The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 185.
Service	This is the name of the service object. **any** means all services.
Source Port	This is the name of a service object. The NXC applies the policy route to the packets sent from the corresponding service port. **any** means all service ports.
Next-Hop	This is the next hop to which packets are directed. It helps forward packets to their destinations and can be a router or outgoing interface.
DSCP Marking	This is how the NXC handles the DSCP value of the outgoing packets that match this route. If this field displays a DSCP value, the NXC applies that DSCP value to the route's outgoing packets. **preserve** means the NXC does not modify the DSCP value of the route's outgoing packets. **default** means the NXC sets the DSCP value of the route's outgoing packets to 0. The "**af**" choices stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences. The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 185.
SNAT	This is the source IP address that the route uses. It displays **none** if the NXC does not perform NAT for this route.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

10.2.1 Add/Edit Policy Route

Click **Configuration > Network > Routing** to open the **Policy Route** screen. Then click the **Add** or **Edit** icon to open the **Policy Route Edit** screen. Use this screen to configure or edit a policy route.

Figure 95 Configuration > Network > Routing > Policy Route > Add/Edit



The following table describes the labels in this screen.

Table 76 Configuration > Network > Routing > Policy Route > Add/Edit

LABEL	DESCRIPTION
Show / Hide Advanced Settings	Click this button to display a greater or lesser number of configuration fields.
Create new Object	Use this to configure any new settings objects that you need to use in this screen.
Configuration	
Enable	Select this to activate the policy.
Description	Enter a descriptive name of up to 60 printable ASCII characters for the policy.
Criteria	
User	Select a user name or user group from which the packets are sent.
Incoming	Select where the packets are coming from; any, an interface, or the NXC itself (**EnterpriseWLAN**). For an interface, you also need to select the individual interface.
Please select one member	This field displays only when you set **Incoming** to **Interface**. Select an interface from which the packets are sent.
Source Address	Select a source IP address object from which the packets are sent.
Destination Address	Select a destination IP address object to which the traffic is being sent.

Table 76 Configuration > Network > Routing > Policy Route > Add/Edit (continued)

LABEL	DESCRIPTION
DSCP Code	Select a DSCP code point value of incoming packets to which this policy route applies or select **User Defined** to specify another DSCP code point. The lower the number the higher the priority with the exception of 0 which is usually given only best-effort treatment. **any** means all DSCP value or no DSCP marker. **default** means traffic with a DSCP value of 0. This is usually best effort traffic The "**af**" choices stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences. The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 185.
User-Defined DSCP Code	Use this field to specify a custom DSCP code point.
Schedule	Select a schedule to control when the policy route is active. **none** means the route is active at all times if enabled.
Service	Select a service or service group to identify the type of traffic to which this policy route applies.
Source Port	Select a service or service group to identify the source port of packets to which the policy route applies.
Next-Hop	
Type	Select **Auto** to have the NXC use the routing table to find a next-hop and forward the matched packets automatically. Select **Gateway** to route the matched packets to the next-hop router or switch you specified in the **Gateway** field. You have to set up the next-hop router or switch as a HOST address object first. Select **Interface** to route the matched packets through the specified outgoing interface to a gateway (which is connected to the interface).
Gateway	This field displays when you select **Gateway** in the **Type** field. Select a HOST address object. The gateway is an immediate neighbor of your NXC that will forward the packet to the destination. The gateway must be a router or switch on the same segment as your NXC's interface(s).
Interface	This field displays when you select **Interface** in the **Type** field. Select an interface to have the NXC send traffic that matches the policy route through the specified interface.
Auto-Disable	This field displays when you select **Interface** in the **Type** field. Select this to have the NXC automatically disable this policy route when the next-hop's connection is down.
DSCP Marking	
DSCP Marking	Set how the NXC handles the DSCP value of the outgoing packets that match this route. Select one of the pre-defined DSCP values to apply or select **User Defined** to specify another DSCP value. The "**af**" choices stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences. Select **preserve** to have the NXC keep the packets' original DSCP value. Select **default** to have the NXC set the DSCP value of the packets to 0. The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 185.
User-Defined DSCP Code	Use this field to specify a custom DSCP value.
Address Translation	Use this section to configure NAT for the policy route.

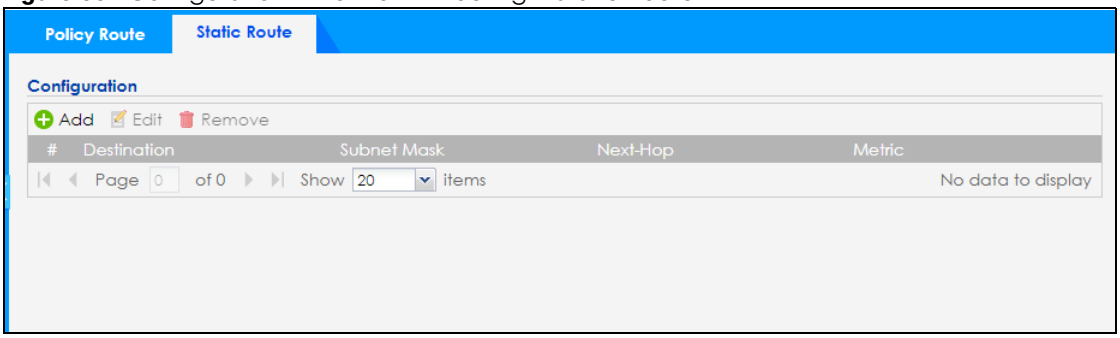
Table 76 Configuration > Network > Routing > Policy Route > Add/Edit (continued)

LABEL	DESCRIPTION
Source Network Address Translation	Select **none** to not use NAT for the route. Select **outgoing-interface** to use the IP address of the outgoing interface as the source IP address of the packets that matches this route. If you select **outgoing-interface**, you can also configure port trigger settings for this interface. Otherwise, select a pre-defined address (group) to use as the source IP address(es) of the packets that match this route. Use **Create new Object** if you need to configure a new address (group) to use as the source IP address(es) of the packets that match this route.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

10.3 Static Route

Click **Configuration > Network > Routing > Static Route** to open the **Static Route** screen. This screen displays the configured static routes.

Figure 96 Configuration > Network > Routing > Static Route



The following table describes the labels in this screen.

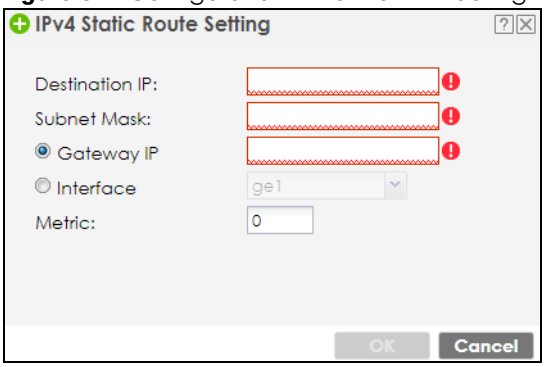
Table 77 Configuration > Network > Routing > Static Route

LABEL	DESCRIPTION
Add	Click this to create a new static route.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
#	This is the number of an individual static route.
Destination	This is the destination IP address.
Subnet Mask	This is the IP subnet mask.
Next-Hop	This is the IP address of the next-hop gateway or the interface through which the traffic is routed. The gateway is a router or switch on the same segment as your NXC's interface(s). The gateway helps forward packets to their destinations.
Metric	This is the route's priority among the NXC's routes. The smaller the number, the higher priority the route has.

10.3.1 Static Route Setting

Select a static route index number and click **Add** or **Edit**. The screen shown next appears. Use this screen to configure the required information for a static route.

Figure 97 Configuration > Network > Routing > Static Route > Add/Edit



The following table describes the labels in this screen.

Table 78 Configuration > Network > Routing > Static Route > Add/Edit

LABEL	DESCRIPTION
Destination IP	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
Subnet Mask	Enter the IP subnet mask here.
Gateway IP	Select the radio button and enter the IP address of the next-hop gateway. The gateway is a router or switch on the same segment as your NXC's interface(s). The gateway helps forward packets to their destinations.
Interface	Select the radio button and a predefined interface through which the traffic is sent.
Metric	Metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be 0~127. In practice, 2 or 3 is usually a good number.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

10.4 Technical Reference

The following section contains additional technical information about the features described in this chapter.

NAT and SNAT

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address in a packet in one network to a different IP address in another network. Use SNAT (Source NAT) to change the source IP address in one network to a different IP address in another network.

Assured Forwarding (AF) PHB for DiffServ

Assured Forwarding (AF) behavior is defined in RFC 2597. The AF behavior group defines four AF classes. Inside each class, packets are given a high, medium or low drop precedence. The drop precedence determines the probability that routers in the network will drop packets when congestion occurs. If congestion occurs between classes, the traffic in the higher class (smaller numbered class) is generally given priority. Combining the classes and drop precedence produces the following twelve DSCP encodings from AF11 through AF43. The decimal equivalent is listed in brackets.

Table 79 Assured Forwarding (AF) Behavior Group

	Class 1	Class 2	Class 3	Class 4
Low Drop Precedence	AF11 (10)	AF21 (18)	AF31 (26)	AF41 (34)
Medium Drop Precedence	AF12 (12)	AF22 (20)	AF32 (28)	AF42 (36)
High Drop Precedence	AF13 (14)	AF23 (22)	AF33 (30)	AF43 (38)

WMM

WiFi Multimedia (WMM) provides basic Quality of Service (QoS) features to wireless networks. The four categories of QoS described by WMM are: voice (VO), video (VI), best effort (BE), and background (BK). These categories, known as a "access categories" (AC), are mapped to 802.1D priority values which can then be mapped to their corresponding DSCP hex values.

Table 80 WMM to DiffServ Conversion on the NXC

Priority	WMM AC	802.1D Priority	DSCP Hex Value
Lowest	BK	1	0x08
	BK	2	0x10
	BE	0	0x00
	BE	3	0x18
	VI	4	0x20
	VI	5	0x28
	VO	6	0x30
Highest	VO	7	0x38

The WMM ACs as implemented on the NXC have the following functions:

VOICE: All wireless traffic to the SSID is tagged as voice data. This is recommended if an SSID is used for activities like placing and receiving VoIP phone calls.

VIDEO: All wireless traffic to the SSID is tagged as video data. This is recommended for activities like video conferencing.

BEST EFFORT: All wireless traffic to the SSID is tagged as "best effort," meaning the data travels the best route it can without displacing higher priority traffic. This is good for activities that do not require the best bandwidth throughput, such as surfing the Internet.

BACKGROUND: All wireless traffic to the SSID is tagged as low priority or "background traffic", meaning all other access categories take precedence over this one. If traffic from an SSID does not have strict throughput requirements, then this access category is recommended. For example, an SSID that only has network printers connected to it.

CHAPTER 11
Zones

11.1 Overview

Set up zones to configure network security and network policies in the NXC. A zone is a group of interfaces. The NXC uses zones instead of interfaces in many security and policy settings, such as firewall rules. Zones cannot overlap. Each interface can be assigned to just one zone.

11.1.1 What You Can Do in this Chapter

The **Zone** screens (see Section 11.2 on page 187) manage the NXC's zones.

11.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Effects of Zones on Different Types of Traffic

Zones effectively divide traffic into three types--intra-zone traffic, inter-zone traffic, and extra-zone traffic--which are affected differently by zone-based security and policy settings.

Intra-zone Traffic

- Intra-zone traffic is traffic between interfaces in the same zone.
- In each zone, you can either allow or prohibit all intra-zone traffic.
- You can also set up firewall rules to control intra-zone traffic, but many other types of zone-based security and policy settings do not affect intra-zone traffic.

Inter-zone Traffic

Inter-zone traffic is traffic between interfaces in different zones.

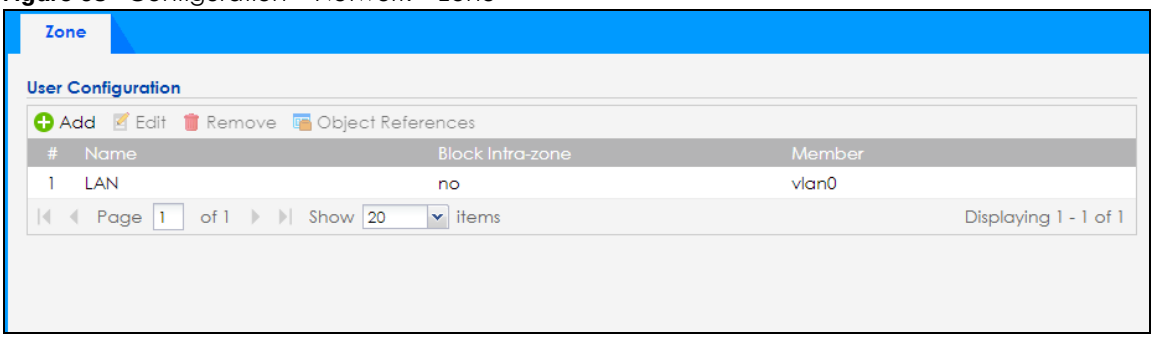
Extra-zone Traffic

- Extra-zone traffic is traffic to or from any interface that is not assigned to a zone.
- Some zone-based security and policy settings may apply to extra-zone traffic, especially if you can set the zone attribute in them to **Any** or **All**. See the specific feature for more information.

11.2 Zone

The **Zone** screen provides a summary of all zones. In addition, this screen allows you to add, edit, and remove zones. To access this screen, click **Configuration > Network > Zone**.

Figure 98 Configuration > Network > Zone



The following table describes the labels in this screen.

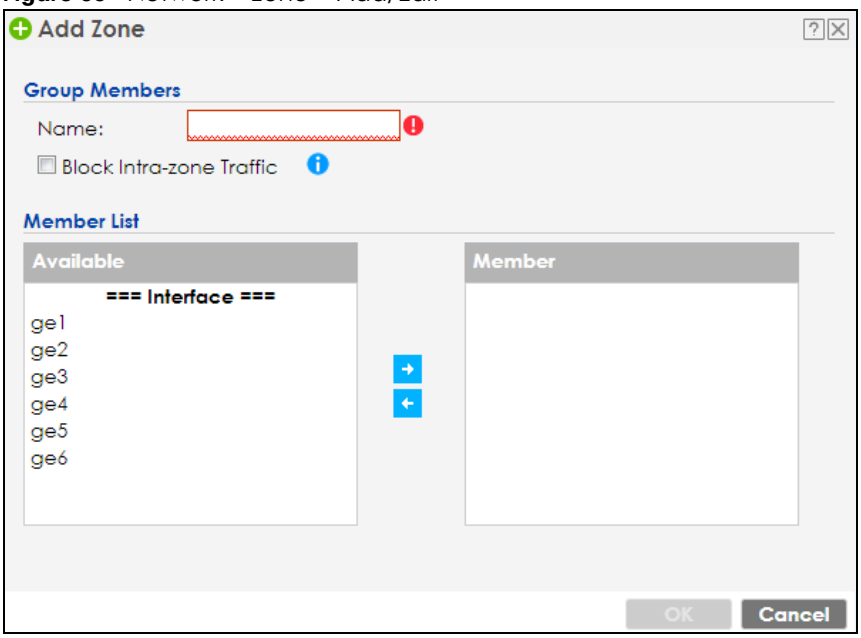
Table 81 Configuration > Network > Zone

LABEL	DESCRIPTION
Add	Click this to create a new, user-configured zone.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove a user-configured zone, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with any interface.
Name	This field displays the name of the zone.
Block Intra-zone	This field indicates whether or not the NXC blocks network traffic between members in the zone.
Member	This field displays the names of the interfaces that belong to each zone.

11.2.1 Add/Edit Zone

This screen allows you to add or edit a zone. To access this screen, go to the **Zone** screen, and click the **Add** icon or an **Edit** icon.

Figure 99 Network > Zone > Add/Edit



The following table describes the labels in this screen.

Table 82 Network > Zone > Add/Edit

LABEL	DESCRIPTION
Name	Type the name used to refer to the zone. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Block Intra-zone Traffic	Select this check box to block network traffic between members in the zone.
Member List	**Available** lists the interfaces that do not belong to any zone. Select the interfaces that you want to add to the zone you are editing, and click the right arrow button to add them. **Member** lists the interfaces that belong to the zone. Select any interfaces that you want to remove from the zone, and click the left arrow button to remove them.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

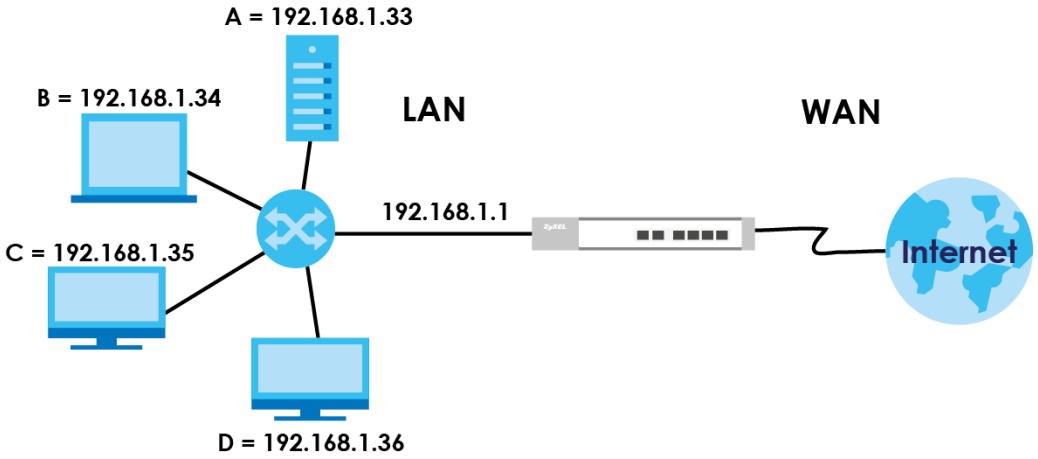
CHAPTER 12
NAT

12.1 Overview

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet. For example, the source address of an outgoing packet, used within one network is changed to a different IP address known within another network. Use Network Address Translation (NAT) to make computers on a private network behind the NXC available outside the private network. If the NXC has only one public IP address, you can make the computers in the private network available by using ports to forward packets to the appropriate private IP address.

Suppose you want to assign ports 21-25 to one FTP, Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example) and assign a default server IP address of 192.168.1.35 to a third (**C** in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 100 Multiple Servers Behind NAT Example



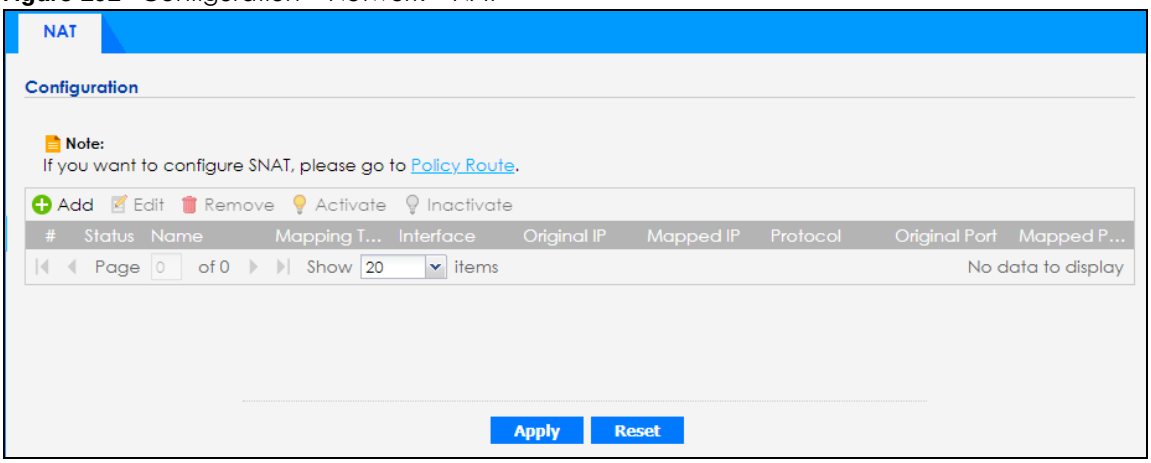
12.1.1 What You Can Do in this Chapter

The **NAT** screens (see Section 12.2 on page 189) display and manage the list of NAT rules and see their configuration details. You can also create new NAT rules and edit or delete existing ones.

12.2 NAT Summary

The **NAT** summary screen provides a summary of all NAT rules and their configuration. In addition, this screen allows you to create new NAT rules and edit and delete existing NAT rules. To access this screen, log into the Web Configurator and click **Configuration > Network > NAT**. The following screen appears, providing a summary of the existing NAT rules.

Figure 101 Configuration > Network > NAT



The following table describes the labels in this screen.

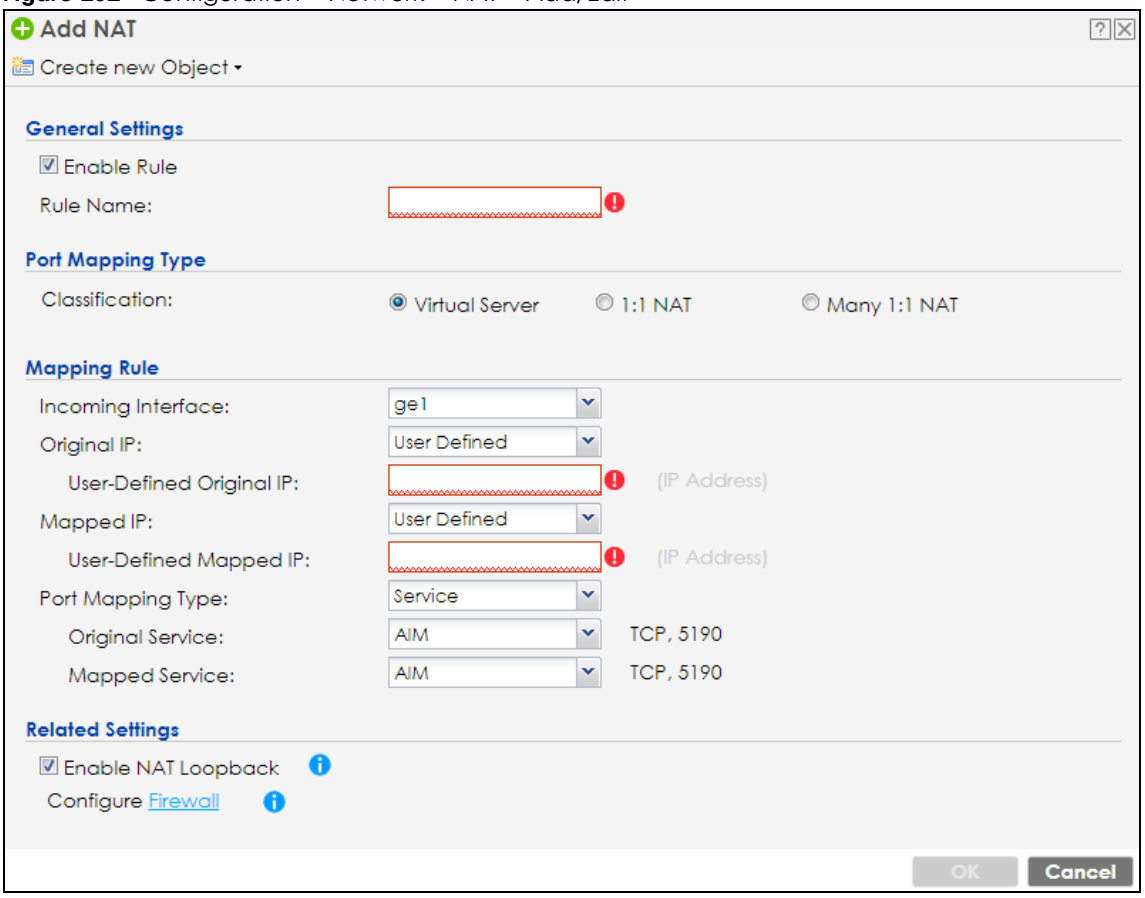
Table 83 Configuration > Network > NAT

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This field is a sequential value, and it is not associated with a specific entry.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Name	This field displays the name of the entry.
Mapping Type	This field displays what kind of NAT this entry performs: **Virtual Server**, **1:1 NAT**, or **Many 1:1 NAT**.
Interface	This field displays the interface on which packets for the NAT entry are received.
Original IP	This field displays the original destination IP address (or address object) of traffic that matches this NAT entry. It displays **any** if there is no restriction on the original destination IP address.
Mapped IP	This field displays the new destination IP address for the packet.
Protocol	This field displays the service used by the packets for this NAT entry. It displays **any** if there is no restriction on the services.
Original Port	This field displays the original destination port(s) of packets for the NAT entry. This field is blank if there is no restriction on the original destination port.
Mapped Port	This field displays the new destination port(s) for the packet. This field is blank if there is no restriction on the original destination port.
Apply	Click this button to save your changes to the NXC.
Reset	Click this button to return the screen to its last-saved settings.

12.2.1 Add/Edit NAT

This screen lets you create new NAT rules and edit existing ones. To open this window, open the **NAT** summary screen. Then, click on an **Add** icon or **Edit** icon to open the following screen.

Figure 102 Configuration > Network > NAT > Add/Edit



The following table describes the labels in this screen.

Table 84 Configuration > Network > NAT > Add/Edit

LABEL	DESCRIPTION
Create new Object	Use to configure any new settings objects that you need to use in this screen.
General Settings	
Enable Rule	Use this option to turn the NAT rule on or off.
Rule Name	Type in the name of the NAT rule. The name is used to refer to the NAT rule. You may use 1-31 alphanumeric characters, underscores (_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Port Mapping Type	

Table 84 Configuration > Network > NAT > Add/Edit (continued)

LABEL	DESCRIPTION
Classification	Select what kind of NAT this rule is to perform. **Virtual Server** - This makes computers on a private network behind the NXC available to a public network outside the NXC (like the Internet). **1:1 NAT** - If the private network server will initiate sessions to the outside clients, select this to have the NXC translate the source IP address of the server's outgoing traffic to the same public IP address that the outside clients use to access the server. **Many 1:1 NAT -** If you have a range of private network servers that will initiate sessions to the outside clients and a range of public IP addresses, select this to have the NXC translate the source IP address of each server's outgoing traffic to the same one of the public IP addresses that the outside clients use to access the server. The private and public ranges must have the same number of IP addresses. One many 1:1 NAT rule works like multiple 1:1 NAT rules, but it eases configuration effort since you only create one rule.
Mapping Rule	
Incoming Interface	Select the interface on which packets for the NAT rule must be received. It can be an Ethernet or VLAN interface.
Original IP	Specify the destination IP address of the packets received by this NAT rule's specified incoming interface. **any** - Select this to use all of the incoming interface's IP addresses including dynamic addresses. **User Defined** - Select this to manually enter an IP address in the **User Defined** field. For example, you could enter a static public IP assigned by the ISP. Host address - select a host address object to use the IP address it specifies. The list also includes address objects based on interface IPs. So for example you could select an address object based on a WAN interface even if it has a dynamic IP address.
User Defined Original IP	This field is available if **Original IP** is **User Defined**. Type the destination IP address that this NAT rule supports.
Original IP Subnet/Range	This field displays for **Many 1:1 NAT**. Select the destination IP address subnet or IP address range that this NAT rule supports. The original and mapped IP address subnets or ranges must have the same number of IP addresses.
Mapped IP	Select to which translated destination IP address this NAT rule forwards packets. **User Defined** - this NAT rule supports a specific IP address, specified in the **User Defined** field. HOST address - the drop-down box lists all the HOST address objects in the NXC. If you select one of them, this NAT rule supports the IP address specified by the address object.
User Defined Mapped IP	This field is available if **Mapped IP** is **User Defined**. Type the translated destination IP address that this NAT rule supports.
Mapped IP Subnet/Range	This field displays for **Many 1:1 NAT**. Select to which translated destination IP address subnet or IP address range this NAT rule forwards packets. The original and mapped IP address subnets or ranges must have the same number of IP addresses.
Port Mapping Type	Use the drop-down list box to select how many original destination ports this NAT rule supports for the selected destination IP address (**Original IP**). Choices are: **Any** - this NAT rule supports all the destination ports. **Service** - this NAT rule supports the destination port(s) used by the specified service(s). **Port** - this NAT rule supports one destination port. **Ports** - this NAT rule supports a range of destination ports. You might use a range of destination ports for unknown services or when one server supports more than one service. This field is read-only and displays **any** for **Many 1:1 NAT**.

Table 84 Configuration > Network > NAT > Add/Edit (continued)

LABEL	DESCRIPTION
Original Service	This field is available if **Port Mapping Type** is **Service**. Select the original service whose destination port(s) is supported by this NAT rule.
Mapped Service	This field is available if **Port Mapping Type** is **Service**. Select the translated service whose destination port(s) is supported if this NAT rule forwards the packet.
Protocol Type	This field is available if **Port Mapping Type** is **Port** or **Ports**. Select the protocol (**TCP**, **UDP**, or **Any**) used by the service requesting the connection.
Original Port	This field is available if **Port Mapping Type** is **Port**. Enter the original destination port this NAT rule supports.
Mapped Port	This field is available if **Port Mapping Type** is **Port**. Enter the translated destination port if this NAT rule forwards the packet.
Original Start Port	This field is available if **Port Mapping Type** is **Ports**. Enter the beginning of the range of original destination ports this NAT rule supports.
Original End Port	This field is available if **Port Mapping Type** is **Ports**. Enter the end of the range of original destination ports this NAT rule supports.
Mapped Start Port	This field is available if **Port Mapping Type** is **Ports**. Enter the beginning of the range of translated destination ports if this NAT rule forwards the packet.
Mapped End Port	This field is available if **Port Mapping Type** is **Ports**. Enter the end of the range of translated destination ports if this NAT rule forwards the packet. The original port range and the mapped port range must be the same size.
Related Settings	
Enable NAT Loopback	Enable NAT loopback to allow users connected to any interface (instead of just the specified **Incoming Interface**) to use the NAT rule's specified **Original IP** address to access the **Mapped IP** device. For users connected to the same interface as the **Mapped IP** device, the NXC uses that interface's IP address as the source address for the traffic it sends from the users to the **Mapped IP** device. For example, if you configure a NAT rule to forward traffic from the WAN to a LAN server, enabling NAT loopback allows users connected to other interfaces to also access the server. For LAN users, the NXC uses the LAN interface's IP address as the source address for the traffic it sends to the LAN server. If you do not enable NAT loopback, this NAT rule only applies to packets received on the rule's specified incoming interface.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to return to the **NAT** summary screen without creating the NAT rule (if it is new) or saving any changes (if it already exists).

12.3 Technical Reference

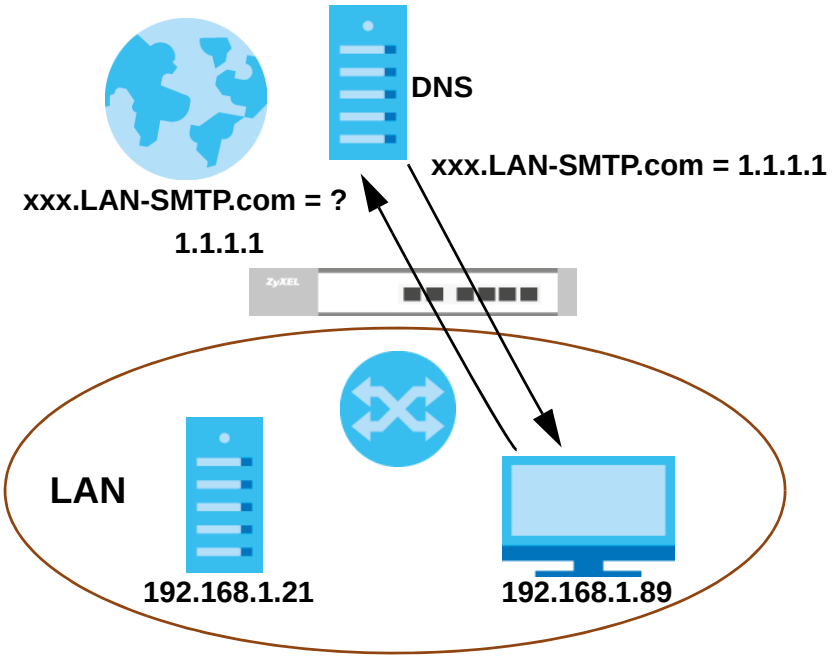
The following section contains additional technical information about the features described in this chapter.

NAT Loopback

Suppose a NAT 1:1 rule maps a public IP address to the private IP address of a LAN SMTP e-mail server to give WAN users access. NAT loopback allows other users to also use the rule's original IP to access the mail server.

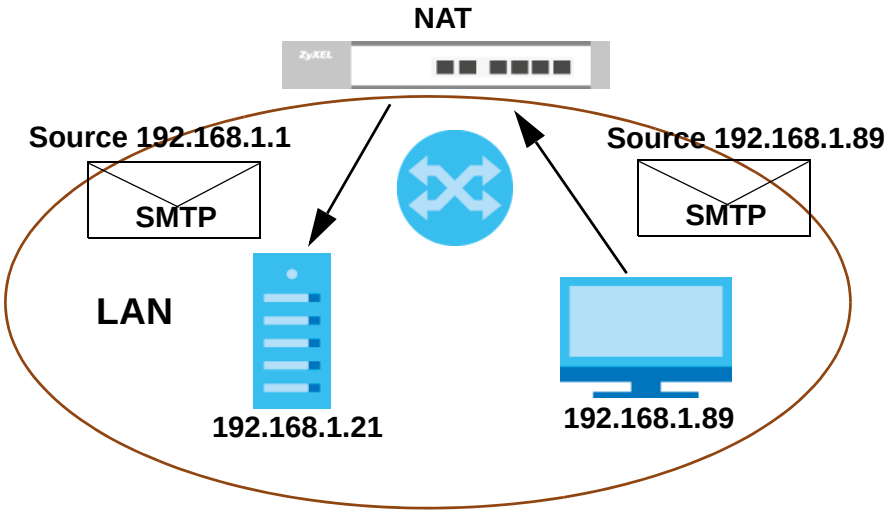
For example, a LAN user's computer at IP address 192.168.1.89 queries a public DNS server to resolve the SMTP server's domain name (xxx.LAN-SMTP.com in this example) and gets the SMTP server's mapped public IP address of 1.1.1.1.

Figure 103 LAN Computer Queries a Public DNS Server



The LAN user's computer then sends traffic to IP address 1.1.1.1. NAT loopback uses the IP address of the NXC's LAN interface (192.168.1.1) as the source address of the traffic going from the LAN users to the LAN SMTP server.

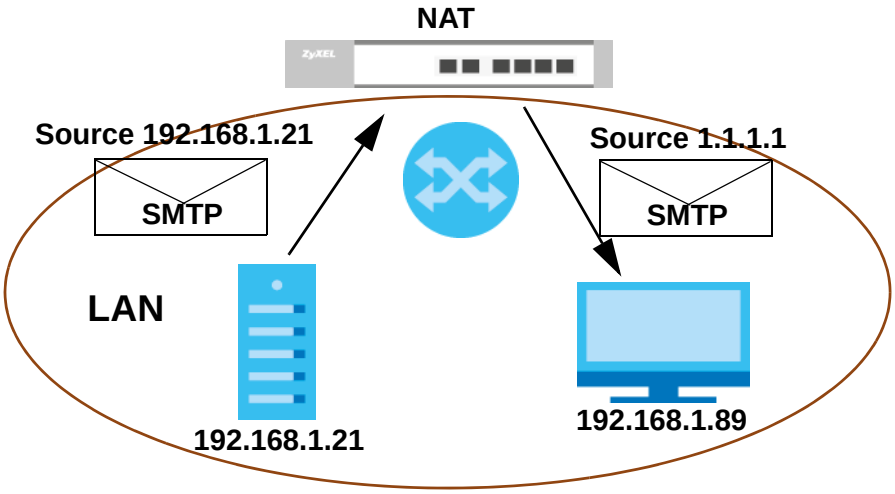
Figure 104 LAN to LAN Traffic



The LAN SMTP server replies to the NXC's LAN IP address and the NXC changes the source address to 1.1.1.1 before sending it to the LAN user. The return traffic's source matches the original destination address (1.1.1.1). If the SMTP server replied directly to the LAN user without the traffic going through NAT,

the source would not match the original destination address which would cause the LAN user's computer to shut down the session.

Figure 105 LAN to LAN Return Traffic



CHAPTER 13
ALG

13.1 Overview

Application Layer Gateway (ALG) allows the following application to operate properly through the NXC's NAT.

- FTP - File Transfer Protocol - an Internet file transfer service.

The ALG feature is only needed for traffic that goes through the NXC's NAT.

13.1.1 What You Can Do in this Chapter

The **ALG** screen (Section 13.2 on page 196) configures the FTP ALG settings.

13.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Application Layer Gateway (ALG) and NAT

The NXC can function as an Application Layer Gateway (ALG) to allow certain NAT unfriendly applications to operate properly through the NXC's NAT. The NXC dynamically creates an implicit NAT session for the application's traffic from the WAN to the LAN. The ALG on the NXC supports all of the NXC's NAT mapping types.

FTP ALG

The FTP ALG allows TCP packets with a specified port destination to pass through. If the FTP server is located on the LAN, you must also configure NAT (port forwarding) rules if you want to allow access to the server from the WAN.

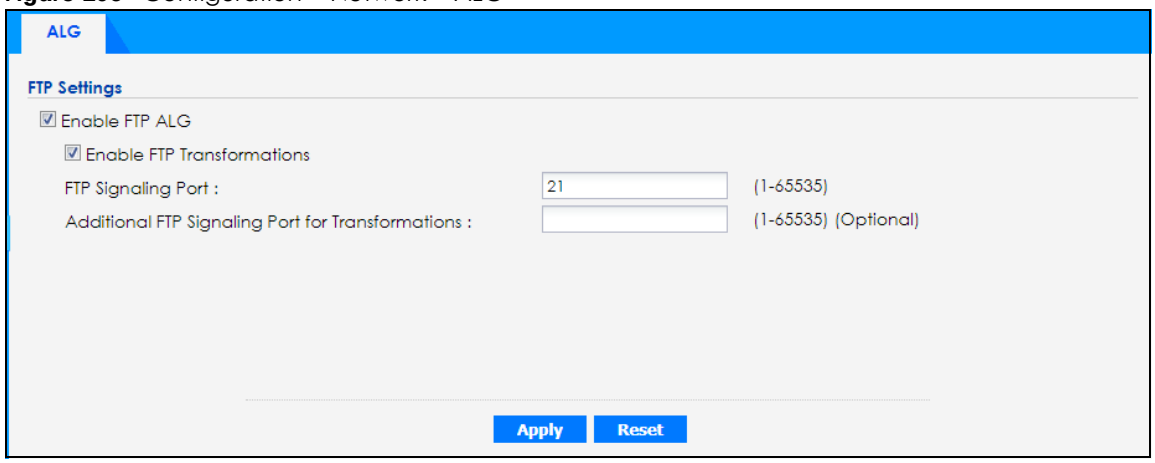
13.1.3 Before You Begin

You must also enable NAT in the NXC to allow sessions initiated from the WAN.

13.2 ALG

Click **Configuration > Network > ALG** to open this screen. Use this screen to turn the ALG off or on, configure the port numbers to which it applies.

Figure 106 Configuration > Network > ALG



The following table describes the labels in this screen.

Table 85 Configuration > Network > ALG

LABEL	DESCRIPTION
Enable FTP ALG	Turn on the FTP ALG to detect FTP (File Transfer Program) traffic and help build FTP sessions through the NXC's NAT.
Enable FTP Transformations	Select this option to have the NXC modify IP addresses and port numbers embedded in the FTP data payload to match the NXC's NAT environment. Clear this option if you have an FTP device or server that will modify IP addresses and port numbers embedded in the FTP data payload to match the NXC's NAT environment.
FTP Signaling Port	If you are using a custom TCP port number (not 21) for FTP traffic, enter it here.
Additional FTP Signaling Port for Transformations	If you are also using FTP on an additional TCP port number, enter it here.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

13.3 Technical Reference

The following section contains additional technical information about the features described in this chapter.

FTP

File Transfer Protocol (FTP) is an Internet file transfer service that operates on the Internet and over TCP/IP networks. A system running the FTP server accepts commands from a system running an FTP client. The service allows users to send commands to the server for uploading and downloading files.

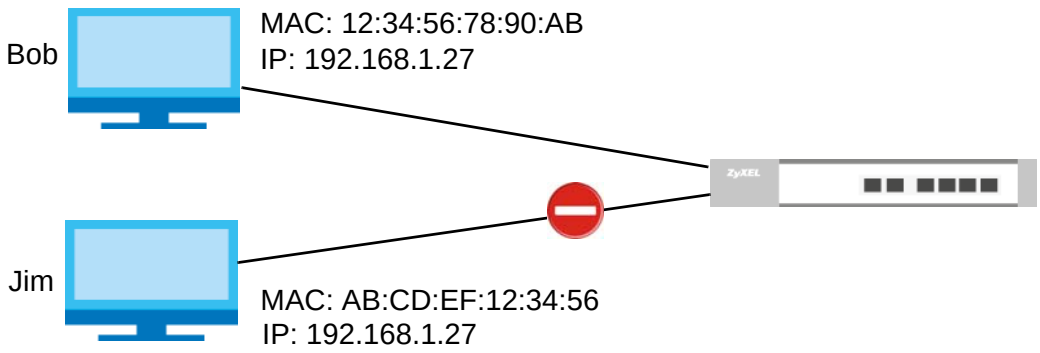
CHAPTER 14
IP/MAC Binding

14.1 Overview

IP address to MAC address binding helps ensure that only the intended devices get to use privileged IP addresses. The NXC uses DHCP to assign IP addresses and records to MAC address it assigned each IP address. The NXC then checks incoming connection attempts against this list. A user cannot manually assign another IP to his computer and use it to connect to the NXC.

Suppose you configure access privileges for IP address 192.168.1.27 and use static DHCP to assign it to Tim's computer's MAC address of 12:34:56:78:90:AB. IP/MAC binding drops traffic from any computer trying to use IP address 192.168.1.27 with another MAC address.

Figure 107 IP/MAC Binding Example



14.1.1 What You Can Do in this Chapter

- The **Summary** and **Edit** screens (Section 14.2 on page 199) bind IP addresses to MAC addresses.
- The **Exempt List** screen (Section 14.3 on page 201) configures ranges of IP addresses to which the NXC does not apply IP/MAC binding.

14.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

DHCP

IP/MAC address bindings are based on the NXC's dynamic and static DHCP entries.

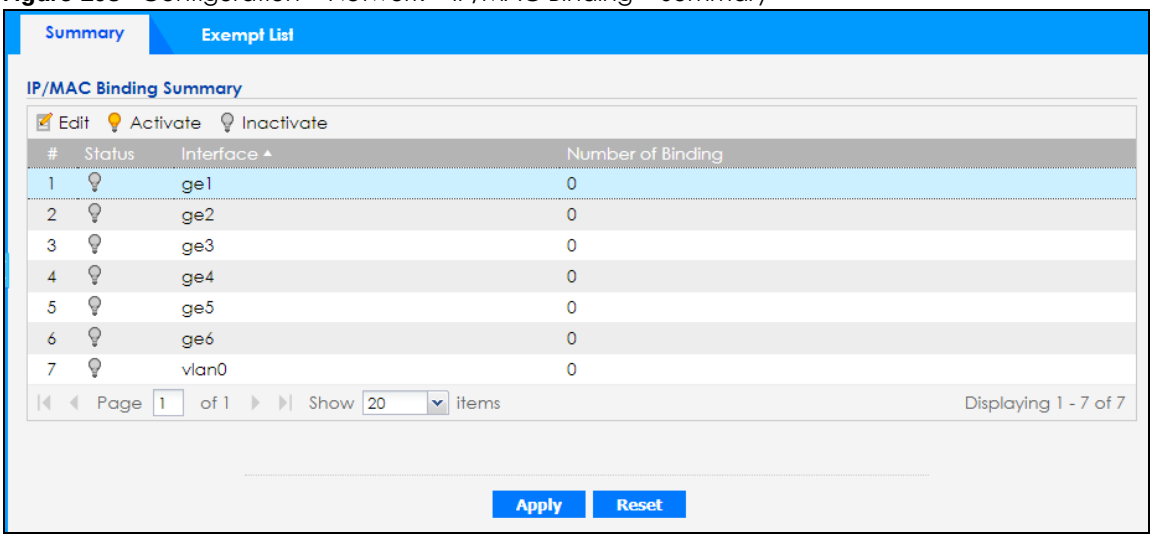
Interfaces Used With IP/MAC Binding

IP/MAC address bindings are grouped by interface. You can use IP/MAC binding with Ethernet and VLAN interfaces. You can also enable or disable IP/MAC binding and logging in an interface's configuration screen.

14.2 IP/MAC Binding Summary

Click **Configuration > Network > IP/MAC Binding** to open the **IP/MAC Binding Summary** screen. This screen lists the total number of IP to MAC address bindings for devices connected to each supported interface.

Figure 108 Configuration > Network > IP/MAC Binding > Summary



The following table describes the labels in this screen.

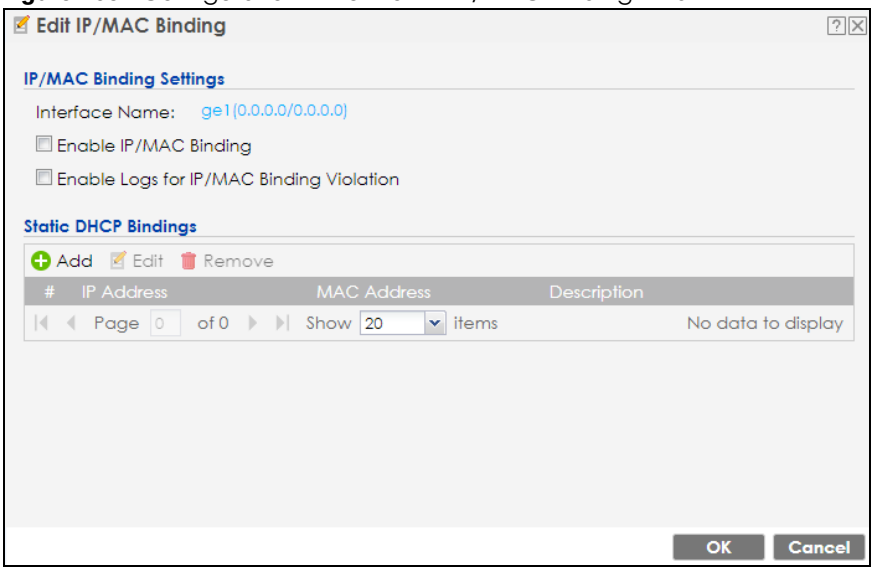
Table 86 Configuration > Network > IP/MAC Binding > Summary

LABEL	DESCRIPTION
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This field is a sequential value, and it is not associated with a specific entry.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Interface	This is the name of an interface that supports IP/MAC binding.
Number of Binding	This field displays the interface's total number of IP/MAC bindings and IP addresses that the interface has assigned by DHCP.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

14.2.1 Edit IP/MAC Binding

Click **Configuration > Network > IP/MAC Binding > Edit** to open this screen. Use this screen to configure an interface's IP to MAC address binding settings.

Figure 109 Configuration > Network > IP/MAC Binding > Edit



The following table describes the labels in this screen.

Table 87 Configuration > Network > IP/MAC Binding > Edit

LABEL	DESCRIPTION
IP/MAC Binding Settings	
Interface Name	This field displays the name of the interface within the NXC and the interface's IP address and subnet mask.
Enable IP/MAC Binding	Select this option to have this interface enforce links between specific IP addresses and specific MAC addresses. This stops anyone else from manually using a bound IP address on another device connected to this interface. Use this to make use only the intended users get to use specific IP addresses.
Enable Logs for IP/MAC Binding Violation	Select this option to have the NXC generate a log if a device connected to this interface attempts to use an IP address not assigned by the NXC.
Static DHCP Bindings	This table lists the bound IP and MAC addresses. The NXC checks this table when it assigns IP addresses. If the computer's MAC address is in the table, the NXC assigns the corresponding IP address. You can also access this table from the interface's edit screen.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
#	This is the index number of the static DHCP entry.
IP Address	This is the IP address that the NXC assigns to a device with the entry's MAC address.
MAC Address	This is the MAC address of the device to which the NXC assigns the entry's IP address.
Description	This helps identify the entry.

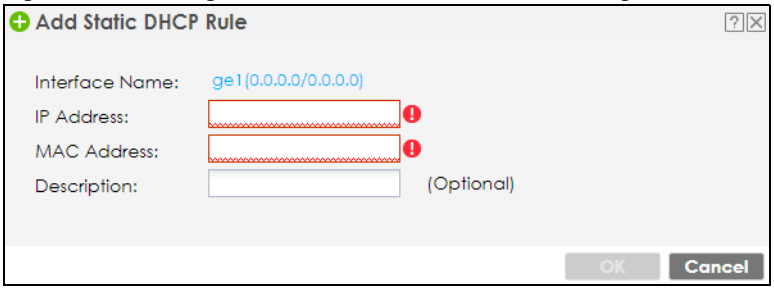
Table 87 Configuration > Network > IP/MAC Binding > Edit (continued)

LABEL	DESCRIPTION
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

14.2.2 Add/Edit Static DHCP Rule

Click **Configuration > Network > IP/MAC Binding > Edit** to open this screen. Click the **Add** or **Edit** icon to open the following screen. Use this screen to configure an interface's IP to MAC address binding settings.

Figure 110 Configuration > Network > IP/MAC Binding > Edit > Add/Edit



The following table describes the labels in this screen.

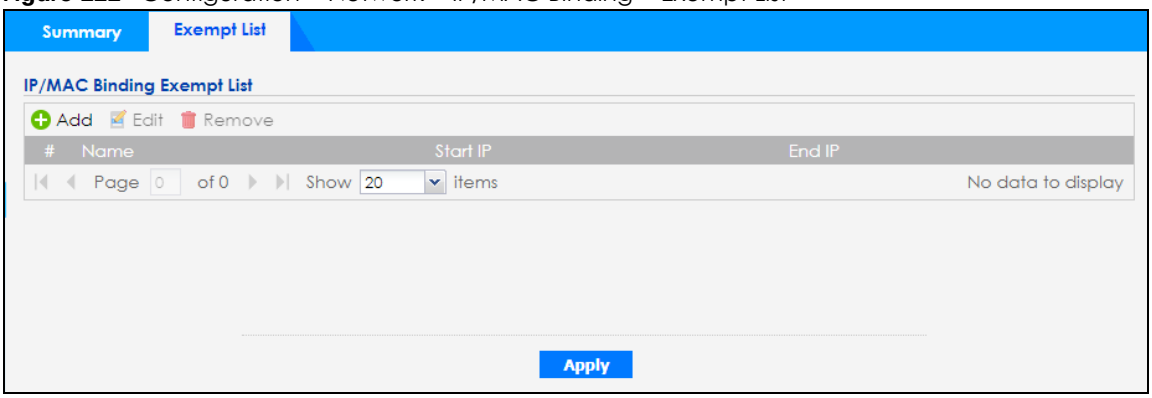
Table 88 Configuration > Network > IP/MAC Binding > Edit > Add/Edit

LABEL	DESCRIPTION
Interface Name	This field displays the name of the interface within the NXC and the interface's IP address and subnet mask.
IP Address	Enter the IP address that the NXC is to assign to a device with the entry's MAC address.
MAC Address	Enter the MAC address of the device to which the NXC assigns the entry's IP address.
Description	Enter up to 64 printable ASCII characters to help identify the entry. For example, you may want to list the computer's owner.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

14.3 IP/MAC Binding Exempt List

Click **Configuration > Network > IP/MAC Binding > Exempt List** to open the **IP/MAC Binding Exempt List** screen. Use this screen to configure ranges of IP addresses to which the NXC does not apply IP/MAC binding.

Figure 111 Configuration > Network > IP/MAC Binding > Exempt List



The following table describes the labels in this screen.

Table 89 Configuration > Network > IP/MAC Binding > Exempt List

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Click an entry or select it and click **Edit** to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
#	This is the index number of the IP/MAC binding list entry.
Name	Enter a name to help identify this entry.
Start IP	Enter the first IP address in a range of IP addresses for which the NXC does not apply IP/MAC binding.
End IP	Enter the last IP address in a range of IP addresses for which the NXC does not apply IP/MAC binding.
Apply	Click **Apply** to save your changes back to the NXC.

CHAPTER 15
Captive Portal

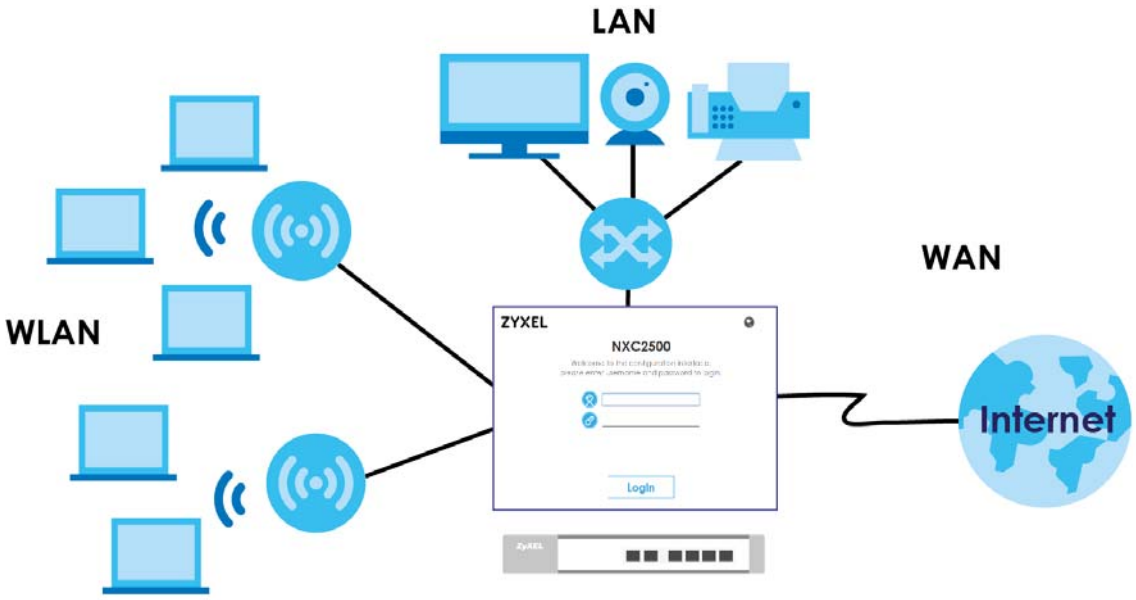
15.1 Overview

A captive portal can intercept network traffic, according to the authentication policies, until the user authenticates his or her connection, usually through a different designated login web page.

As an added security measure, the NXC contains captive portal functionality. This means all web page requests can initially be redirected to a special web page that requires you to authenticate your session. Once authentication is successful, you can then connect to the rest of the network or Internet.

Typically, you often find captive portal pages in public hotspots such as bookstores, coffee shops, and hotel rooms, to name a few; as soon as you attempt to open a web page, the hotspot's AP reroutes your browser to a captive portal page that prompts you to log in.

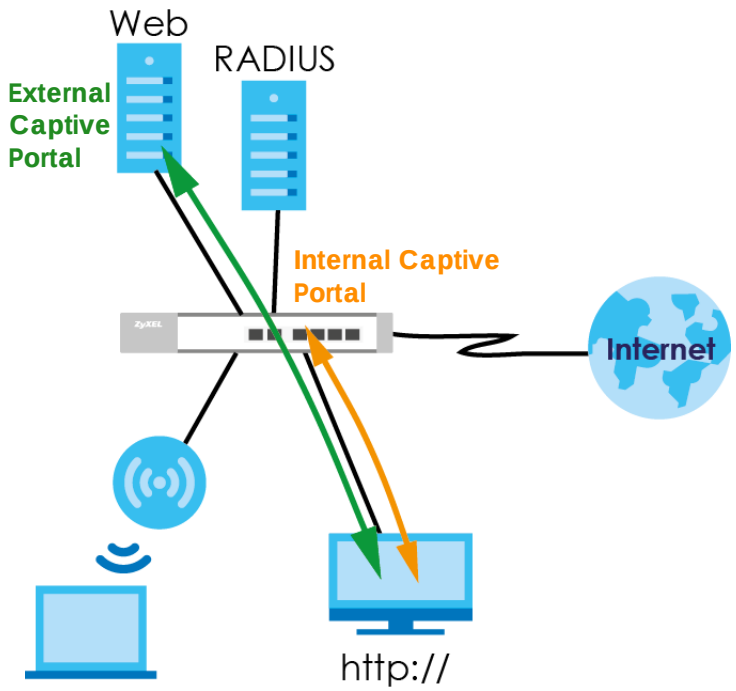
Figure 112 Captive Portal Example



The captive portal page only appears once per authentication session. Unless a user idles out or closes the connection, he or she generally will not see it again during the same session.

15.1.1 Captive Portal Type

The NXC allows you to use either an internal captive web portal (built into the NXC) or external captive web portal (on an external web server). You can even customize the portal page(s). See Section 15.3.3 on page 213 for portal pages details.



The following table shows you the differences between available web portal options.

Table 90 Captive Portal Options

OPTION	PORTAL TYPE	USER-DEFINED PORTAL PAGES	WHERE TO CONFIGURE
External Web Portal	External	Login, Logout, Welcome, Session, Error, Userlogout	Captive Portal > Redirect on Controller/AP
Default Login Page	Internal	N/A	Captive Portal > Custom Captive Portal
Customized Login Page	Internal	Login, Access, Userlogout	
Uploaded Web Portal File	Internal	Login, Logout, Welcome, Session, Error, Userlogout	

15.1.2 What You Can Do in this Chapter

- The **Captive Portal** screen (Section 15.2 on page 204) enables captive portal and defines how long a client can be connected to an SSID profile.
- The **Custom Captive Portal** screen (Section 15.3 on page 207) creates a customized login theme or uploads a login theme.
- The **Redirect on Controller** screen (Section 15.4 on page 216) allows clients to use a QR code for authentication with the NXC, and configures the authentication policy rules for traffic going through the NXC.
- The **Redirect on AP** screen (Section 15.5 on page 221) configures the authentication policy rules for traffic from specific SSIDs of the managed APs.

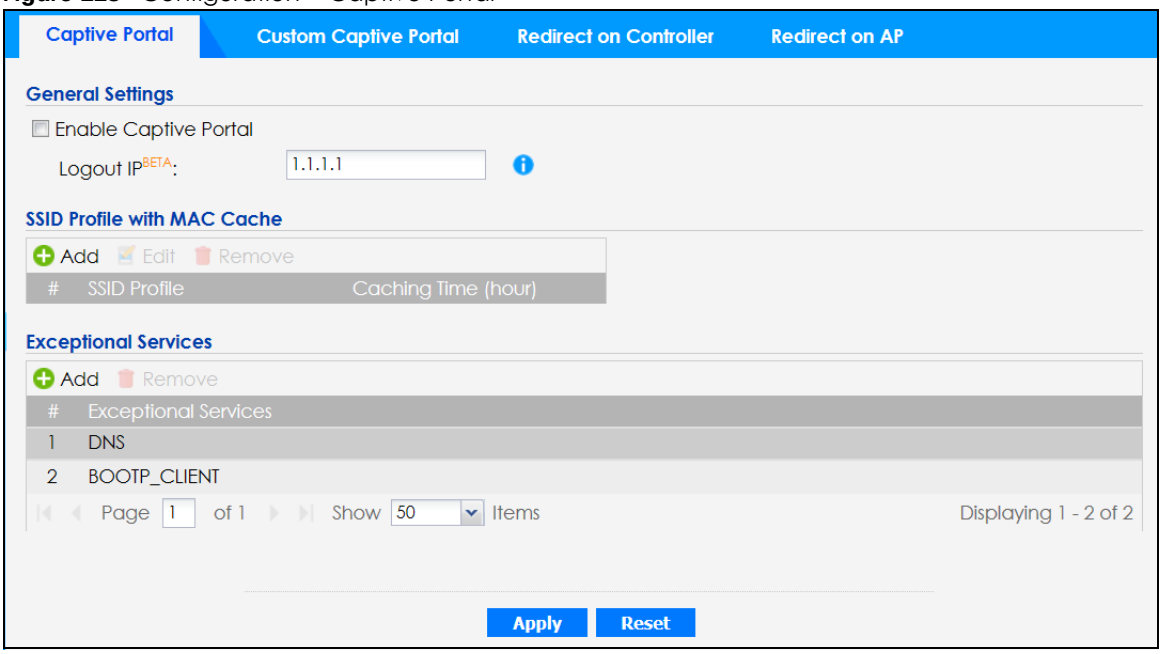
15.2 Captive Portal

This screen allows you to enable captive portal and define any exceptional services.

Click **Configuration > Captive Portal** to access this screen.

Note: You can configure the look and feel of the captive portal web page built into the NXC on the **Custom Captive Portal** screen; see Section 15.3 on page 207 for details.

Figure 113 Configuration > Captive Portal



The following table describes the labels in this screen.

Table 91 Configuration > Captive Portal

LABEL	DESCRIPTION
General Settings	
Enable Captive Portal	Select this to turn on the captive portal feature. Once enabled, all network traffic is blocked until a client authenticates with the NXC through the specifically designated captive portal page.
Logout IP	Specify an IP address that users can use to terminate their sessions manually by entering the IP address in the address bar of the web browser. Note: The manual logout IP will not work if **Authentication Type** is set to **No Authentication** in the **Captive Portal > Redirect on Controller** or **Redirect on AP > Auth. Policy Add/Edit** screen.
SSID Profile with MAC Cache	This table shows the SSID profile's MAC caching time. If you didn't set the MAC caching time for an SSID profile, the wireless client that connects to the specified SSID has to log into the network via captive portal after the session times out. Note: This only works when you select **Fallback to Captive Portal after MAC authentication failure** in the **Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit** screen.
Add	Click this to add a new rule.
Edit	Select an entry and click this to change the rule settings. The new setting applies to the new client's MAC address if you change the MAC caching time after a rule is created.

Table 91 Configuration > Captive Portal (continued)

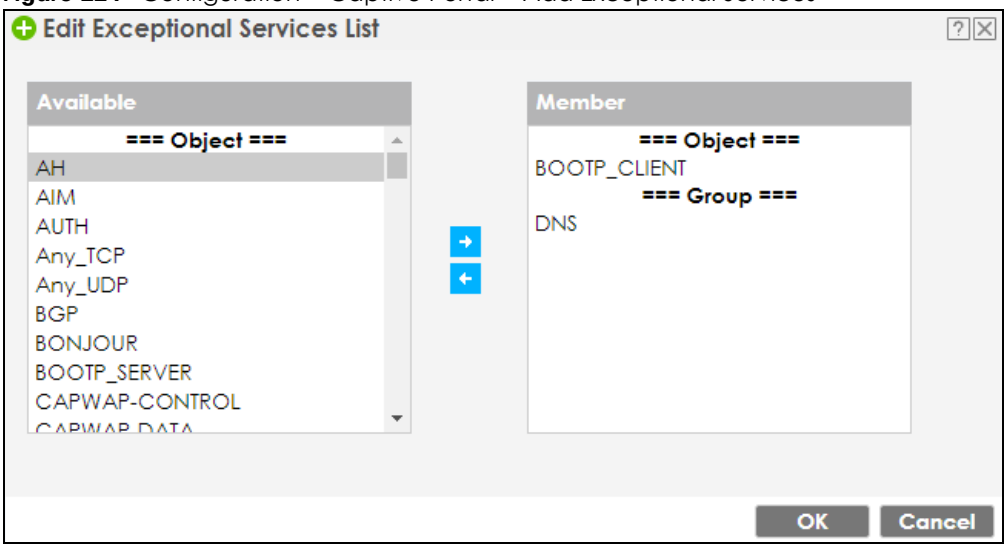
LABEL	DESCRIPTION
Remove	Select an entry and click this to delete the rule.
#	This field is a sequential value, and it is not associated with a specific rule.
SSID Profile	Select an existing SSID profile.
Caching Time (hour)	Specify how long each client (connected to the SSID defined in the SSID profile) can use the information (especially the IP address) before it has to request the information again or how long the client can log into the network via MAC authentication.
Exceptional Services	
Add	Click to add a service that is allowed to by-pass the captive portal. This allows certain networking features (such as being able to connect to a DNS server, one of the pre-configured default exceptions), to remain unhindered.
Remove	Select an exception from the table then click this button to remove it. Once removed, all traffic from the specified protocol goes back to being intercepted by the captive portal.
#	This is the index number of the **Exceptional Services** list entry.
Exceptional Services	This column lists the services that you have flagged as exceptions to captive portal interception.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

15.2.1 Add Exceptional Services

This screen allows you to manage exceptions to captive portal interception. Click the **Add** button in the **Exceptional Services** table on the **Captive Portal** screen to access this screen.

Note: If you want 802.1x to work properly, you must set BOOTP_Client and DNS as exceptional services.

Figure 114 Configuration > Captive Portal > Add Exceptional Services



The following table describes the labels in this screen.

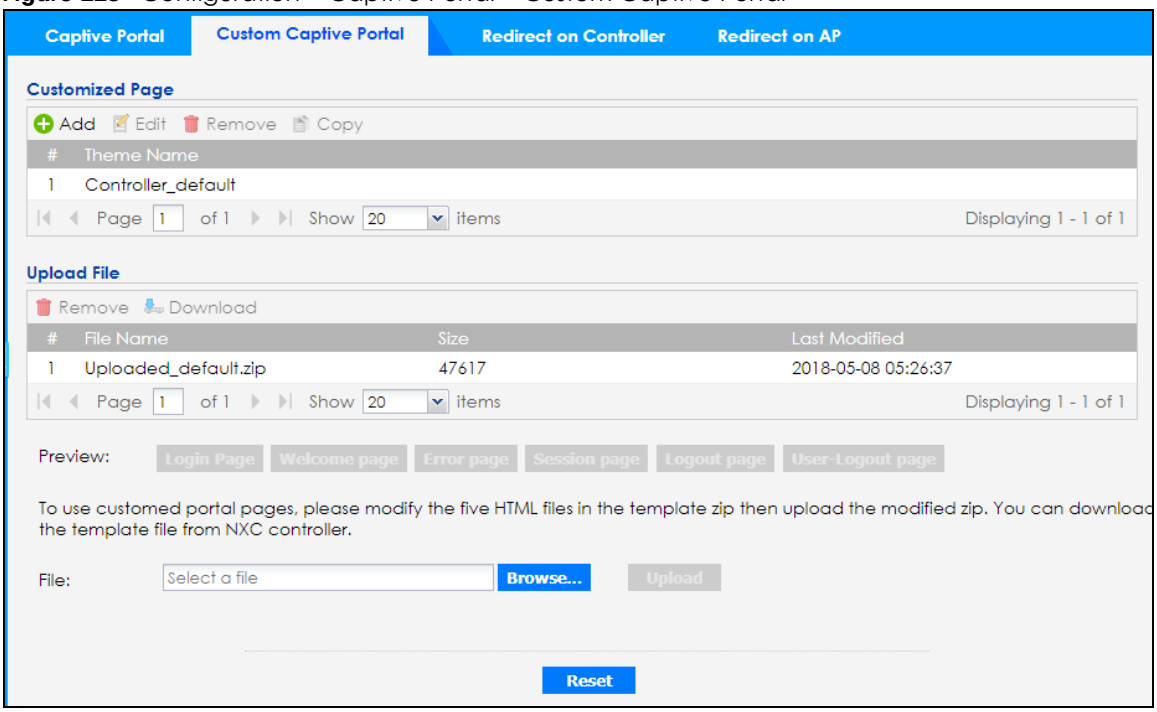
Table 92 Configuration > Captive Portal > Add Exceptional Services

LABEL	DESCRIPTION
Available	This lists all available network services eligible for being excepted from captive portal interception.
Member	This lists all networks services currently assigned to the **Exceptional Services** table.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

15.3 Custom Captive Portal

The login page appears whenever the captive portal intercepts network traffic, preventing unauthorized users from gaining access to the network. Use this page to design specific customized portal page or upload portal page zip file into the NXC. Click **Configuration > Captive Portal > Custom Captive Portal** to access this screen.

Figure 115 Configuration > Captive Portal > Custom Captive Portal



The following screen describes the labels on this screen.

Table 93 Configuration > Captive Portal > Custom Captive Portal

LABEL	DESCRIPTION
Customized Page	
Add	Click this to add a new customized login page theme.
Edit	Select an existing theme and click this to modify it.
Remove	Select an existing theme and click this to delete it.

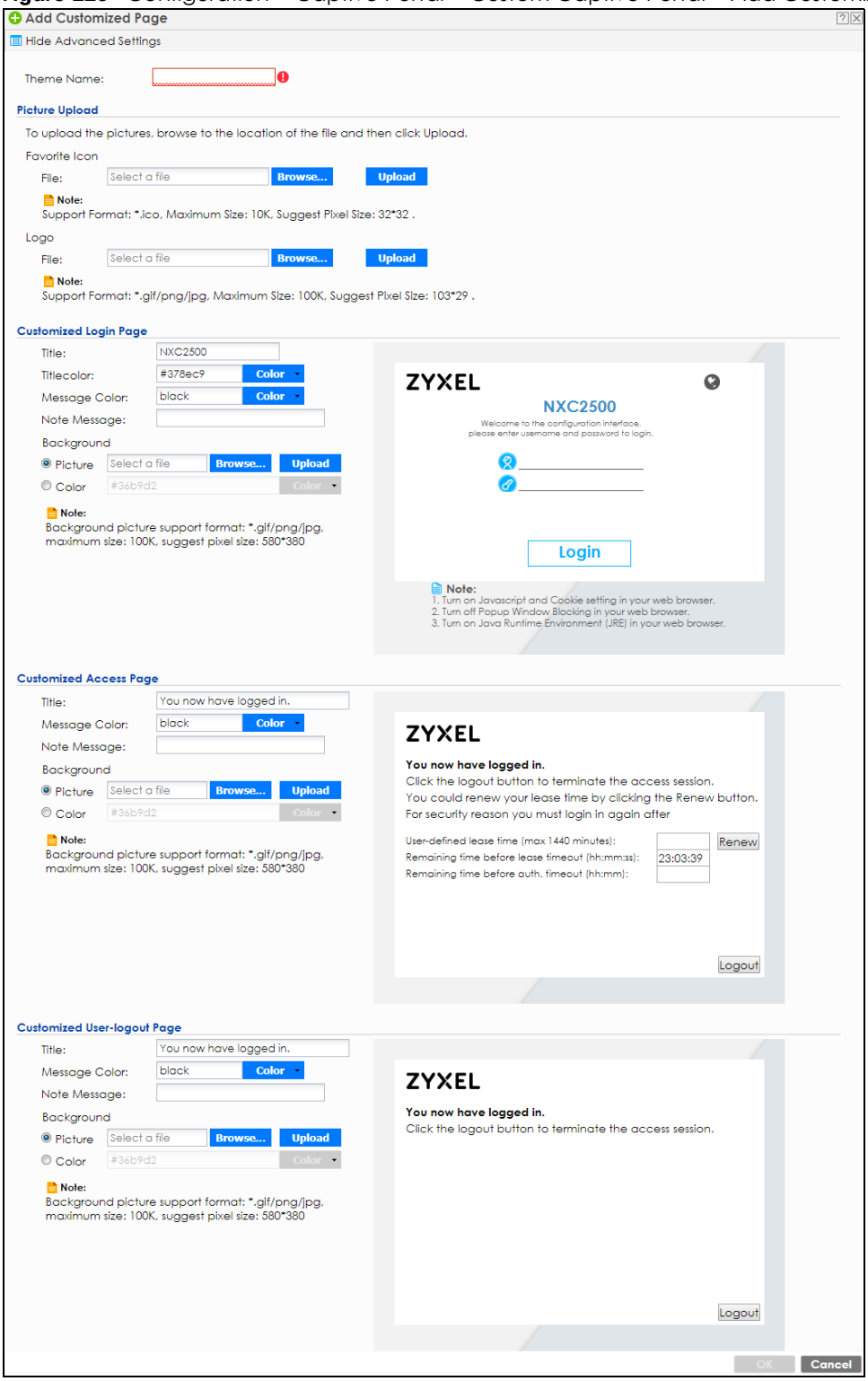
Table 93 Configuration > Captive Portal > Custom Captive Portal

LABEL	DESCRIPTION
Copy	Select an existing theme and click this to copy it. A new screen appears. The **Source File** shows the theme name of the customized page you are copying. Assign a new name to the theme in the **New Theme File** name. Click **OK** to save apply your changes, otherwise click **Cancel**.
#	This is the index number of the theme.
Theme Name	This shows the descriptive name of the theme.
Upload File	This section appears when you select **Use uploaded file**. It allows you to choose and upload a zipped web portal file to the NXC.
Remove	Select an existing web portal file and click this to delete it.
Download	Select an existing and click **Download** to download the web portal file from the NXC to your computer. This button is clickable only after you upload a zipped web port file to the NXC.
#	This is the index number of the file.
File Name	This is the descriptive name of the uploaded file.
Size	This shows the size in KB of the uploaded file.
Last Modified	This shows the date of the last time this file was modified.
Preview	Click a button to display the corresponding portal page you uploaded to the NXC. The buttons are clickable only after you upload the corresponding portal pages to the NXC.
File Path / Browse / Upload	Browse for the web portal file or enter the file path in the available input box, then click the **Upload** button to put it on the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

15.3.1 Add Customized Page

This screen allows you to add a customized login page. Click the **Add** button in the **Customized Page** table on the **Custom Captive Portal** screen to access this screen.

Figure 116 Configuration > Captive Portal > Custom Captive Portal > Add Customized Page



The following table describes the labels in this screen.

Table 94 Configuration > Captive Portal > Custom Captive Portal > Add Customized Page

LABEL	DESCRIPTION
Theme Name	Enter a descriptive name for the customized page you are creating. It should not exceed 31 characters, valid characters are [0-9][a-z] [A-Z][-_]
Picture Upload	This section allows you to choose and upload a custom favorite icon or logo image for the customized login page.
Favorite Icon	The favorite icon is an image associated with the captive portal page. The icon displays in the web browser's address bar and also next to the page's title on the tab.
File / Browse / Upload	Browse for the image file or enter the file path in the available input box, then click the **Upload** button to put it on the NXC. You can use the following image file format: ICO.
Logo	This corresponds to the "Zyxel" logo image in the default page.
File / Browse / Upload	Browse for the image file or enter the file path in the available input box, then click the **Upload** button to put it on the NXC. Once uploaded, this image file replaces the default "Zyxel" logo on the login page. You can use the following image file formats: GIF, PNG, or JPG.
Customized Login Page	This section allows you to customize the other elements on the captive portal login page.
Title	Enter 1-64 characters for the page title. Spaces are allowed. This corresponds to the "NXC" title in the default page.
Title Color	Select a font color for the page title. You can use the color palette chooser, or enter a color value of your own.
Message Color	Specify the color of the screen's text.
Note Message	Enter a note to display below the title. Use up to 1024 printable ASCII characters. Spaces are allowed.
Background	Set how the window's background looks. To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG. To use a color, select **Color** and specify the color.
Customized Access Page	This section allows you to customize elements on the 'access' page that appears upon successful login.
Title	Enter 1-64 characters for the page title. Spaces are allowed.
Message Color	Specify the color of the screen's text.
Note Message	Enter a note to display below the title. Use up to 1024 printable ASCII characters. Spaces are allowed.
Background	Set how the window's background looks. To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG. To use a color, select **Color** and specify the color.
Customized User-logout Page	This section allows you to customize elements on the user logout page.
Title	Enter 1-64 characters for the page title. Spaces are allowed.
Message Color	Specify the color of the screen's text.

Table 94 Configuration > Captive Portal > Custom Captive Portal > Add Customized Page

LABEL	DESCRIPTION
Note Message	Enter a note to display below the title. Use up to 1024 printable ASCII characters. Spaces are allowed.
Background	Set how the window's background looks. To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG. To use a color, select **Color** and specify the color.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

15.3.2 Custom Login and Access Pages

The following identify the parts you can customize in the login and access pages.

Figure 117 Login Page Customization

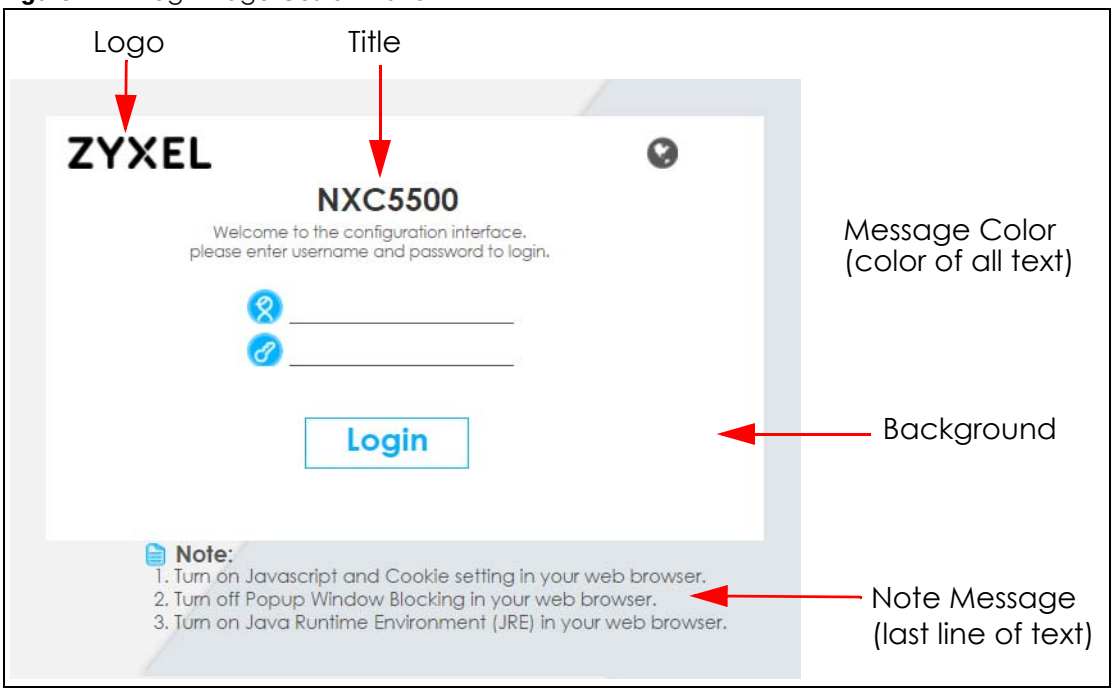


Figure 118 Access Page Customization

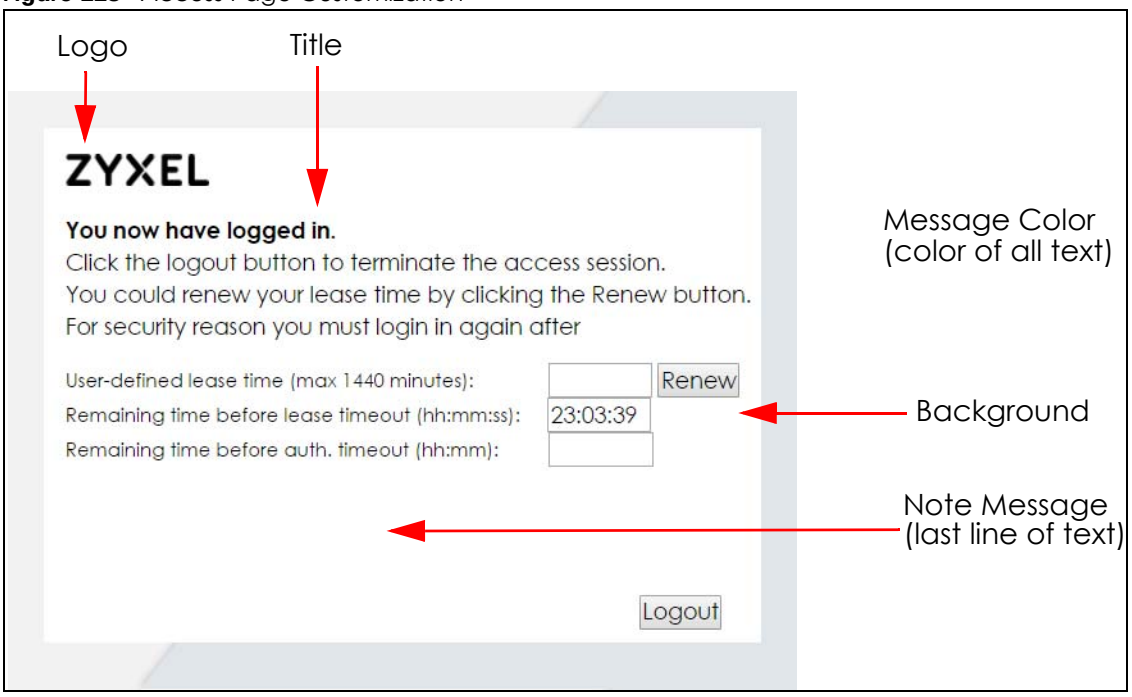
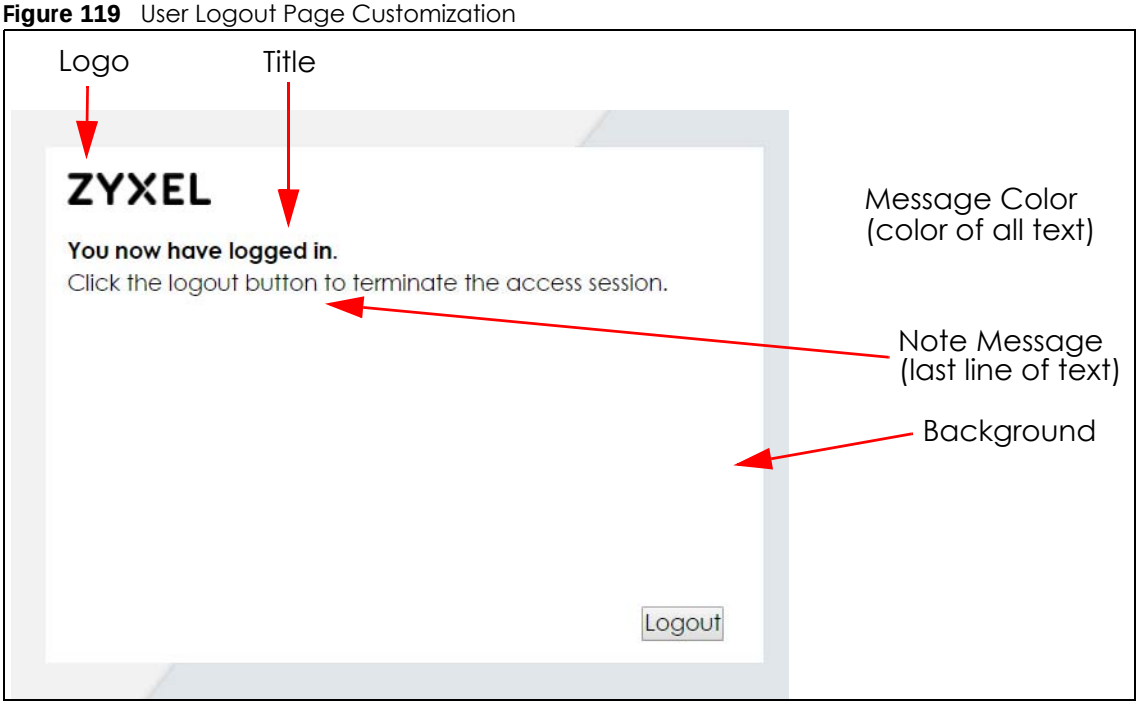


Figure 119 User Logout Page Customization



You can specify colors in one of the following ways:

- Click **Color** to display a screen of web-safe colors from which to choose.
- Enter the name of the desired color.

- Enter a pound sign (#) followed by the six-digit hexadecimal number that represents the desired color. For example, use "#000000" for black.
- Enter "rgb" followed by red, green, and blue values in parenthesis and separate by commas. For example, use "rgb(0,0,0)" for black.

Your desired color should display in the preview screen on the right after you click in another field, click **Apply**, or press [ENTER]. If your desired color does not display, your browser may not support it. Try selecting another color.

15.3.3 External or Uploaded Web Portal Details

You can also configure the look and feel of the web portal page if you use an external web portal or upload a web portal file to the NXC. Here are some examples.

Figure 120 External Web Portal Login Page Example

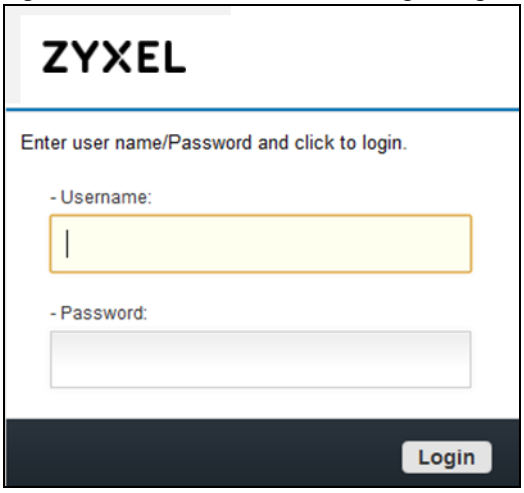


Figure 121 External Web Portal Welcome Page Example

Figure 122 External Web Portal Session Page Example

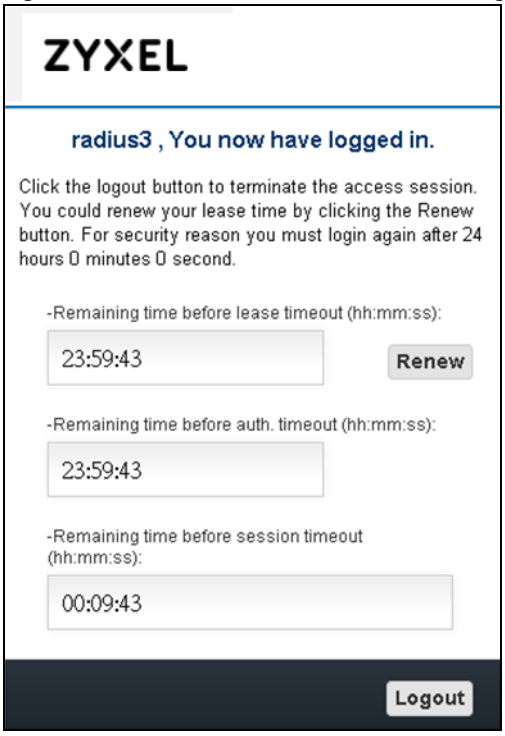


Figure 123 External Web Portal Logout Page Example

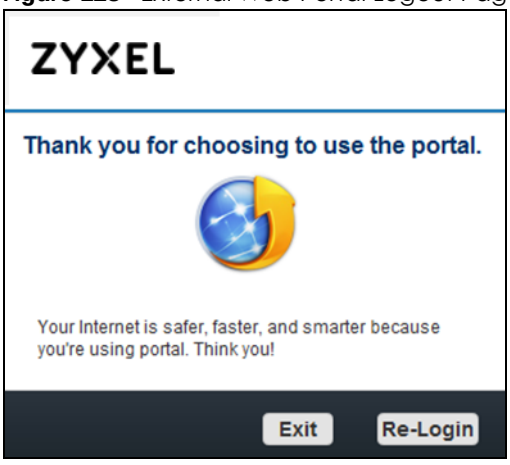


Figure 124 External Web Portal User Logout Page Example

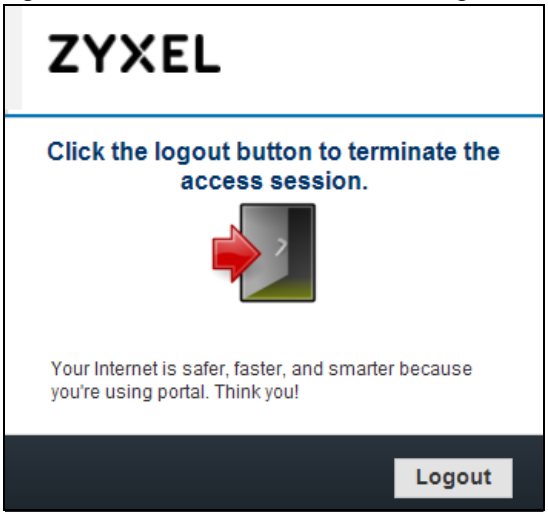
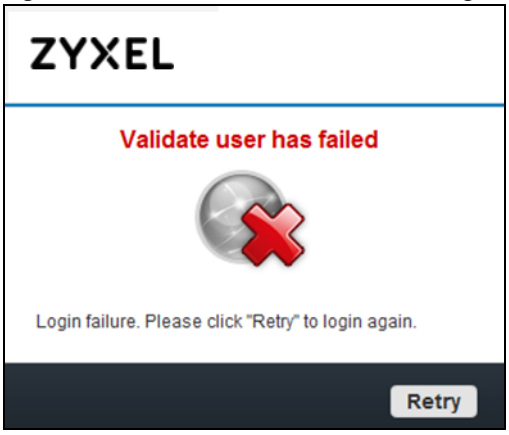


Figure 125 External Web Portal Error Page Example



Here are the error codes the NXC sends to the External Web Portal Error page.

Table 95 External Web Portal Error Page Error Codes

ERROR CODE	TITLE	MESSAGE
-1	Login denied	Validation failed
-2	Login denied	Login attempt from a locked out address
-3	Login denied	Simultaneous admin/access logons or users have reached the maximum number

Here are the HTTP parameters the NXC uses with the external URL.

Table 96 HTTP Parameters for External URL

PARAMETER	DESCRIPTION	LOGIN	WELCOME	SESSION	LOGOUT	ERROR
gw_addr	NXC IP Address	V	V	V	V	
error_num	Login error code					V
auth_hour	The remaining hours before authentication timeout			V		

Table 96 HTTP Parameters for External URL

PARAMETER	DESCRIPTION	LOGIN	WELCOME	SESSION	LOGOUT	ERROR
mpldx		V	V	V	V	
auth_min	The remaining minutes before authentication timeout			V		
auth_sec	The remaining seconds before authentication timeout			V		
lease_time	Total remaining seconds before lease timeout			V		
username	Login username			V		
cgi_str	The CGI for user login. The admin type is "admin.cgi" and the user related type is "login.cgi".	V				
Ses_time	Accounting session timeout			V		
qrcode_gw_addr	The NXC's IP address which can be accessed by the Authenticator	V				
client_ip	The IP address of the client that authenticates with a QR code	V				

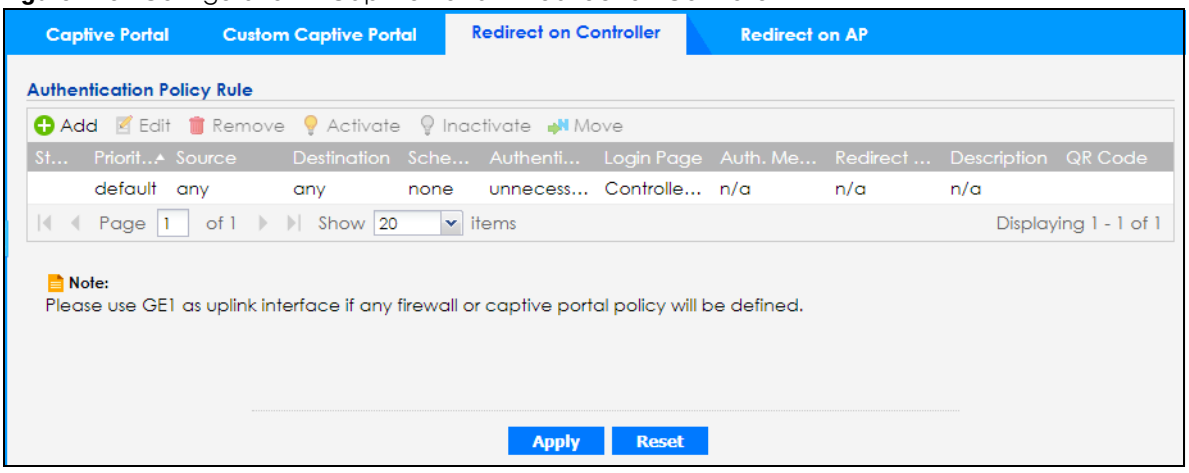
15.4 Redirect on Controller

This screen allows you to configure the authentication policy rules for traffic that goes through the controller (NXC).

To set a captive portal authentication policy rule for traffic that comes from the managed AP's WiFi clients and is not forwarded to the NXC, go to the **Captive Portal > Redirect on AP** screen.

Click **Configuration > Captive Portal > Redirect on Controller** to access this screen.

Figure 126 Configuration > Captive Portal > Redirect on Controller



The following table describes the labels in this screen.

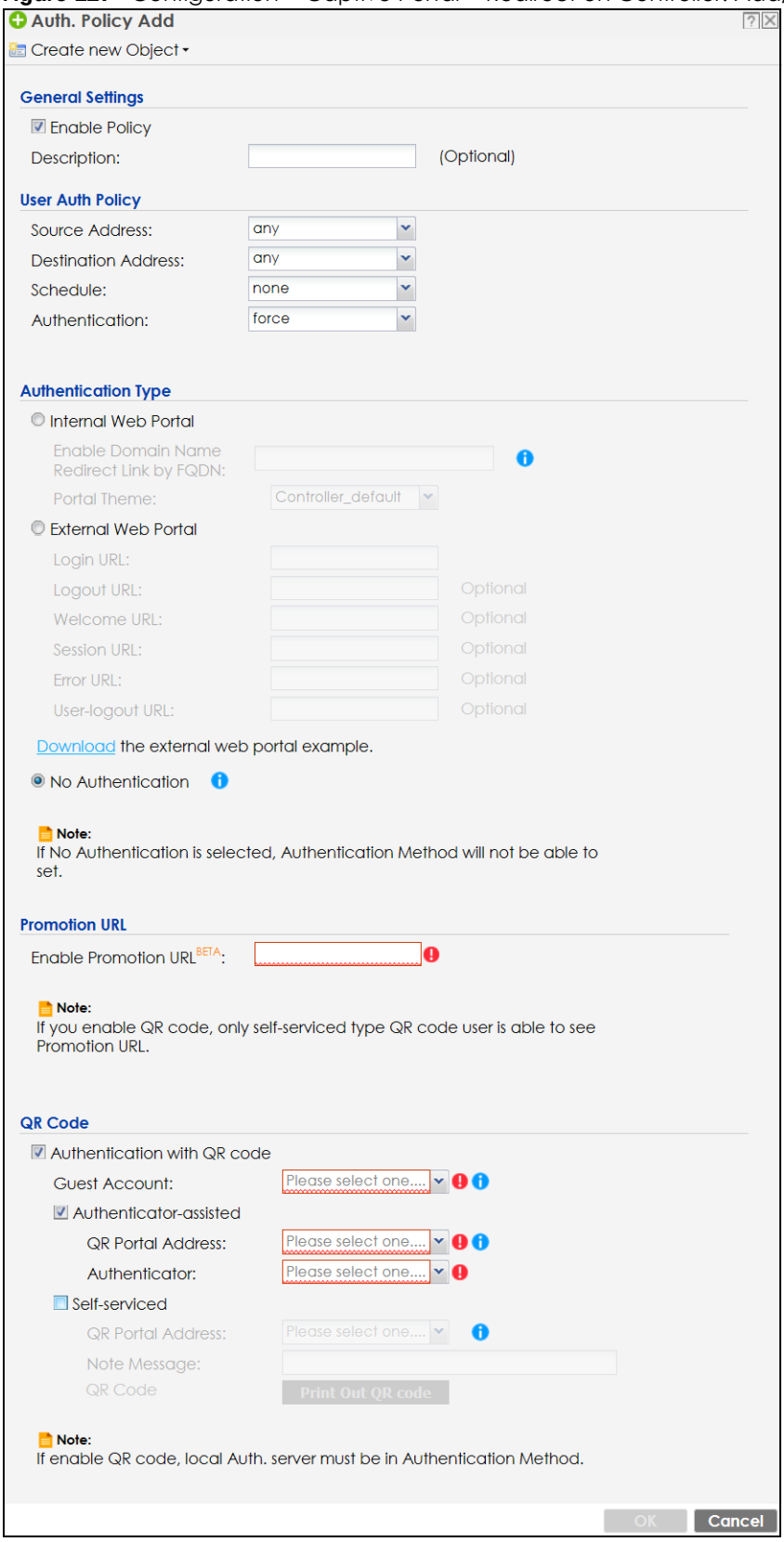
Table 97 Configuration > Captive Portal > Redirect on Controller

LABEL	DESCRIPTION
Authentication Policy Rule	This table defines how captive portal interception is implemented using the source IPs, and destination IPs that you specify.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Move	Click this to assign the selected policy a new **Priority**. When you click the button, an entry box opens beside it. Enter the priority value, then press [Enter].
Status	This indicates whether a policy is active or inactive.
Priority	This indicates the priority of a policy. Priority values are unique to each policy. If you want to adjust the priority, use the **Move** button.
Source	This indicates the source IP address to be monitored by the policy. All traffic from the source IP has the policy applied to it.
Destination	This indicates the destination IP address to be monitored by the policy. All traffic going to the destination IP has the policy applied to it.
Schedule	This indicates which **Schedule** objects (if any) is applied to the policy. A schedule object allows you to configure which times the rule is in effect.
Authentication	This indicates whether authentication is required for the policy.
Login Page	This displays the login page theme when **Authentication Type** is set to **Internal Web Portal** or **External Web Portal** in the **Auth. Policy Add/Edit** screen. Otherwise, it shows **No Authentication.**
Auth. Method	This displays the authentication method used for the captive portal page.
Redirect FQDN	This displays the internal login page's URL that you specified.
Description	This displays the description of the policy. It has no intrinsic value to the system.
QR Code	This displays whether clients can authenticate themselves with a QR code or not.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

15.4.1 Auth. Policy Add/Edit

This screen allows you to add authentication policies to captive portal interception. Click the **Add** or **Edit** button (for an existing policy) in the **Authentication Policy Summary** table on the **Captive Portal > Redirect on Controller** screen to access this screen.

Figure 127 Configuration > Captive Portal > Redirect on Controller: Add/Edit



The following table describes the labels in this screen.

Table 98 Configuration > Captive Portal > Redirect on Controller: Add/Edit

LABEL	DESCRIPTION
Create New Object	Select an object (**Address** or **Schedule**) from the list to create a new one. You can then use the object with the authentication policy rule. For example, if you create a new address object called 'CoffeeBar', then you can select it immediately from the **Source Address** list or the **Destination Address** list in this screen.
General Settings	
Enable Policy	Select this to enable the new authentication policy. You can later edit the authentication policy and deselect it if you want to disable it.
Description	Enter an optional description of the authentication policy. You can enter up to 60 characters.
User Auth Policy	
Source Address	Select an address object from the list. If none are available, you can create a new one using the **Create New Object** button. The source address is an IP address for which the captive portal intercepts all network traffic.
Destination Address	Select an address object from the list. If none are available, you can create a new one using the **Create New Object** button. The destination address is an IP address for which the captive portal intercepts all network traffic toward.
Schedule	Select a schedule from the list. If none are available, you can create one in **Configuration > Object > Schedule**.
Authentication	Select whether authentication is required or not necessary for this rule.
Authentication Method	Select an authentication method for the captive portal page. You can configure the authentication method in the **Configuration > Object > Auth. Method** screen (Chapter 26 on page 313). This field is not available if you select **No Authentication** under **Authentication Type**. Note: If the **Authentication with QR code** option is selected, make sure you also have the NXC use the local user database to authenticate clients.
Authentication Type	
Internal Web Portal	Select this to use the login page built into the NXC. The login page appears whenever the web portal intercepts network traffic, preventing unauthorized users from gaining access to the network.
Enable Domain Name Redirect Link by FQDN	This field is optional. Enter the Fully-Qualified Domain Name (FQDN) of the NXC interface to which the clients connect. This is the internal login page's URL.
Portal Theme	Select a login page theme that you created or uploaded using the **Custom Captive Portal** screen.
External Web Portal	Select this to use a custom login page from an external web portal instead of the one built into the NXC. You can configure the look and feel of the web portal page. Note: It is recommended to have the external web server on the same subnet as the login users.
Login URL	Specify the login page's URL; for example, http://IIS server IP Address/login.html. You must configure this field if you select **External Web Portal**. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Logout URL	Specify the logout page's URL; for example, http://IIS server IP Address/logout.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.

Table 98 Configuration > Captive Portal > Redirect on Controller: Add/Edit

LABEL	DESCRIPTION
Welcome URL	Specify the welcome page's URL; for example, http://IIS server IP Address/welcome.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Session URL	Specify the session page's URL; for example, http://IIS server IP Address/session.html. This page records the lease-timeout, reauth-timeout, and session-timeout for a user. The user can also click a logout button to log out. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Error URL	Specify the error page's URL; for example, http://IIS server IP Address/error.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
User-logout URL	Specify the URL of the page from which users can terminate their sessions; for example, http://IIS server IP Address/userlogout.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Download	Click this to download an example web portal file for your reference.
No Authentication	Select this to disable web authentication. Note: You must configure a web site address (in the **Enable Promotion URL** field), to which the users will be redirected. Note: If you enable captive portal and select **No Authentication**, the users use the "ua-users" account to log into the NXC and access the Internet.
Promotion URL The NXC opens the specified web site when a user attempts to access the Internet. Note: The web page (you configured in the **Enable Promotion URL** field) only appears once per user session. It may not open on an Android device or when you select to display the QR code on the login page for authentication.	
Enable Promotion URL	Enter the URL or IP address of the web page, that displays as the first web page when the user connects to the Internet. Use "http://" followed by up to 262 characters (0-9a-zA-Z;/?:@&=+$\.-_!~*'()%). For example, http://www.example.com or http://172.16.1.35.
QR Code	
Authentication with QR code	Select this option to allow clients to authenticate themselves with a QR code. A QR Code is a graphical representation of data it contains, which can be a URL. Users scan the QR code on the web portal by running a scanning app on their mobile devices or desktops and pointing the camera or webcam to the QR code. They then can quickly log into the website without entering a username and password.
Guest Account	Select a user or guest account that you created in the **Object > User/Group > User** screen. Clients that authenticate with a QR code are represented by this account name in the user list.
Authenticator -assisted	Select this option to display the QR code on the captive portal login page. Clients can log in by entering the **Guest Account** information. They can also have the specified **Authenticator** help to scan the QR code to authenticate.
QR Portal Address	Select a VLAN interface on the NXC, through which the authenticator is allowed to access the NXC.
Authenticator	Select a user account or user group that you created in the **Object > User/Group** screen to act as an authenticator. The authenticator assists clients in authentication with a QR code. Note: The authenticator must be able to access the IP address of the specified VLAN interface.

Table 98 Configuration > Captive Portal > Redirect on Controller: Add/Edit

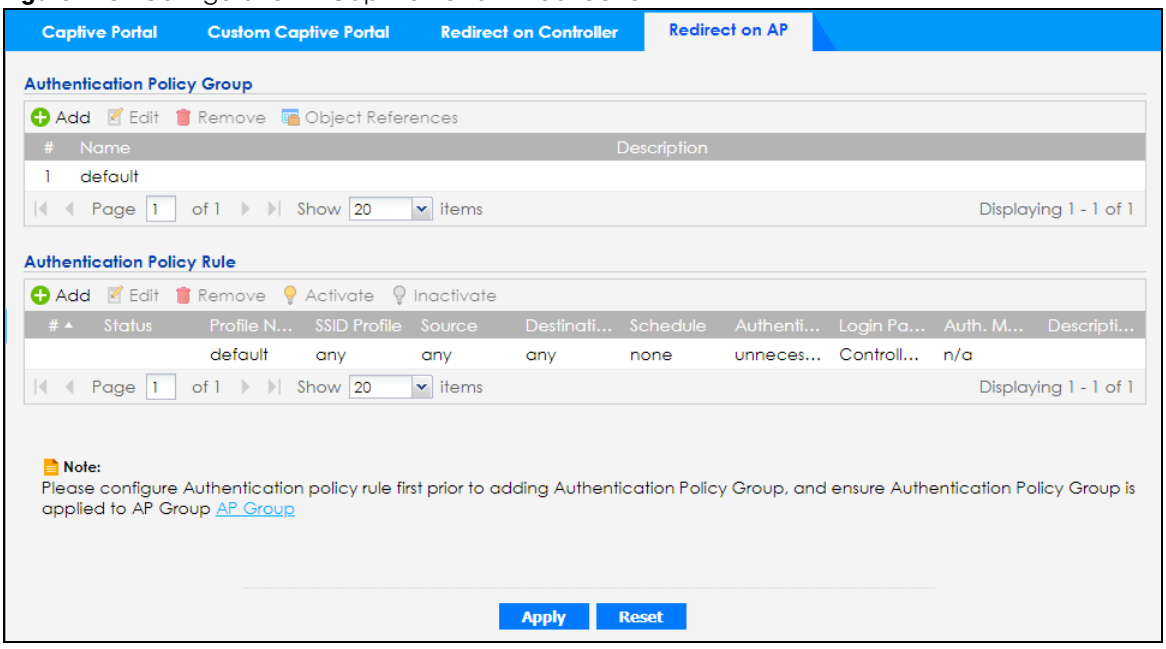
LABEL	DESCRIPTION
Self-serviced	Select this option to allow clients themselves to scan the QR code (printed out by the administrator) to log into the web site.
QR Portal Address	Select a VLAN interface on the NXC, through which the client is allowed to access the NXC.
Note Message	Enter the notes you want to display along with the QR code.
QR Code	Click the **Print Out QR Code** button to view and print the QR code.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

15.5 Redirect on AP

Use this screen to configure the authentication policy rules for traffic from SSIDs in local bridge mode and used by the managed APs. Click **Configuration > Captive Portal > Redirect on AP** to access this screen.

Note: To apply an authentication policy rule to a specific SSID, make sure the SSID is set to work in local bridge forwarding mode and associated with an AP group. You also need to add the authentication policy rule to an authentication policy group, and apply the policy group to the AP group with which the SSID is associated.

Figure 128 Configuration > Captive Portal > Redirect on AP



The following table describes the labels in this screen.

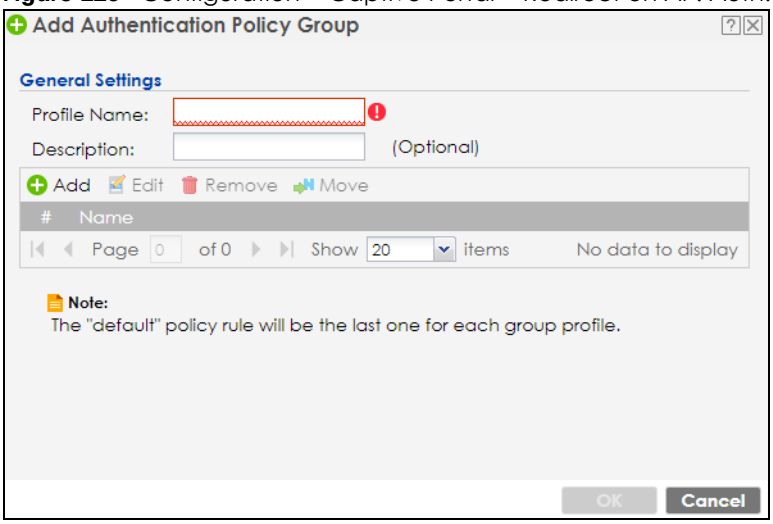
Table 99 Configuration > Captive Portal > Redirect on AP

LABEL	DESCRIPTION
Authentication Policy Group	This section allows you to view, create and manage the authentication policy groups which can be applied to a group of managed APs.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This displays the index number of the policy group.
Name	This displays the name of the policy group.
Description	This displays the description of the policy group.
Authentication Policy Rule	This section allows you to view, create and manage the authentication policies which can be added to a policy group or applied to an individual managed AP. The table defines how captive portal interception is implemented using the source IPs, and destination IPs that you specify.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This displays the index number of the policy.
Status	This indicates whether a policy is active or inactive.
Profile Name	This indicates the name of the policy.
SSID Profile	This indicates the name of the SSID profile to which the policy is applied.
Source	This indicates the source IP address to be monitored by the policy. All traffic from the source IP has the policy applied to it.
Destination	This indicates the destination IP address to be monitored by the policy. All traffic going to the destination IP has the policy applied to it.
Schedule	This indicates which **Schedule** objects (if any) is applied to the policy. A schedule object allows you to configure which times the rule is in effect.
Authentication	This indicates whether authentication is required for the policy.
Login Page	This displays the login page theme when **Authentication Type** is set to **Internal Web Portal** or **External Web Portal** in the **Auth. Policy Group Add/Edit** screen. Otherwise, it shows **No Authentication**.
Auth. Method	This displays the authentication method used for the captive portal page.
Description	This displays the description of the policy. It has no intrinsic value to the system.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

15.5.1 Auth. Policy Group Add/Edit

This screen allows you to add authentication policy groups for managed AP groups. Click the **Add** or **Edit** button (for an existing policy) in the **Authentication Policy Group** table on the **Captive Portal > Redirect on AP** screen to access this screen.

Figure 129 Configuration > Captive Portal > Redirect on AP: Auth. Policy Group Add/Edit



The following table describes the labels in this screen.

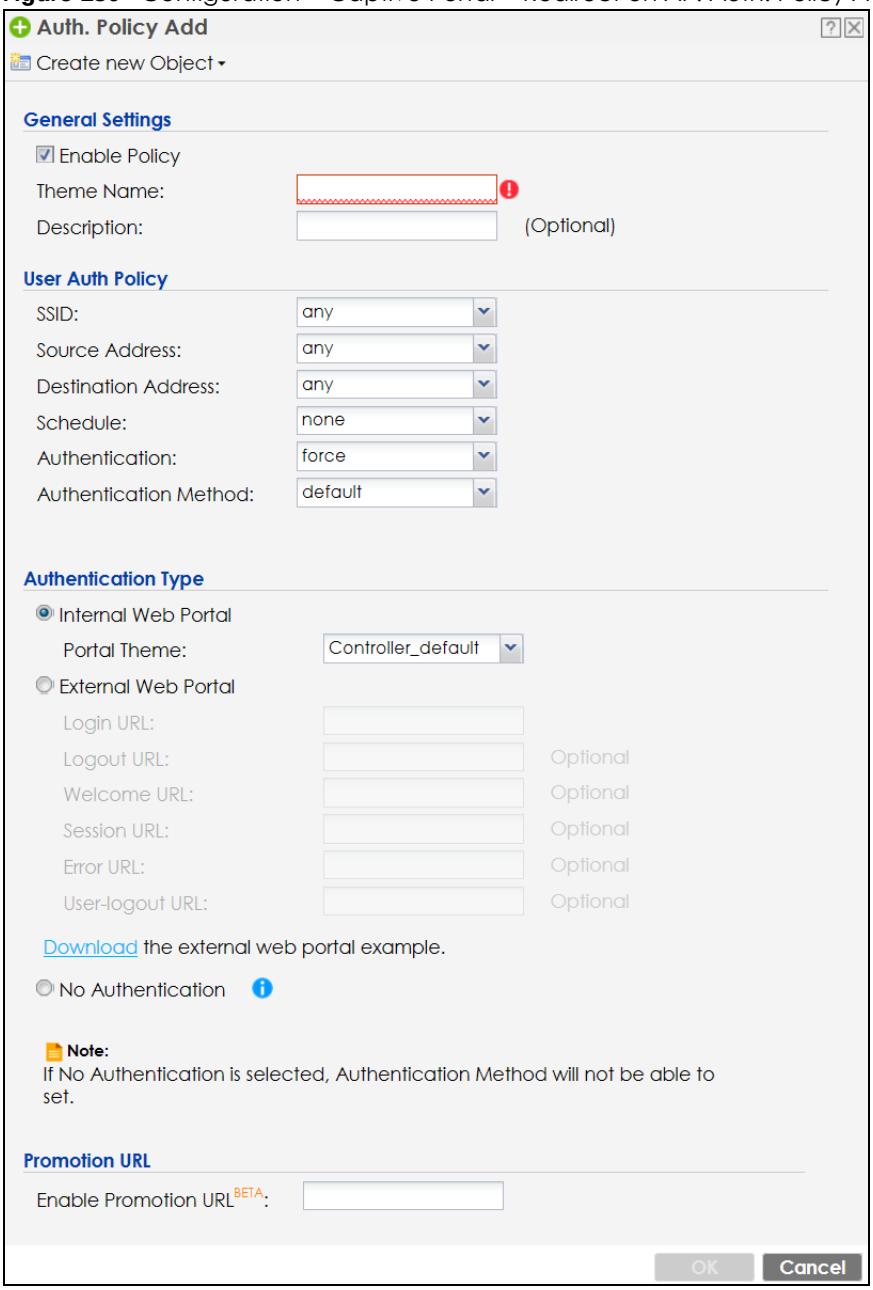
Table 100 Configuration > Captive Portal > Redirect on AP: Auth. Policy Group Add/Edit

LABEL	DESCRIPTION
General Settings	
Profile Name	Enter a name for this policy group. You can use up to 31 alphanumeric characters. Dashes and underscores are also allowed. The name should start with a letter.
Description	Enter an optional description of the authentication policy group. You can enter up to 60 characters.
Add	Click this to create a new entry.
Edit	Select an entry and click **Edit** to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Move	Click this to assign the selected policy group a new priority. When you click the button, an entry box opens beside it. Enter the priority value, then press [Enter].
#	This indicates the priority of a policy group. Priority values are unique to each policy group. If you want to adjust the priority, use the **Move** button.
Name	This field displays the name of the authentication policy that is added to this group. You can click the name to make it editable.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

15.5.2 Auth. Policy Add/Edit

This screen allows you to add or configure authentication policy rules. Click the **Add** or **Edit** button (for an existing policy) in the **Authentication Policy Rule** table on the **Captive Portal > Redirect on AP** screen to access this screen.

Figure 130 Configuration > Captive Portal > Redirect on AP: Auth. Policy Add/Edit



The following table describes the labels in this screen.

Table 101 Configuration > Captive Portal > Redirect on AP: Auth. Policy Add/Edit

LABEL	DESCRIPTION
Create New Object	Select an object (**SSID Profile**, **Address** or **Schedule**) from the list to create a new one. You can then use the object with the authentication policy rule. For example, if you create a new address object called 'CoffeeBar', then you can select it immediately from the **Source Address** list or the **Destination Address** list in this screen.
General Settings	
Enable Policy	Select this to enable the new authentication policy. You can later edit the authentication policy and deselect it if you want to disable it.
Theme Name	Enter a name for this policy. You can use up to 31 alphanumeric characters. Dashes and underscores are also allowed. The name should start with a letter.
Description	Enter an optional description of the authentication policy. You can enter up to 60 characters.
User Auth Policy	
SSID	Select a pre-defined SSID profile to which the policy is applied. Note: You cannot select and apply the policy to an SSID profile in **Tunnel** forwarding mode.
Source Address	Select an address object from the list. If none are available, you can create a new one using the **Create New Object** button. The source address is an IP address for which the captive portal intercepts all network traffic.
Destination Address	Select an address object from the list. If none are available, you can create a new one using the **Create New Object** button. The destination address is an IP address for which the captive portal intercepts all network traffic toward.
Schedule	Select a schedule from the list. If none are available, you can create one in **Configuration > Object > Schedule**.
Authentication	Select whether authentication is required or not necessary for this rule.
Authentication Method	Select an authentication method for the captive portal page. You can configure the authentication method in the **Configuration > Object > Auth. Method** screen (Chapter 26 on page 313). This field is not available if you select **No Authentication** under **Authentication Type**.
Authentication Type	
Internal Web Portal	Select this to use the login page built into the NXC. The login page appears whenever the web portal intercepts network traffic, preventing unauthorized users from gaining access to the network.
Portal Theme	Select a login page theme that you created or uploaded using the **Custom Captive Portal** screen.
External Web Portal	Select this to use a custom login page from an external web portal instead of the one built into the NXC. You can configure the look and feel of the web portal page. Note: It is recommended to have the external web server on the same subnet as the login users.
Login URL	Specify the login page's URL; for example, http://IIS server IP Address/login.html. You must configure this field if you select **External Web Portal**. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Logout URL	Specify the logout page's URL; for example, http://IIS server IP Address/logout.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.

Table 101 Configuration > Captive Portal > Redirect on AP: Auth. Policy Add/Edit

LABEL	DESCRIPTION
Welcome URL	Specify the welcome page's URL; for example, http://IIS server IP Address/welcome.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Session URL	Specify the session page's URL; for example, http://IIS server IP Address/session.html. This page records the lease-timeout, reauth-timeout, and session-timeout for a user. The user can also click a logout button to log out. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Error URL	Specify the error page's URL; for example, http://IIS server IP Address/error.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
User-logout URL	Specify the URL of the page from which users can terminate their sessions; for example, http://IIS server IP Address/userlogout.html. The Internet Information Server (IIS) is the web server on which the web portal files are installed.
Download	Click this to download an example web portal file for your reference.
No Authentication	Select this to disable web authentication. Note: You must configure a web site address (in the **Enable Promotion URL** field), to which the users will be redirected. Note: If you enable captive portal and select **No Authentication**, the users use the "ua-users" account to log into the NXC and access the Internet.
Promotion URL The AP opens the specified web site when a user attempts to access the Internet. Note: The web page (you configured in the **Enable Promotion URL** field) only appears once per user session. It may not open on an Android device.	
Enable Promotion URL	Enter the URL or IP address of the web page, that displays as the first web page whenthe user connects to the Internet. Use "http://" followed by up to 262 characters (0-9a-zA-Z;/?:@&=+$\.-_!~*'()%). For example, http://www.example.com or http://172.16.1.35.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 16
RTLS

16.1 Overview

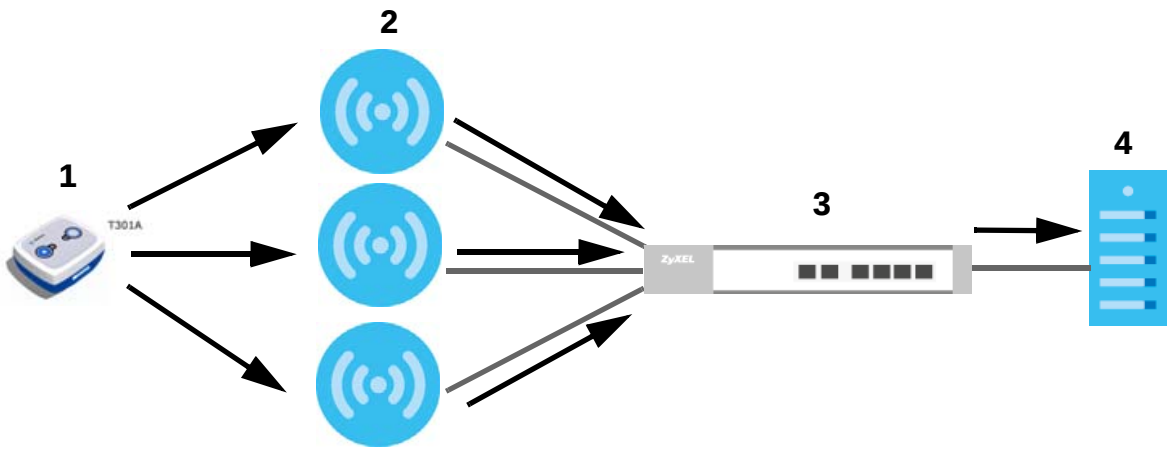
Ekahau RTLS (Real Time Location Service) tracks battery-powered WiFi tags attached to APs managed by the NXC to create maps, alerts, and reports.

The Ekahau RTLS Controller is the centerpiece of the RTLS system. This server software runs on a Windows computer to track and locate Ekahau tags from WiFi signal strength measurements. Use the NXC with the Ekahau RTLS system to take signal strength measurements at the APs (Integrated Approach / Blink Mode).

The following example shows the Ekahau RTLS Integrated Approach (Blink Mode).

1. The WiFi tag sends blink packets at specified intervals (or triggered by something like motion or button presses).
2. The APs pick up the blink packets, measure the signal strength, and send it to the NXC.
3. The NXC forwards the signal measurements to the Ekahau RTLS Controller.
4. The Ekahau RTLS Controller calculates the tag positions.

Figure 131 RTLS Example



16.1.1 What You Can Do in this Chapter

Use the **RTLS** screen (Section 16.3 on page 228) to use the managed APs as part of an Ekahau RTLS to track the location of Ekahau WiFi tags.

16.2 Before You Begin

You need:

- At least three APs managed by the NXC (the more APs the better since it increases the amount of information the Ekahau RTLS Controller has for calculating the location of the tags)
- IP addresses for the Ekahau WiFi tags.
- A dedicated RTLS SSID is recommended.
- Ekahau RTLS Controller in blink mode with TZSP Updater enabled.
- Firewall rules to allow RTLS traffic if the NXC firewall is enabled or the Ekahau RTLS Controller is behind a firewall.

For example, if the Ekahau RTLS Controller is behind a firewall, open ports 8550, 8553, and 8569 to allow traffic the APs send to reach the Ekahau RTLS Controller.

The following table lists default port numbers and types of packets RTLS uses.

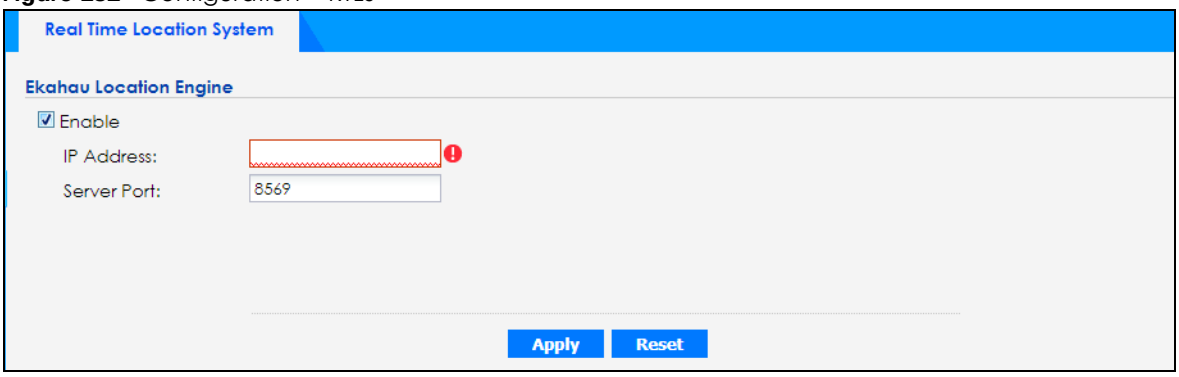
Table 102 RTLS Traffic Port Numbers

PORT NUMBER	TYPE	DESCRIPTION
8548	TCP	Ekahau T201 location update.
8549	UDP	Ekahau T201 location update.
8550	TCP	Ekahau T201 tag maintenance protocol and Ekahau RTLS Controller user interface.
8552	UDP	Ekahau Location Protocol.
8553	UDP	Ekahau Maintenance Protocol.
8554	UDP	Ekahau T301 firmware update.
8560	TCP	Ekahau Vision web interface.
8562	UDP	Ekahau T301W firmware update.
8569	UDP	Ekahau TZSP Listener Port.

16.3 Configuring RTLS

Click **Configuration > RTLS** to open this screen. Use this screen to turn RTLS (Real Time Location System) on or off and specify the IP address and server port of the Ekahau RTLS Controller.

Figure 132 Configuration > RTLS



The following table describes the labels in this screen.

Table 103 Configuration > RTLS

LABEL	DESCRIPTION
Enable	Select this to use WiFi to track the location of Ekahau WiFi tags.
IP Address	Specify the IP address of the Ekahau RTLS Controller.
Server Port	Specify the server port number of the Ekahau RTLS Controller.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

CHAPTER 17
Firewall

17.1 Overview

Use the firewall to block or allow services that use static port numbers. The firewall can also limit the number of user sessions.

17.1.1 What You Can Do in this Chapter

- The **Firewall** screens (Section 17.2 on page 232) enable or disable the firewall and asymmetrical routes, and manage and configure firewall rules.
- The **Session Control** screens (Section 17.3 on page 235) limit the number of concurrent NAT/firewall sessions a client can use.

17.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

Stateful Inspection

The NXC has a stateful inspection firewall. The NXC restricts access by screening data packets against defined access rules. It also inspects sessions. For example, traffic from one zone is not allowed unless it is initiated by a computer in another zone first.

Zones

A zone is a group of interfaces. Group the NXC's interfaces into different zones based on your needs. You can configure firewall rules for data passing between zones or even between interfaces in a zone.

Default Firewall Behavior

Firewall rules are grouped based on the direction of travel of packets to which they apply. Here is the default firewall behavior for traffic going through the NXC in various directions.

Table 104 Default Firewall Behavior

FROM ZONE TO ZONE	BEHAVIOR
From ANY to ANY	Traffic that does not match any firewall rule is allowed. So for example, LAN to WAN, LAN to DMZ, and LAN to WLAN traffic is allowed. This also includes traffic to or from interfaces that are not assigned to a zone (extra-zone traffic).

To-NXC Rules

Rules with **EnterpriseWLAN** as the **To Zone** apply to traffic going to the NXC itself. By default:

- The firewall allows any computers to access or manage the NXC.

When you configure a firewall rule for packets destined for the NXC itself, make sure it does not conflict with your service control rule. The NXC checks the firewall rules before the service control rules for traffic destined for the NXC.

You can configure a To-NXC firewall rule (with **From Any To EnterpriseWLAN** direction) for traffic from an interface which is not in a zone.

Global Firewall Rules

Firewall rules with **from any** and/or **to any** as the packet direction are called global firewall rules. The global firewall rules are the only firewall rules that apply to an interface that is not included in a zone. The **from any** rules apply to traffic coming from the interface and the **to any** rules apply to traffic going to the interface.

Firewall Rule Criteria

The NXC checks the schedule, user name (user's login name on the NXC), source IP address, destination IP address and IP protocol type of network traffic against the firewall rules (in the order you list them). When the traffic matches a rule, the NXC takes the action specified in the rule.

User Specific Firewall Rules

You can specify users or user groups in firewall rules. For example, to allow a specific user from any computer to access a zone by logging in to the NXC, you can set up a rule based on the user name only. If you also apply a schedule to the firewall rule, the user can only access the network at the scheduled time. A user-aware firewall rule is activated whenever the user logs in to the NXC and will be disabled after the user logs out of the NXC.

Session Limits

Accessing the NXC or network resources through the NXC requires a NAT session and corresponding firewall session. Peer to peer applications, such as file sharing applications, may use a large number of NAT sessions. A single client could use all of the available NAT sessions and prevent others from connecting to or through the NXC. The NXC lets you limit the number of concurrent NAT/firewall sessions a client can use.

Asymmetrical Routes

If an alternate gateway on the LAN has an IP address in the same subnet as the NXC's LAN IP address, return traffic may not go through the NXC. This is called an asymmetrical or "triangle" route. This causes the NXC to reset the connection, as the connection has not been acknowledged.

You can have the NXC permit the use of asymmetrical route topology on the network (not reset the connection). However, allowing asymmetrical routes may let traffic from the WAN go directly to the LAN without passing through the NXC.

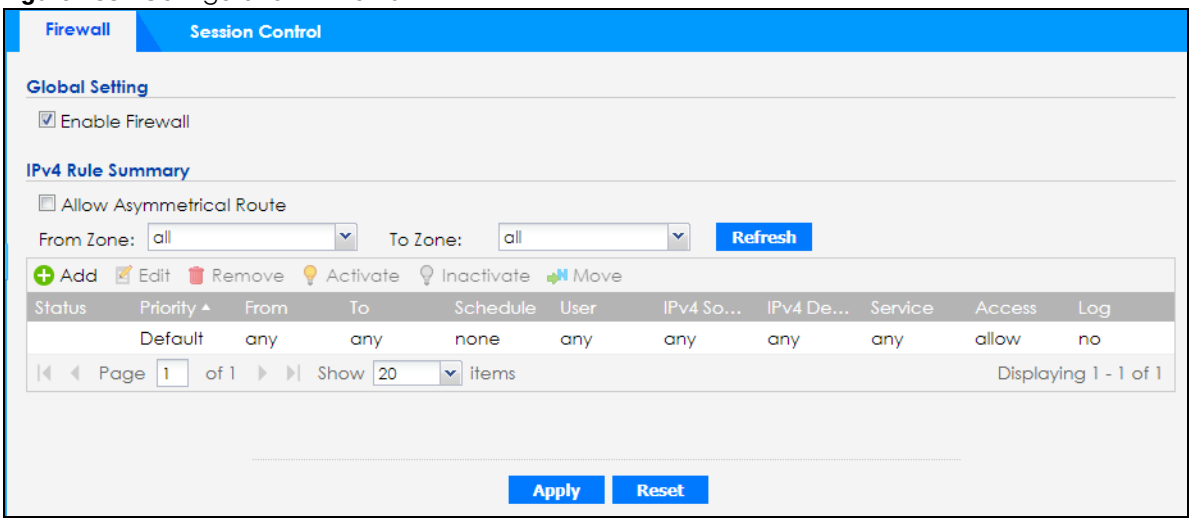
17.2 Firewall

The following describes the firewall screen functions.

Click **Configuration > Firewall** to open the **Firewall** screen. Use this screen to enable or disable the firewall and asymmetrical routes, and display the configured firewall rules. Specify from which zone packets come and to which zone packets travel to display only the rules specific to the selected direction. Note the following.

- If you enable intra-zone traffic blocking (see the chapter about zones), the firewall automatically creates (implicit) rules to deny packet passage between the interfaces in the specified zone.
- Besides configuring the firewall, you also need to configure NAT rules to allow computers on the WAN to access LAN devices.
- The NXC applies NAT (Destination NAT) settings before applying the firewall rules. So for example, if you configure a NAT entry that sends WAN traffic to a LAN IP address, when you configure a corresponding firewall rule to allow the traffic, you need to set the LAN IP address as the destination.
- The ordering of your rules is very important as rules are applied in sequence.

Figure 133 Configuration > Firewall



The following table describes the labels in this screen.

Table 105 Configuration > Firewall

LABEL	DESCRIPTION
Global Setting	
Enable Firewall	Select this check box to activate the firewall. The NXC performs access control when the firewall is activated.
IPv4 Rule Summary	
Allow Asymmetrical Route	If an alternate gateway on the LAN has an IP address in the same subnet as the NXC's LAN IP address, return traffic may not go through the NXC. This is called an asymmetrical or "triangle" route. This causes the NXC to reset the connection, as the connection has not been acknowledged. Select this check box to have the NXC permit the use of asymmetrical route topology on the network (not reset the connection). Note: Allowing asymmetrical routes may let traffic from the WAN go directly to the LAN without passing through the NXC.

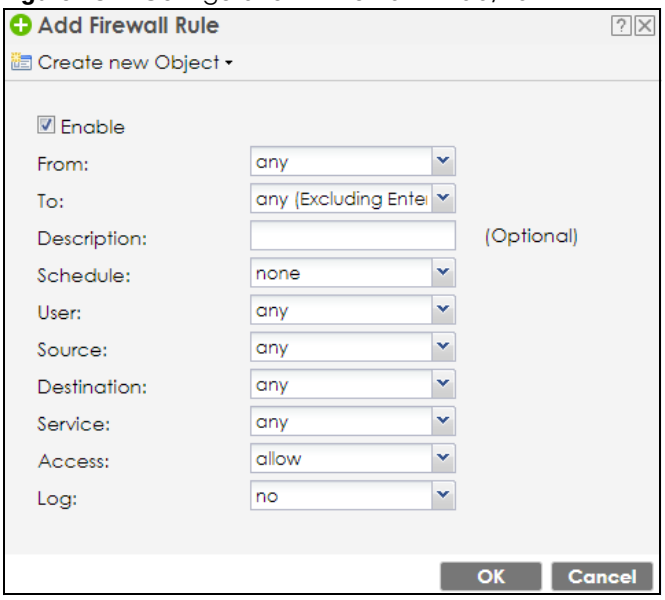
Table 105 Configuration > Firewall (continued)

LABEL	DESCRIPTION
From Zone / To Zone	This is the direction of travel of packets. Select from which zone the packets come and to which zone they go. Firewall rules are grouped based on the direction of travel of packets to which they apply. For example, from **LAN** to **LAN** means packets traveling from a computer or subnet on the LAN to either another computer or subnet on the LAN. From **all** displays all the firewall rules for traffic going to the selected **To Zone**. To **all** displays all the firewall rules for traffic coming from the selected **From Zone**. From **all** to **all** displays all of the firewall rules. To **EnterpriseWLAN** rules are for traffic that is destined for the NXC and control which computers can manage the NXC.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Move	To change a rule's position in the numbered list, select the rule and click **Move** to display a field to type a number for where you want to put that rule and press [ENTER] to move the rule to the number that you typed. The ordering of your rules is important as they are applied in order of their numbering.
The following read-only fields summarize the rules you have created that apply to traffic traveling in the selected packet direction.	
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Priority	This is the position of your firewall rule in the global rule list (including all through-NXC and to-NXC rules). The ordering of your rules is important as rules are applied in sequence. **Default** displays for the default firewall behavior that the NXC performs on traffic that does not match any other firewall rule.
From To	This is the direction of travel of packets to which the firewall rule applies.
Schedule	This field tells you the schedule object that the rule uses. **none** means the rule is active at all times if enabled.
User	This is the user name or user group name to which this firewall rule applies.
IPv4 Source	This displays the source address object to which this firewall rule applies.
IPv4 Destination	This displays the destination address object to which this firewall rule applies.
Service	This displays the service object to which this firewall rule applies.
Access	This field displays whether the firewall silently discards packets (**deny**), discards packets and sends a TCP reset packet to the sender (**reject**) or permits the passage of packets (**allow**).
Log	This field shows you whether a log (and alert) is created when packets match this rule or not.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

17.2.1 Add/Edit Firewall Screen

In the **Firewall** screen, click the **Edit** or **Add** icon to display this screen. Use this screen to add or edit a firewall rule.

Figure 134 Configuration > Firewall > Add/Edit



The following table describes the labels in this screen.

Table 106 Configuration > Firewall > Add/Edit

LABEL	DESCRIPTION
Create new Object	Use to configure any new settings objects that you need to use in this screen.
Enable	Select this check box to activate the firewall rule.
From To	For through-NXC rules, select the direction of travel of packets to which the rule applies. **any** means all interfaces. **EnterpriseWLAN** means packets destined for the NXC itself.
Description	Enter a descriptive name of up to 60 printable ASCII characters for the firewall rule. Spaces are allowed.
Schedule	Select a schedule that defines when the rule applies. Otherwise, select **none** and the rule is always effective.
User	This field is not available when you are configuring a to-NXC rule. Select a user name or user group to which to apply the rule. The firewall rule is activated only when the specified user logs into the system and the rule will be disabled when the user logs out. Otherwise, select **any** and there is no need for user logging. Note: If you specified a source IP address (group) instead of **any** in the field below, the user's IP address should be within the IP address range.
Source	Select a source address or address group for whom this rule applies. Select **any** if the policy is effective for every source.
Destination	Select a destination address or address group for whom this rule applies. Select **any** if the policy is effective for every destination.

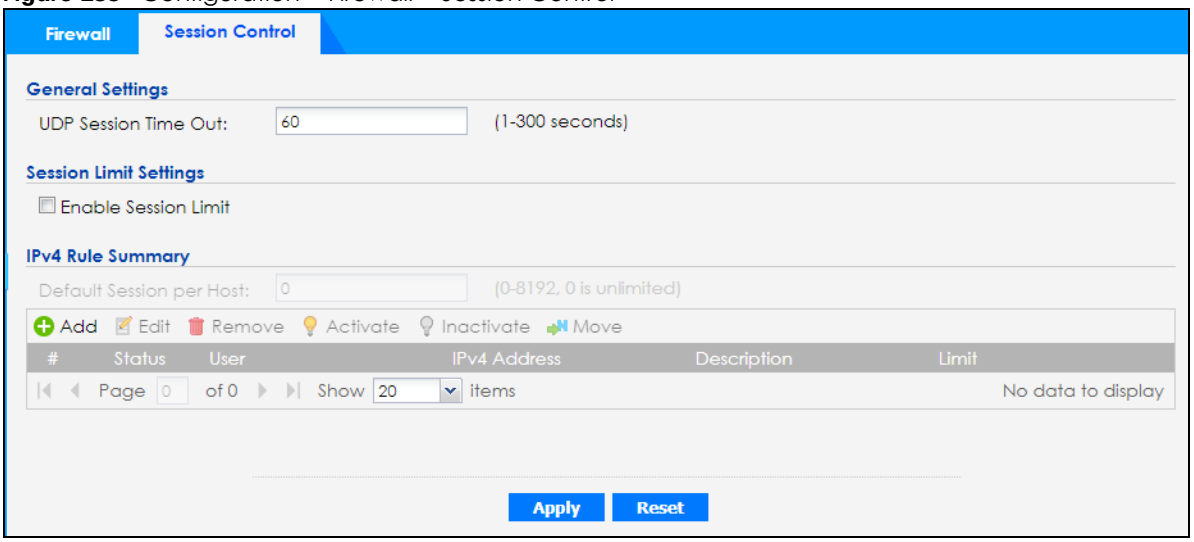
Table 106 Configuration > Firewall > Add/Edit (continued)

LABEL	DESCRIPTION
Service	Select a service or service group from the drop-down list box.
Access	Use the drop-down list box to select what the firewall is to do with packets that match this rule. Select **deny** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender. Select **reject** to deny the packets and send a TCP reset packet to the sender. Any UDP packets are dropped without sending a response packet. Select **allow** to permit the passage of the packets.
Log	Select whether to have the NXC generate a log(**log**), log and alert (**log alert**) or not (**no**) when the rule is matched.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

17.3 Session Control

Click **Configuration > Firewall > Session Control** to display the **Firewall Session Control** screen. Use this screen to limit the number of concurrent NAT/firewall sessions a client can use. You can apply a default limit for all users and individual limits for specific users, addresses, or both. The individual limit takes priority if you apply both.

Figure 135 Configuration > Firewall > Session Control



The following table describes the labels in this screen.

Table 107 Configuration > Firewall > Session Control

LABEL	DESCRIPTION
General Settings	
UDP Session Time Out	Set how many seconds (from 1 to 300) the NXC will allow a UDP session to remain idle (without UDP traffic) before closing it.
Session Limit Settings	

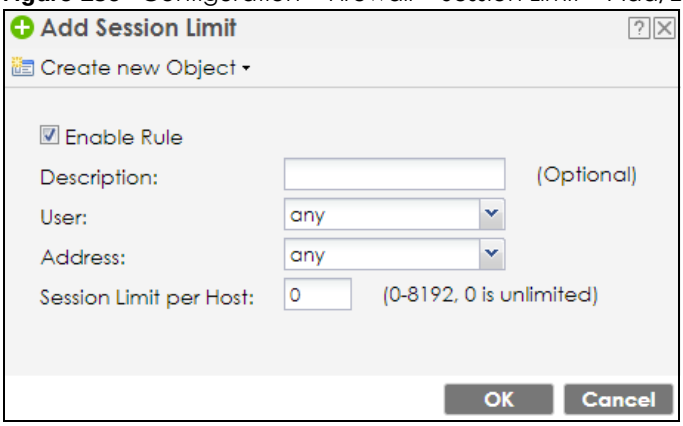
Table 107 Configuration > Firewall > Session Control (continued)

LABEL	DESCRIPTION
Enable Session limit	Select this check box to control the number of concurrent sessions hosts can have.
IPv4 Rule Summary	This table lists the rules for limiting the number of concurrent sessions hosts can have.
Default Session per Host	This field is configurable only when you enable session limit. Use this field to set a common limit to the number of concurrent NAT/firewall sessions each client computer can have. If only a few clients use peer to peer applications, you can raise this number to improve their performance. With heavy peer to peer application use, lower this number to ensure no single client uses too many of the available NAT sessions. Create rules below to apply other limits for specific users or addresses.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Move	To change a rule's position in the numbered list, select the rule and click **Move** to display a field to type a number for where you want to put that rule and press [ENTER] to move the rule to the number that you typed. The ordering of your rules is important as they are applied in order of their numbering.
#	This is the index number of a session limit rule. It is not associated with a specific rule.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
User	This is the user name or user group name to which this session limit rule applies.
IPv4 Address	This is the address object to which this session limit rule applies.
Description	This is the description for the rule.
Limit	This is how many concurrent sessions this user or address is allowed to have.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

17.3.1 Add/Edit Session Limit

Click **Configuration > Firewall > Session Limit** and the **Add** or **Edit** icon to display the **Firewall Session Limit Edit** screen. Use this screen to configure rules that define a session limit for specific users or addresses.

Figure 136 Configuration > Firewall > Session Limit > Add/Edit



The following table describes the labels in this screen.

Table 108 Configuration > Firewall > Session Limit > Add/Edit

LABEL	DESCRIPTION
Create new Object	Use to configure any new settings objects that you need to use in this screen.
Enable Rule	Select this check box to turn on this session limit rule.
Description	Enter information to help you identify this rule. Use up to 60 printable ASCII characters. Spaces are allowed.
User	Select a user name or user group to which to apply the rule. The rule is activated only when the specified user logs into the system and the rule will be disabled when the user logs out. Otherwise, select **any** and there is no need for user logging. Note: If you specified an IP address (or address group) instead of **any** in the field below, the user's IP address should be within the IP address range.
Address	Select a source address or address group for whom this rule applies. Select **any** if the policy is effective for every source address.
Session Limit per Host	Use this field to set a limit to the number of concurrent NAT/firewall sessions this rule's users or addresses can have. For this rule's users and addresses, this setting overrides the **Default Session per Host** setting in the general **Firewall Session Limit** screen.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

CHAPTER 18
User/Group

18.1 Overview

This chapter describes how to set up user accounts, user groups, and user settings for the NXC. You can also set up rules that control when users have to log in to the NXC before the NXC routes traffic for them.

18.1.1 What You Can Do in this Chapter

- The **User** screen (see Section 18.2 on page 240) lets you see, add, and edit user accounts.
- The **Group** screen (see Section 18.3 on page 244) provides a summary of all user groups. In addition, this screen allows you to add, edit, and remove user groups. User groups may consist of access users and other user groups. You cannot put admin users in user groups
- The **Setting** screen (see Section 18.4 on page 246) controls default settings, login settings, lockout settings, and other user settings for the NXC. You can also use this screen to specify when users must log in to the NXC before it routes traffic for them.
- The **MAC Address** screen (see Section 18.5 on page 255) lists all the mappings of MAC addresses to MAC address user accounts (MAC roles).

18.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

User Account

A user account defines the privileges of a user logged into the NXC. User accounts are used in controlling access to configuration and services in the NXC.

User Types

These are the types of user accounts the NXC uses.

Table 109 Types of User Accounts

TYPE	ABILITIES	LOGIN METHOD(S)
Admin Users		
admin	Change NXC configuration (web, CLI)	WWW, TELNET, SSH, FTP, Console
limited-admin	Look at NXC configuration (web, CLI) Perform basic diagnostics (CLI)	WWW, TELNET, SSH, Console
Access Users		
user	Access network services Browse user-mode commands (CLI)	Captive Portal, TELNET, SSH
guest	Access network services	Captive Portal

Table 109 Types of User Accounts (continued)

TYPE	ABILITIES	LOGIN METHOD(S)
ext-user	External user account	Captive Portal
ext-group-user	External group user account	Captive Portal
guest-manager	Create dynamic guest accounts	WWW
dynamic guest	Access network services	Captive Portal
mac-address	As permitted by the user-aware feature configuration.	MAC Authentication

Note: The default **admin** account is always authenticated locally, regardless of the authentication method setting.

Ext-User Accounts

Set up an **ext-user** account if the user is authenticated by an external server and you want to set up specific policies for this user in the NXC. If you do not want to set up policies for this user, you do not have to set up an **ext-user** account.

All **ext-user** users should be authenticated by an external server, such as AD, LDAP or RADIUS. If the NXC tries to use the local database to authenticate an **ext-user**, the authentication attempt always fails.

Note: If the NXC tries to authenticate an **ext-user** using the local database, the attempt always fails.

Once an **ext-user** has been authenticated, the NXC tries to get the user type from the external server. If the external server does not have the information, the NXC sets the user type for this session to **User**.

Ext-Group-User Accounts

Ext-Group-User accounts work are similar to ext-user accounts but allow you to group users by the value of the group membership attribute configured for the AD or LDAP server.

Ext-Server Accounts

Ext-Server accounts are admin accounts that can log into the NXC from the WAN and which are authenticated by an associated RADIUS server.

Dynamic Guest Accounts

Dynamic guest accounts are guest accounts, but are created dynamically with the guest manager account and stored in the NXC's local user database. A dynamic guest account has a dynamically-created user name and password. A dynamic guest account user can access the NXC's services only within a given period of time and will become invalid after the expiration date/time. You cannot modify or edit a dynamic guest account.

MAC Address Accounts

Use an external server to authenticate wireless clients by MAC address. After authentication the NXC maps the wireless client to a **mac-address** user account (MAC role). Configure user-aware features to control MAC address user access to network services.

For example, do the following to give a notebook access to a network printer.

1 Configure the external server to authenticate the notebook's wireless client MAC address.

2 Click **Configuration > Object > AP Profile > SSID > Security List > Add/Edit Security Profile** and configure an SSID security profile's MAC authentication settings to have the AP use the external server to authenticate wireless clients by MAC address (see Section 19.3.2.1 on page 271).

3 Click **Configuration > Object > User/Group > User > Add** and create a MAC address user account (see Section 18.2.1 on page 241).

4 Click **Configuration > Object > User/Group > MAC Address > Add** and map the notebook's MAC address to the MAC address user account (also called a MAC role). See Section 18.5 on page 255.

User Groups

User groups may consist of user accounts or other user groups. Use user groups when you want to create the same rule for several user accounts, instead of creating separate rules for each one.

Note: You cannot put access users and admin users in the same user group.

Note: You cannot put the default **admin** account into any user group.

User Awareness

By default, users do not have to log into the NXC to use the network services it provides. The NXC automatically routes packets for everyone. If you want to restrict network services that certain users can use via the NXC, you can require them to log in to the NXC first. The NXC is then 'aware' of the user who is logged in and you can create 'user-aware policies' that define what services they can use.

User Role Priority

The NXC checks the following in order of priority.

1 User role setting in ext-user.

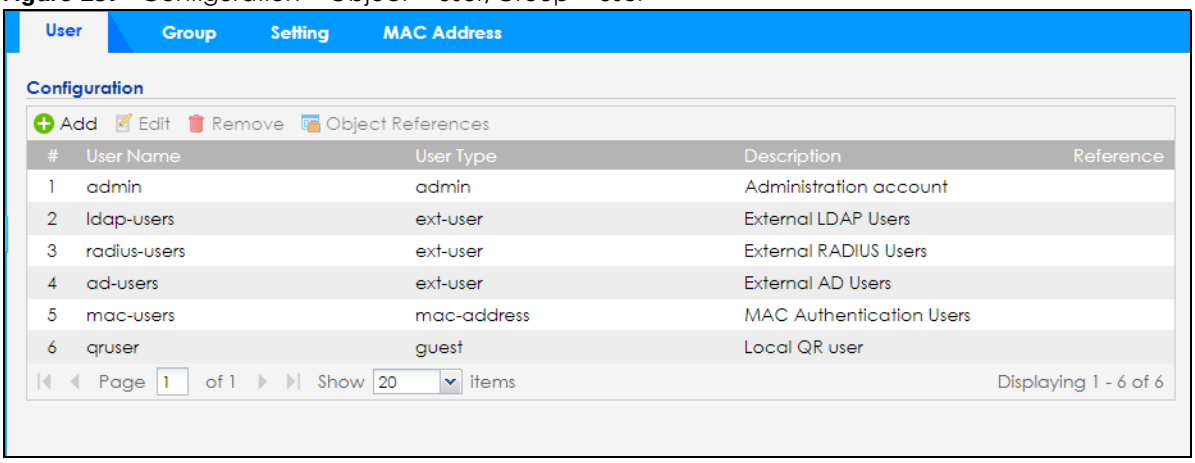
2 User role setting in ext-group-user.

3 User role setting in default user (ldap-users, ad-users, radius-users).

18.2 User Summary

The **User** screen provides a summary of all user accounts. To access this screen click **Configuration > Object > User/Group**.

Figure 137 Configuration > Object > User/Group > User



The following table describes the labels in this screen.

Table 110 Configuration > Object > User/Group > User

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific user.
User Name	This field displays the user name of each user.
User Type	This field displays the kind of account of each user. These are the kinds of user account the NXC supports. • **admin** - this user can look at and change the configuration of the NXC. • **limited-admin** - this user can look at the configuration of the NXC but not to change it. • **user** - this user has access to the NXC's services but cannot look at the configuration. • **guest** - this user has access to the NXC's services but cannot look at the configuration. • **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Guest Manager** screen that pops up. • **mac-address** - an external server authenticates wireless clients based on their MAC addresses. After authentication the NXC maps a wireless client to a MAC address user account (MAC role). User-aware features control MAC address user access to specific resources.
Description	This field displays the description for each user.
Reference	This field displays the number of times an object reference is used in a profile.

18.2.1 Add/Edit User

The **User Add/Edit** screen allows you to create a new user account or edit an existing one.

18.2.1.1 Rules for User Names

Enter a user name from 1 to 31 characters.

The user name can only contain the following characters:

- Alphanumeric A-z 0-9 (there is no unicode support)
- _ [underscores]
- - [dashes]

The first character must be alphabetical (A-Z a-z), an underscore (_), or a dash (-). Other limitations on user names are:

- User names are case-sensitive. If you enter a user 'bob' but use 'BOB' when connecting via CIFS or FTP, it will use the account settings used for 'BOB' not 'bob'.
- User names have to be different than user group names.
- Here are the reserved user names:

• adm	• admin	• any	• bin	• daemon
• debug	• devicehaecived	• ftp	• games	• halt
• ldap-users	• lp	• mail	• news	• nobody
• operator	• radius-users	• root	• shutdown	• sshd
• sync	• uucp	• zyxel		

To access this screen, go to the **User** screen, and click **Add** or **Edit**.

Figure 138 Configuration > Object > User/Group > User > Add/Edit A User (user)

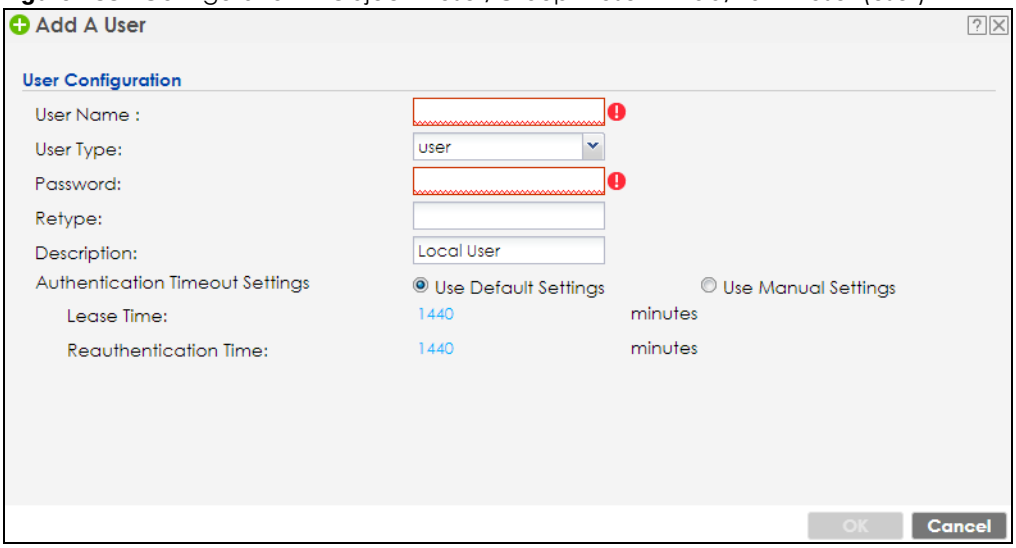
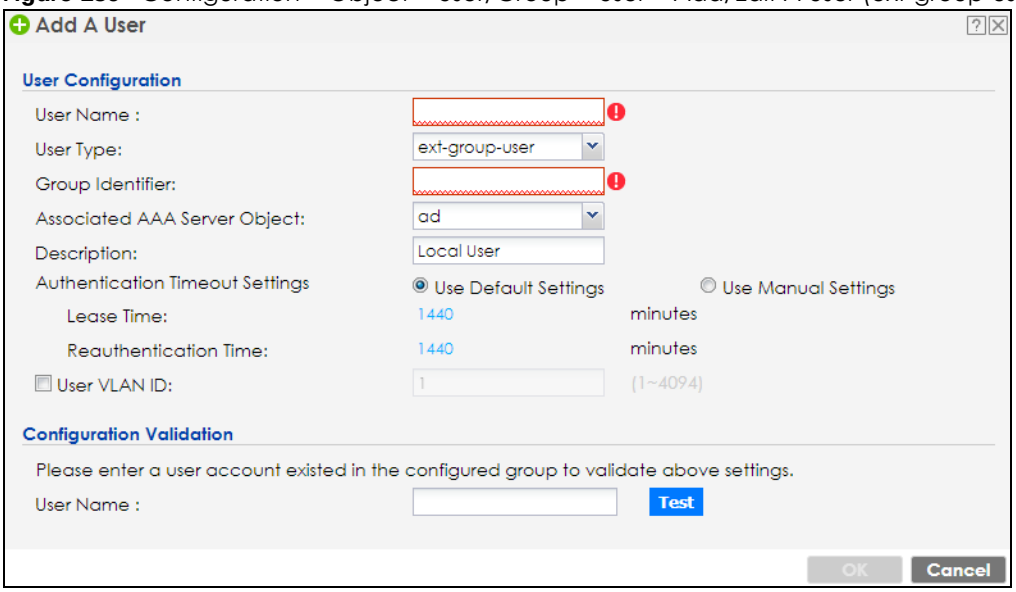


Figure 139 Configuration > Object > User/Group > User > Add/Edit A User (ext-group-user)



The following table describes the labels in this screen.

Table 111 Configuration > Object > User/Group > User > Add/Edit A User

LABEL	DESCRIPTION
User Name	Type the user name for this user account. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. User names have to be different than user group names, and some words are reserved.
User Type	Select what type of user this is. Choices are: • **admin** - this user can look at and change the configuration of the NXC. • **limited-admin** - this user can look at the configuration of the NXC but not to change it. • **user** - this user has access to the NXC's services but cannot look at the configuration. • **guest** - this user has access to the NXC's services but cannot look at the configuration. • **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Guest Manager** screen that pops up. • **mac-address** - an external server authenticates wireless clients based on their MAC addresses. After authentication the NXC maps a wireless client to a MAC address user account (MAC role). User-aware features control MAC address user access to specific resources.
Password	This field is not available if you select the **ext-user**, **ext-group-user** or **mac-address** type. Enter the password of this user account. It can consist of 4 - 63 alphanumeric characters.
Retype	This field is not available if you select the **ext-user**, **ext-group-user** or **mac-address** type. Retype the password for confirmation.
Group Identifier	This field is available for a **ext-group-user** type user account. Specify the value of the AD or LDAP server's **Group Membership Attribute** that identifies the group to which this user belongs.
Associated AAA Server Object	This field is available for a **ext-group-user** type user account. Select the AAA server to use to authenticate this account's users.
Description	Enter the description of each user, if any. You can use up to 60 printable ASCII characters. Default descriptions are provided.

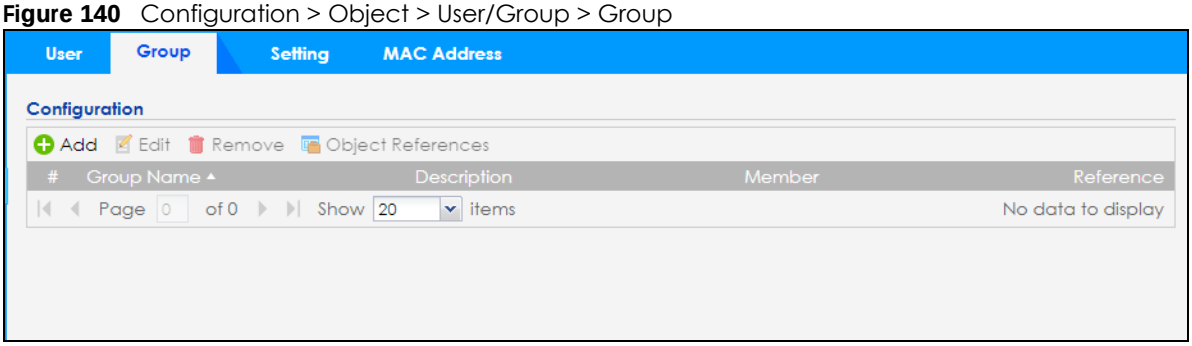
Table 111 Configuration > Object > User/Group > User > Add/Edit A User (continued)

LABEL	DESCRIPTION
Authentication Timeout Settings	If you want to set authentication timeout to a value other than the default settings, select **Use Manual Settings** then fill your preferred values in the fields that follow.
Lease Time	Enter the number of minutes this user has to renew the current session before the user is logged out. You can specify 1 to 1440 minutes. You can enter 0 to make the number of minutes unlimited. Admin users renew the session every time the main screen refreshes in the Web Configurator. Access users can renew the session by clicking the **Renew** button on their screen. If you allow access users to renew time automatically, the users can select this check box on their screen as well. In this case, the session is automatically renewed before the lease time expires.
Reauthentication Time	Type the number of minutes this user can be logged into the NXC in one session before the user has to log in again. You can specify 1 to 1440 minutes. You can enter 0 to make the number of minutes unlimited. Unlike **Lease Time**, the user has no opportunity to renew the session without logging out.
User VLAN ID	This field is available for a **ext-group-user** type user account. Select this option to enable dynamic VLAN assignment on the NXC. When a user is authenticated successfully, all data traffic from this user is tagged with the VLAN ID number you specify here. This allows you to assign a user of the **ext-group-user** type to a specific VLAN based on the user credentials instead of using an AAA server.
Configuration Validation	Use a user account from the group specified above to test if the configuration is correct. Enter the account's user name in the **User Name** field and click **Test**.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

18.3 Group Summary

User groups consist of access users and other user groups. You cannot put admin users in user groups. The **Group** screen provides a summary of all user groups. In addition, this screen allows you to add, edit, and remove user groups. To access this screen, log into the Web Configurator, and click **Configuration > Object > User/Group > Group**.

Figure 140 Configuration > Object > User/Group > Group



The following table describes the labels in this screen.

Table 112 Configuration > Object > User/Group > Group

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.

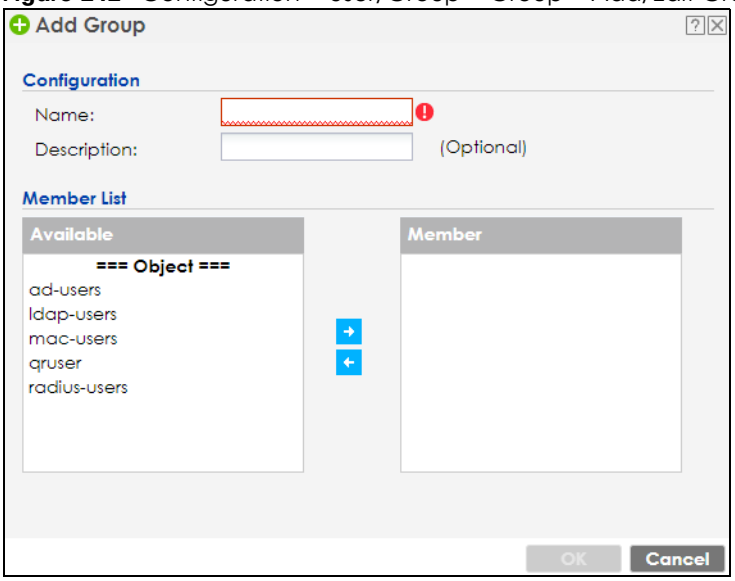
Table 112 Configuration > Object > User/Group > Group (continued)

LABEL	DESCRIPTION
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Removing a group does not remove the user accounts in the group.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific user group.
Group Name	This field displays the name of each user group.
Description	This field displays the description for each user group.
Member	This field lists the members in the user group. Each member is separated by a comma.
Reference	This displays the number of times an object reference is used in a profile.

18.3.1 Add/Edit Group

This screen allows you to add a new user group or edit an existing one. To access this screen, go to the **Group** screen, and click either the **Add** icon or an **Edit** icon.

Figure 141 Configuration > User/Group > Group > Add/Edit Group



The following table describes the labels in this screen.

Table 113 Configuration > User/Group > Group > Add/Edit Group

LABEL	DESCRIPTION
Name	Type the name for this user group. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. User group names have to be different than user names.
Description	Enter the description of the user group, if any. You can use up to 60 characters, punctuation marks, and spaces.

Table 113 Configuration > User/Group > Group > Add/Edit Group (continued)

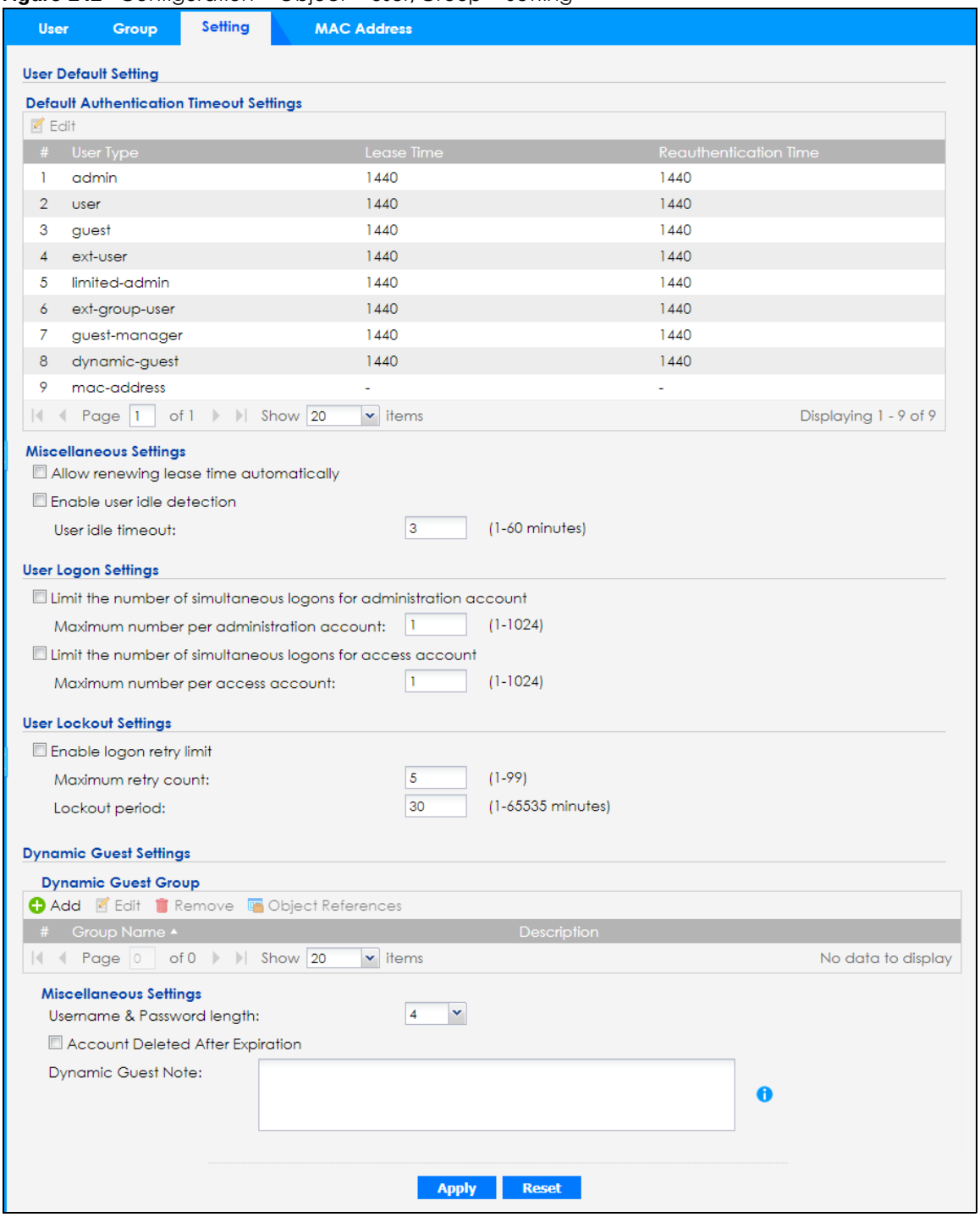
LABEL	DESCRIPTION
Member List	The **Member** list displays the names of the users and user groups that have been added to the user group. The order of members is not important. Select users and groups from the **Available** list that you want to be members of this group and move them to the **Member** list. You can double-click a single entry to move it or use the [Shift] or [Ctrl] key to select multiple entries and use the arrow button to move them. Move any members you do not want included to the **Available** list.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

18.4 Setting

This screen controls default settings, login settings, lockout settings, and other user settings for the NXC. You can also use this screen to specify when users must log in to the NXC before it routes traffic for them.

To access this screen, login to the Web Configurator, and click **Configuration > Object > User/Group > Setting**.

Figure 142 Configuration > Object > User/Group > Setting



The following table describes the labels in this screen.

Table 114 Configuration > Object > User/Group > Setting

LABEL	DESCRIPTION
User Default Setting	
Default Authentication Timeout Settings	These authentication timeout settings are used by default when you create a new user account. They also control the settings for any existing user accounts that are set to use the default settings. You can still manually configure any user account's authentication timeout settings.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
#	This field is a sequential value, and it is not associated with a specific entry.
User Type	These are the kinds of user account the NXC supports. • **admin** - this user can look at and change the configuration of the NXC • **limited-admin** - this user can look at the configuration of the NXC but not to change it • **user** - this user has access to the NXC's services but cannot look at the configuration. • **guest** - this user has access to the NXC's services but cannot look at the configuration. • **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Guest Manager** screen that pops up. • **dynamic-guest** - this user has access to the NXC's services within a given period of time but cannot look at the configuration. • **mac-address** - an external server authenticates wireless clients based on their MAC addresses. After authentication the NXC maps a wireless client to a MAC address user account (MAC role). User-aware features control MAC address user access to specific resources. You do not need to set the lease time and reauthentication time for this type of user account.
Lease Time	This is the default lease time in minutes for each type of user account. It defines the number of minutes the user has to renew the current session before the user is logged out. Admin users renew the session every time the main screen refreshes in the Web Configurator. Access users can renew the session by clicking the **Renew** button on their screen. If you allow access users to renew time automatically, the users can select this check box on their screen as well. In this case, the session is automatically renewed before the lease time expires.
Reauthentication Time	This is the default reauthentication time in minutes for each type of user account. It defines the number of minutes the user can be logged into the NXC in one session before having to log in again. Unlike **Lease Time**, the user has no opportunity to renew the session without logging out.
Miscellaneous Settings	
Allow renewing lease time automatically	Select this check box if access users can renew lease time automatically, as well as manually, simply by selecting the **Updating lease time automatically** check box on their screen.
Enable user idle detection	This is applicable for access users. Select this check box if you want the NXC to monitor how long each access user is logged in and idle (in other words, there is no traffic for this access user). The NXC automatically logs out the access user once the **User idle timeout** has been reached.
User idle timeout	This is applicable for access users. This field is effective when **Enable user idle detection** is checked. Type the number of minutes each access user can be logged in and idle before the NXC automatically logs out the access user.
User Logon Settings	

Table 114 Configuration > Object > User/Group > Setting (continued)

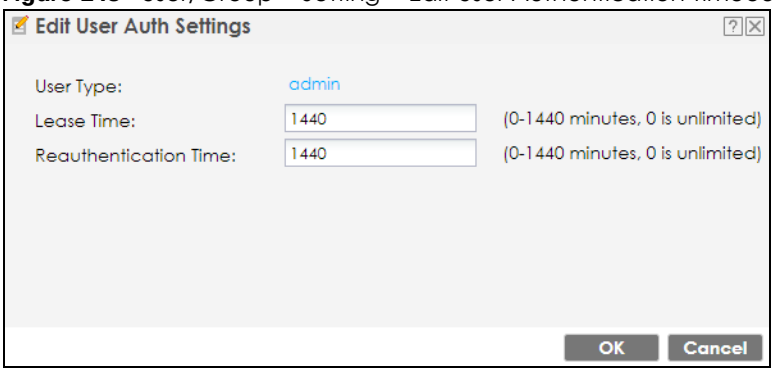
LABEL	DESCRIPTION
Limit the number of simultaneous logons for administration account	Select this check box if you want to set a limit on the number of simultaneous logins by admin users. If you do not select this, admin users can login as many times as they want at the same time using the same or different IP addresses.
Maximum number per administration account	This field is effective when **Limit ... for administration account** is checked. Type the maximum number of simultaneous logins by each admin user.
Limit the number of simultaneous logons for access account	Select this check box if you want to set a limit on the number of simultaneous logins by non-admin users. If you do not select this, access users can login as many times as they want as long as they use different IP addresses.
Maximum number per access account	This field is effective when **Limit ... for access account** is checked. Type the maximum number of simultaneous logins by each access user.
User Lockout Settings	
Enable logon retry limit	Select this check box to set a limit on the number of times each user can login unsuccessfully (for example, wrong password) before the IP address is locked out for a specified amount of time.
Maximum retry count	This field is effective when **Enable logon retry limit** is checked. Type the maximum number of times each user can login unsuccessfully before the IP address is locked out for the specified **lockout period**. The number must be between 1 and 99.
Lockout period	This field is effective when **Enable logon retry limit** is checked. Type the number of minutes the user must wait to try to login again, if **logon retry limit** is enabled and the **maximum retry count** is reached. This number must be between 1 and 65,535 (about 45.5 days).
Dynamic Guest Settings	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Removing a group does not remove the user accounts in the group.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific user group.
Group Name	This field displays the name of each dynamic guest group.
Description	This field displays the description for each dynamic guest group.
Miscellaneous Settings	
User name & Password Length	Specify the length of a user name and password for dynamic guest accounts.
Account Deleted After Expiration	Select this check box to remove the dynamic guest accounts from the **Monitor > System Status > Dynamic Guest** screen when they expire.
Dynamic Guest Note	Enter the notes (such as the SSID and security key the dynamic guests can use to access the network services) you wan to display in the paper along with the account information you print out for dynamic guest users. You can enter up to 1024 ASCII characters.
Apply	Click **Apply** to save the changes.
Reset	Click **Reset** to return the screen to its last-saved settings.

18.4.1 Edit User Authentication Timeout Settings

This screen allows you to set the default authentication timeout settings for the selected type of user account. These default authentication timeout settings also control the settings for any existing user accounts that are set to use the default settings. You can still manually configure any user account's authentication timeout settings.

To access this screen, go to the **Configuration > Object > User/Group > Setting** screen, and click one of the **Default Authentication Timeout Settings** section's **Edit** icons.

Figure 143 User/Group > Setting > Edit User Authentication Timeout Settings



The following table describes the labels in this screen.

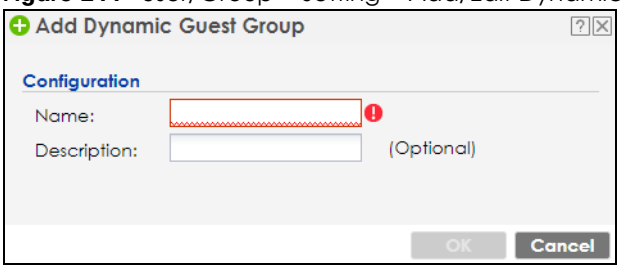
Table 115 User/Group > Setting > Edit User Authentication Timeout Settings

LABEL	DESCRIPTION
User Type	This read-only field identifies the type of user account for which you are configuring the default settings. • **admin** - this user can look at and change the configuration of the NXC. • **limited-admin** - this user can look at the configuration of the NXC but not to change it. • **user** - this user has access to the NXC's services but cannot look at the configuration. • **guest** - this user has access to the NXC's services but cannot look at the configuration. • **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP. • **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Guest Manager** screen that pops up. • **dynamic-guest** - this user has access to the NXC's services within a given period of time but cannot look at the configuration.
Lease Time	Enter the number of minutes this type of user account has to renew the current session before the user is logged out. You can specify 1 to 1440 minutes. You can enter 0 to make the number of minutes unlimited. Admin users renew the session every time the main screen refreshes in the Web Configurator. Access users can renew the session by clicking the **Renew** button on their screen. If you allow access users to renew time automatically, the users can select this check box on their screen as well. In this case, the session is automatically renewed before the lease time expires.
Reauthentication Time	Type the number of minutes this type of user account can be logged into the NXC in one session before the user has to log in again. You can specify 1 to 1440 minutes. You can enter 0 to make the number of minutes unlimited. Unlike **Lease Time**, the user has no opportunity to renew the session without logging out.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

18.4.2 Add/Edit Dynamic Guest Group

This screen allows you to create a dynamic guest group or edit an existing one. To access this screen, go to the **Configuration > Object > User/Group > Setting** screen, and click either the **Add** icon or an **Edit** icon in the **Dynamic Guest Group** section.

Figure 144 User/Group > Setting > Add/Edit Dynamic Guest Group



The following table describes the labels in this screen.

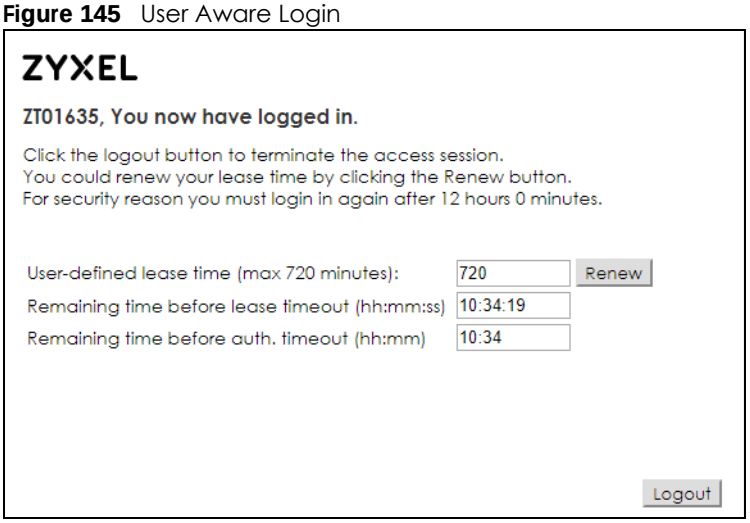
Table 116 User/Group > Setting > Add/Edit Dynamic Guest Group

LABEL	DESCRIPTION
Name	Specify the name used to identify the dynamic guest group.
Description	Enter a description for the dynamic guest group.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

18.4.3 User Aware Login Example

Access users cannot use the Web Configurator to browse the configuration of the NXC. Instead, after access users log into the NXC, the following user aware login screen appears.

Figure 145 User Aware Login



The following table describes the labels in this screen.

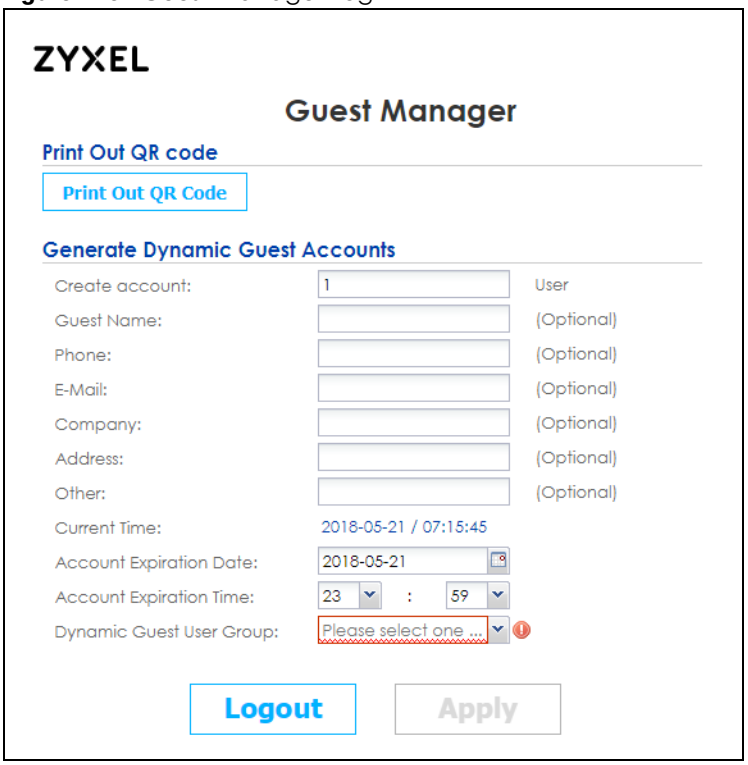
Table 117 User Aware Login

LABEL	DESCRIPTION
User-defined lease time (max ... minutes)	Access users can specify a lease time shorter than or equal to the one that you specified. The default value is the lease time that you specified.
Renew	Access users can click this button to reset the lease time, the amount of time remaining before the NXC automatically logs them out. The NXC sets this amount of time according to the • **User-defined lease time** field in this screen. • **Lease time** field in the **User Add/Edit** screen. • **Lease time** field in the **Setting > Edit** screen.
Updating lease time automatically	This box appears if you checked the **Allow renewing lease time automatically** box in the **Setting** screen. Access users can select this check box to reset the lease time automatically 30 seconds before it expires. Otherwise, access users have to click the **Renew** button to reset the lease time.
Remaining time before lease timeout	This field displays the amount of lease time that remains, though the user might be able to reset it.
Remaining time before auth. timeout	This field displays the amount of time that remains before the NXC automatically logs the access user out, regardless of the lease time.

18.4.4 Guest Manager Login Example

To create dynamic guest accounts, enter the guest-manager account information in the Web Configurator login screen. After you log in successfully, the following guest manager screen appears.

Figure 146 Guest Manager Login



The following table describes the labels in this screen.

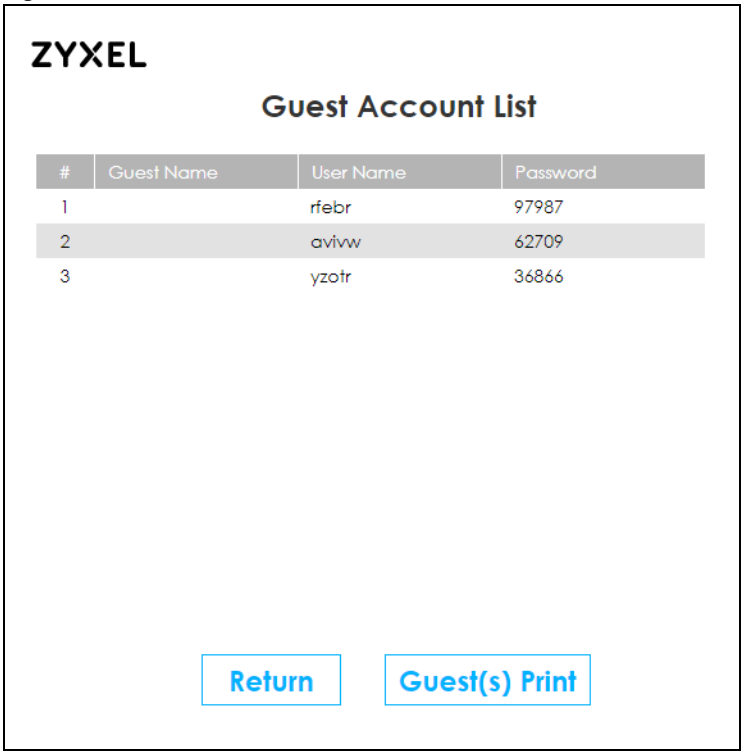
Table 118 Guest Manager Login

LABEL	DESCRIPTION
Print Out QR Code	The button is available only when clients are allowed to authenticate themselves with a QR code in the **Configuration > Captive Portal > Redirect on Controller** screen. Click the **Print Out QR Code** button to view and print the QR code. Users scan the QR code on the web portal by running a scanning app on their mobile devices or desktops and pointing the camera or webcam to the QR code. They then can quickly log into the website without entering a username and password.
Create account	Enter the number (up to 32) of dynamic guest accounts you want to create.
Guest Name	This field is available only when you want to create one account. Enter the name for the guest account.
Phone	This field is available only when you want to create one account. Enter the telephone number for the guest account.
E-mail	This field is available only when you want to create one account. Enter the E-mail address for the guest account.
Company	Enter the company name (up to 64 characters) for the guest account(s).
Address	Enter the geographic address (up to 64 characters) for the guest account(s).
Other	Enter the additional information (up to 60 characters) for the guest account(s).
Account Expiration Date	Select the date when the account(s) becomes invalid.
Account Expiration Time	Select the time when the account(s) becomes invalid.
Dynamic Guest User Group	Select the dynamic guest group with which the dynamic guest account(s) is associated.
Apply	Click this icon to create the account(s).
Logout	Click this icon to exit and go back to the Web Configurator login screen.

18.4.4.1 Guest Account List

After you click **Apply** to create dynamic guest accounts, the following guest account list screen appears.

Figure 147 Guest Account List



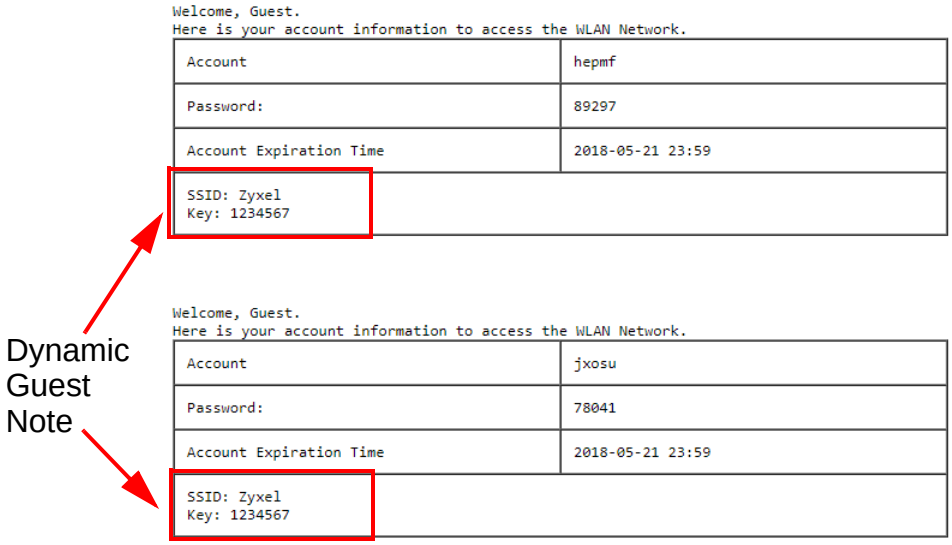
The following table describes the labels in this screen.

Table 119 Guest Account List

LABEL	DESCRIPTION
#	This is the rank of an account in the list.
Guest Name	This is the descriptive name for an account.
User Name	This is the user name of an account.
Password	This is the password of an account.
Return	Click this icon to go back to the previous screen.
Guest(s) Print	Click this icon to print out the account information and the notes you specified in the **User/Group > Setting** screen for dynamic guests.

The following figure shows the dynamic guest account printout example.

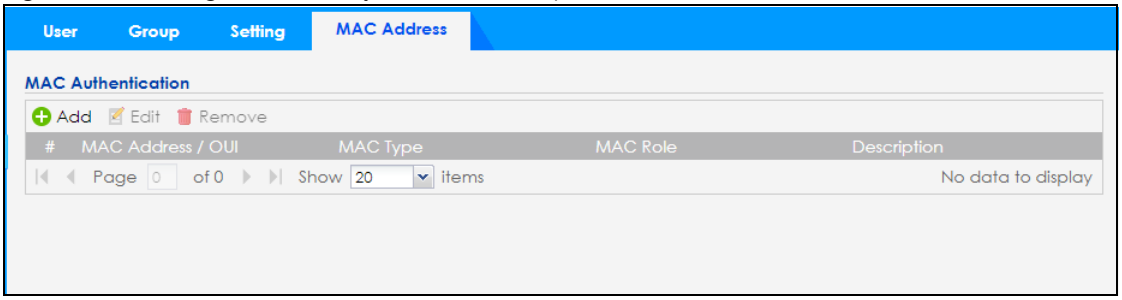
Figure 148 Preview of Dynamic Guest Account Printout



18.5 MAC Address

The **MAC Address** screen maps wireless client MAC addresses to MAC roles (MAC address user accounts). See MAC Address Accounts on page 239 for more on MAC address user accounts and MAC roles. Click **Configuration > Object > User/Group > MAC Address** to open this screen.

Figure 149 Configuration > Object > User/Group > MAC Address



The following table describes the labels in this screen.

Table 120 Configuration > Object > User/Group > MAC Address

LABEL	DESCRIPTION
MAC Authentication	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
#	This field is a sequential value, and it is not associated with a specific entry.
MAC Address/ OUI	The wireless client MAC address or OUI (Organizationally Unique Identifier). The OUI is the first three octets in a MAC address and uniquely identifies the manufacturer of a network device.

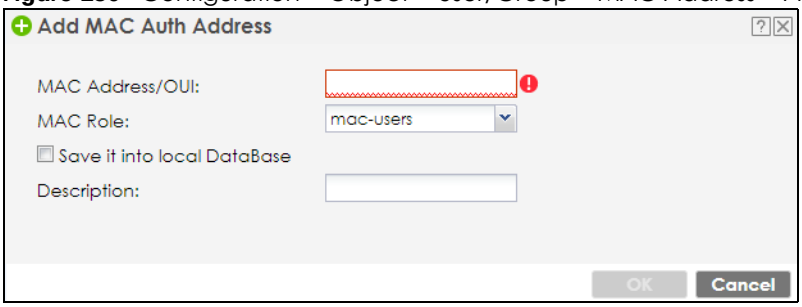
Table 120 Configuration > Object > User/Group > MAC Address (continued)

LABEL	DESCRIPTION
MAC Type	This displays whether the entry is for a MAC address or an OUI. **ext-mac-address** is a MAC address authenticated by an external server. **int-mac-address** is a MAC address authenticated by the NXC's local user database. **ext-oui** is an OUI authenticated by an external server. **int-oui** is an OUI authenticated by the NXC's local user database.
MAC Role	The MAC address user account to which the NXC maps the entry's MAC address or OUI.
Description	This field displays the description for each mapping.

18.5.1 Add/Edit MAC Address

Use the **MAC Address Add/Edit** screen to map a wireless client's MAC address or OUI to a MAC role (MAC address user account).

Figure 150 Configuration > Object > User/Group > MAC Address > Add



The following table describes the labels in this screen.

Table 121 Configuration > Object > User/Group > MAC Address > Add/Edit

LABEL	DESCRIPTION
MAC Address/ OUI	Specify the wireless client's MAC address or OUI (Organizationally Unique Identifier). The OUI is the first three octets in a MAC address and uniquely identifies the manufacturer of a network device.
MAC Role	Select one of the MAC address user accounts that you have configured to which to map this entry's MAC address or OUI.
Save it into Local Database	Select this option to save the mapping settings into the NXC's local user database and to have the NXC authenticate the MAC address or OUI using the local user database.
Description	Enter the description of the mapping, if any.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 19
AP Profile

19.1 Overview

This chapter shows you how to configure preset profiles for the Access Points (APs) connected to your NXC's wireless network.

19.1.1 What You Can Do in this Chapter

- The **Radio** screen (Section 19.2 on page 258) creates radio configurations that can be used by the APs.
- The **SSID** screen (Section 19.3 on page 265) configures three different types of profiles for your networked APs.

19.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Wireless Profiles

At the heart of all wireless AP configurations on the NXC are profiles. A profile represents a group of saved settings that you can use across any number of connected APs. You can set up the following wireless profile types:

- **Radio** - This profile type defines the properties of an AP's radio transmitter. You can have a maximum of 32 radio profiles on the NXC.
- **SSID** - This profile type defines the properties of a single wireless network signal broadcast by an AP. Each radio on a single AP can broadcast up to 8 SSIDs. You can have a maximum of 32 SSID profiles on the NXC.
- **Security** - This profile type defines the security settings used by a single SSID. It controls the encryption method required for a wireless client to associate itself with the SSID. You can have a maximum of 32 security profiles on the NXC.
- **MAC Filtering** - This profile provides an additional layer of security for an SSID, allowing you to block access or allow access to that SSID based on wireless client MAC addresses. If a client's MAC address is on the list, then it is either allowed or denied, depending on how you set up the MAC Filter profile. You can have a maximum of 32 MAC filtering profiles on the NXC.
- **Layer-2 Isolation** - This profile can be used to prevent connected wireless clients from communicating with each other in the NXC's wireless network(s), on which layer-2 isolation is enabled, except the devices in the layer-2 isolation list.

SSID

The SSID (Service Set IDentifier) is the name that identifies the Service Set with which a wireless station is associated. Wireless stations associating to the access point (AP) must have the same SSID. In other words, it is the name of the wireless network that clients use to connect to it.

WEP

WEP (Wired Equivalent Privacy) encryption scrambles all data packets transmitted between the AP and the wireless stations associated with it in order to keep network communications private. Both the wireless stations and the access points must use the same WEP key for data encryption and decryption.

WPA and WPA2

WiFi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA. Key differences between WPA(2) and WEP are improved data encryption and user authentication.

IEEE 802.1x

The IEEE 802.1x standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication is done using an external RADIUS server.

IEEE 802.11k/v Assisted Roaming

IEEE 802.11k is a standard for radio resource management of wireless LANs, which allows clients to request neighbor lists from the connected AP and discover the best available AP when roaming. An 802.11k neighbor list can contain up to six BSSIDs with the highest RCPI (Received Channel Power Indicator) value in both bands (5 GHz and 2.4 GHz, in the ratio of 4:2).

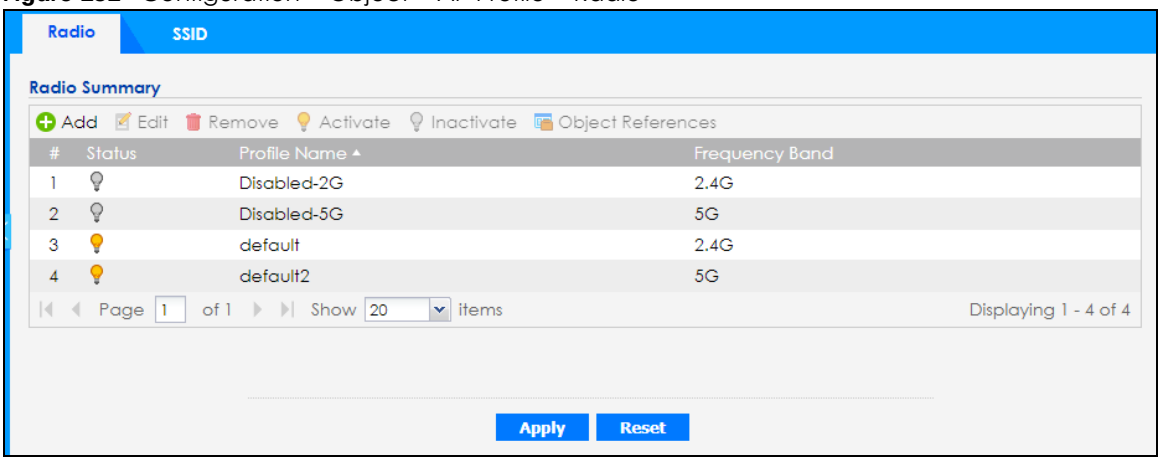
The IEEE 802.11v BSS Transition Management feature lets an AP automatically provide load information of the neighbor APs to clients. It helps the NXC steer clients to a suitable AP for better performance or load balancing.

19.2 Radio

This screen allows you to create radio profiles for the APs on your network. A radio profile is a list of settings that a supported managed AP (NWA5121-N for example) can use to configure either one of its two radio transmitters. To access this screen click **Configuration > Object > AP Profile**.

Note: You can have a maximum of 32 radio profiles on the NXC.

Figure 151 Configuration > Object > AP Profile > Radio



The following table describes the labels in this screen.

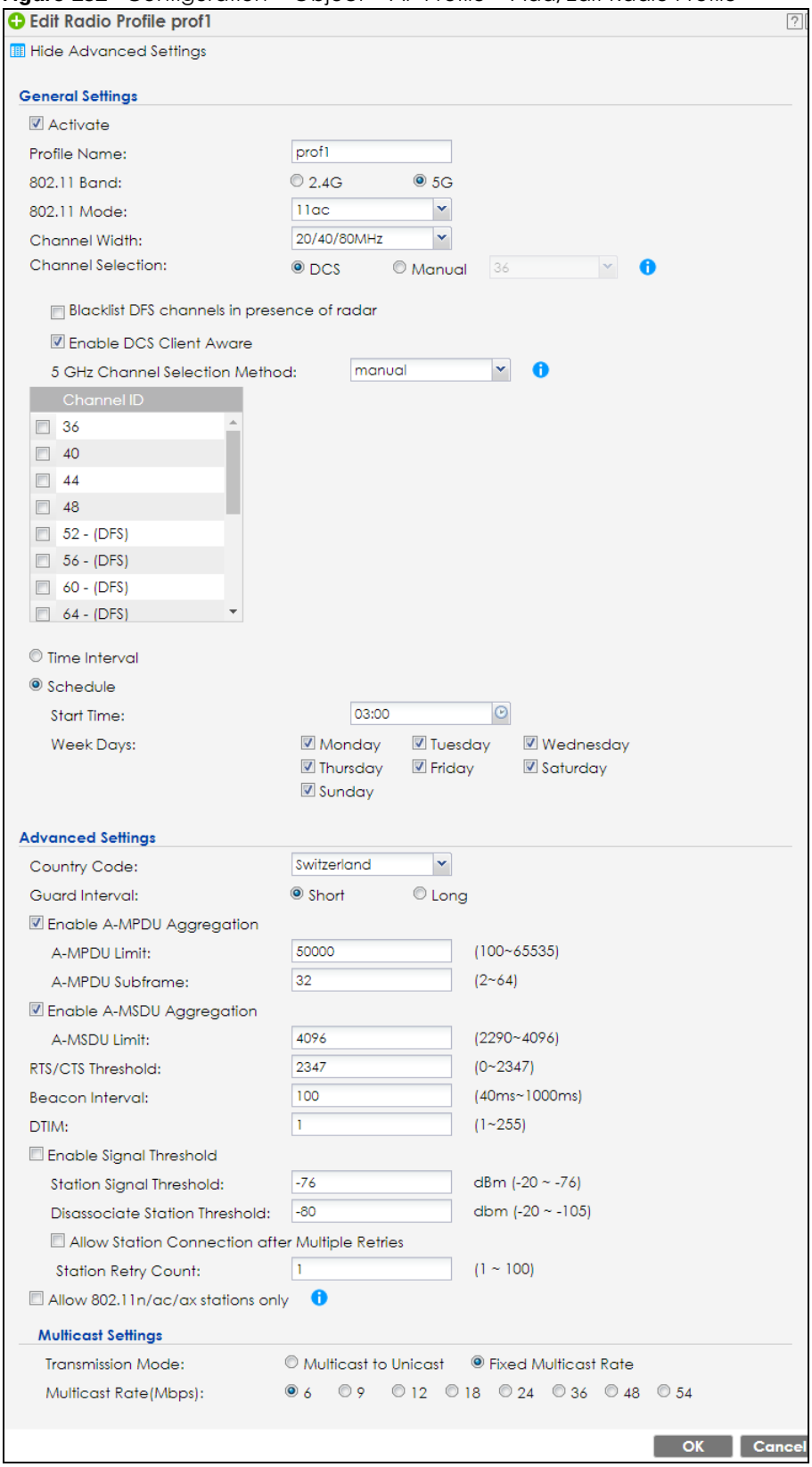
Table 122 Configuration > Object > AP Profile > Radio

LABEL	DESCRIPTION
Radio Summary	
Add	Click this to add a new radio profile.
Edit	Click this to edit the selected radio profile.
Remove	Click this to remove the selected radio profile.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Object References	Click this to view which other objects are linked to the selected radio profile.
#	This field is a sequential value, and it is not associated with a specific profile.
Status	This icon is lit when the radio profile is active and dimmed when the radio profile is inactive.
Profile Name	This field indicates the name assigned to the radio profile.
Frequency Band	This field indicates the frequency band which this radio profile is configured to use.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

19.2.1 Add/Edit Radio Profile

This screen allows you to create a new radio profile or edit an existing one. To access this screen, click the **Add** button or select a radio profile from the list and click the **Edit** button.

Figure 152 Configuration > Object > AP Profile > Add/Edit Radio Profile



The following table describes the labels in this screen.

Table 123 Configuration > Object > AP Profile > Add/Edit Radio Profile

LABEL	DESCRIPTION
Hide / Show Advanced Settings	Click this to hide or show the **Advanced Settings** in this window.
General Settings	
Activate	Select this option to make this profile active.
Profile Name	Enter up to 31 alphanumeric characters to be used as this profile's name. Spaces and underscores are allowed.
802.11 Band	Select whether this radio would use the 2.4G or 5G band.
802.11 Mode	Select how to let wireless clients connect to the AP. If **802.11 Band** is set to 2.4G: • **11b/g**: allows either IEEE 802.11b or IEEE 802.11g compliant WLAN devices to associate with the AP. The AP adjusts the transmission rate automatically according to the wireless standard supported by the wireless devices. • **11n**: allows IEEE802.11b, IEEE802.11g and IEEE802.11n compliant WLAN devices to associate with the AP. • **11ax**: allows IEEE802.11b, IEEE802.11g, IEEE802.11n, and IEEE802.11ax compliant WLAN devices to associate with the AP. If the WLAN device isn't compatible with 802.11ax, the AP will communicate with the WLAN device using 802.11n, and so on. If **802.11 Band** is set to 5G: • **11a**: allows only IEEE 802.11a compliant WLAN devices to associate with the AP. • **11n**: allows both IEEE802.11n and IEEE802.11a compliant WLAN devices to associate with the AP. • **11ac**: allows IEEE802.11n, IEEE802.11a, and IEEE802.11ac compliant WLAN devices to associate with the AP. If the WLAN device isn't compatible with 802.11ac, the AP will communicate with the WLAN device using 802.11n, and so on. • **11ax**: allows IEEE802.11n, IEEE802.11a, IEEE802.11ac, and IEEE802.11ax compliant WLAN devices to associate with the AP. If the WLAN device isn't compatible with 802.11ax, the AP will communicate with the WLAN device using 802.11ac, and so on.
Channel Width	Select the wireless channel bandwidth you want the AP to use. A standard 20 MHz channel offers transfer speeds of up to 144Mbps (2.4GHz) or 217Mbps (5GHZ) whereas a 40MHz channel uses two standard channels and offers speeds of up to 300Mbps (2.4GHz) or 450Mbps (5GHZ). An IEEE 802.11ac-specific 80MHz channel offers speeds of up to 1.3Gbps. 40 MHz (channel bonding or dual channel) bonds two adjacent radio channels to increase throughput. A 80 MHz channel consists of two adjacent 40 MHz channels. The wireless clients must also support 40 MHz or 80 MHz. It is often better to use the 20 MHz setting in a location where the environment hinders the wireless signal. Because not all devices support 40 MHz and/or 80 MHz channels, select **20/40MHz** or **20/40/80MHz** to allow the AP to adjust the channel bandwidth automatically. Select **20MHz** if you want to lessen radio interference with other wireless devices in your neighborhood or the wireless clients do not support channel bonding. Note: If the environment has poor signal-to-noise ratio (SNR), the AP will switch to a lower bandwidth.

Table 123 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

LABEL	DESCRIPTION
Channel Selection	Select the wireless channel which this radio profile should use. It is recommended that you choose the channel least in use by other APs in the region where this profile will be implemented. This will reduce the amount of interference between wireless clients and the AP to which this profile is assigned. Select **DCS** to have the AP automatically select the radio channel upon which it broadcasts by scanning the area around it and determining what channels are currently being used by other devices. Note: If you change the country code later, **Channel Selection** is set to **Manual** automatically. Select **Manual** and specify the channels the AP uses.
Blacklist DFS channels in presence of radar	This field is available if **802.11 Band** is set to **5G** and **Channel Selection** is set to **DCS**. Enable this to temporarily blacklist the wireless channels in the Dynamic Frequency Selection (DFS) range whenever a radar signal is detected by the AP.
Enable DCS Client Aware	This field is available when you set **Channel Selection** to **DCS**. Select this to have the AP switch channels only when there are no clients connected to it. If there is a client connected, the AP will not switch channels but generate a log. The AP tries to scan and switch channels again at the end of the specified time interval or at the scheduled time. If you disable this then the AP switches channels immediately regardless of any client connections. In this instance, clients that are connected to the AP when it switches channels are dropped.
2.4 GHz Channel Selection Method	This field is available when you set **Channel Selection** to **DCS**. Select **auto** to have the AP search for available channels automatically in the 2.4 GHz band. The available channels vary depending on what you select in the **2.4 GHz Channel Deployment** field. Select **manual** and specify the channels the AP uses in the 2.4 GHz band. Note: The method is automatically set to **auto** when no channel is selected or any one of the previously selected channels is not supported.
Channel ID	This field is available only when you set **Channel Selection** to **DCS** and set **2.4 GHz Channel Selection Method** to **manual**. Select the check boxes of the channels that you want the AP to use.
2.4 GHz Channel Deployment	This field is available only when you set **Channel Selection** to **DCS** and set **2.4 GHz Channel Selection Method** to **auto**. Select **Three-Channel Deployment** to limit channel switching to channels 1,6, and 11, the three channels that are sufficiently attenuated to have almost no impact on one another. In other words, this allows you to minimize channel interference by limiting channel-hopping to these three "safe" channels. Select **Four-Channel Deployment** to limit channel switching to four channels. Depending on the country domain, if the only allowable channels are 1-11 then the NXC uses channels 1, 4, 7, 11 in this configuration; otherwise, the NXC uses channels 1, 5, 9, 13 in this configuration. Four channel deployment expands your pool of possible channels while keeping the channel interference to a minimum.

Table 123 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

LABEL	DESCRIPTION
Enable 5 GHz DFS Aware	This field is available only when you select **11a**, **11n**,**11ac, or ax** in the **802.11 Band** field and set **5 GHz Channel Selection Method** to **auto**. Select this if your APs are operating in an area known to have RADAR devices. This allows the device to downgrade its frequency to below 5 GHz in the event a RADAR signal is detected, thus preventing it from interfering with that signal. Enabling this forces the AP to select a non-DFS channel.
5 GHz Channel Selection Method	Select **auto** to allow the AP to search for available channels automatically in the 5 GHz band. Select **manual** and specify the channels the AP uses in the 5 GHz band. Note: The method is automatically set to **auto** when no channel is selected or any one of the previously selected channels is not supported.
Channel ID	This field is available only when you set **Channel Selection** to **DCS** and set **5 GHz Channel Selection Method** to **manual**. Select the check boxes of the channels that you want the AP to use.
Time Interval	Select this option to have the AP survey the other APs within its broadcast radius at the end of the specified time interval.
DCS Time Interval	This field is available when you set **Channel Selection** to **DCS** and select the **Time Interval** option. Enter a number of minutes. This regulates how often the AP surveys the other APs within its broadcast radius. If the channel on which it is currently broadcasting suddenly comes into use by another AP, the AP will then dynamically select the next available clean channel or a channel with lower interference.
Schedule	Select this option to have the AP survey the other APs within its broadcast radius at a specific time on selected days of the week.
Start Time	Specify the time of the day (in 24-hour format) to have the AP use DCS to automatically scan and find a less-used channel.
Week Days	Select each day of the week to have the AP use DCS to automatically scan and find a less-used channel.
Advanced Settings	
Country Code	Select the country where the NXC is located/installed. The available channels vary depending on the country you selected. Be sure to select the correct/same country for both radios on an AP and all connected APs, in order to prevent roaming failure and interference to other systems.
Guard Interval	This field is available only when the channel width is **20/40MHz** or **20/40/80MHz** and the **802.11 Mode** is either b, g, n, or ac. It is set to auto when **802.11 Mode** is set to ax and does not appear in the screen. Set the guard interval for this radio profile to either **Short** or **Long**. The guard interval is the gap introduced between data transmission from users in order to reduce interference. Reducing the interval increases data transfer rates but also increases interference. Increasing the interval reduces data transfer rates but also reduces interference.
Enable A-MPDU Aggregation	Select this to enable A-MPDU aggregation. Message Protocol Data Unit (MPDU) aggregation collects Ethernet frames along with their 802.11n headers and wraps them in a 802.11n MAC header. This method is useful for increasing bandwidth throughput in environments that are prone to high error rates.
A-MPDU Limit	Enter the maximum frame size to be aggregated.

Table 123 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

LABEL	DESCRIPTION
A-MPDU Subframe	Enter the maximum number of frames to be aggregated each time.
Enable A-MSDU Aggregation	Select this to enable A-MSDU aggregation. Mac Service Data Unit (MSDU) aggregation collects Ethernet frames without any of their 802.11n headers and wraps the header-less payload in a single 802.11n MAC header. This method is useful for increasing bandwidth throughput. It is also more efficient than A-MPDU except in environments that are prone to high error rates.
A-MSDU Limit	Enter the maximum frame size to be aggregated.
RTS/CTS Threshold	Use RTS/CTS to reduce data collisions on the wireless network if you have wireless clients that are associated with the same AP but out of range of one another. When enabled, a wireless client sends an RTS (Request To Send) and then waits for a CTS (Clear To Send) before it transmits. This stops wireless clients from transmitting packets at the same time (and causing data collisions). A wireless client sends an RTS for all packets larger than the number (of bytes) that you enter here. Set the RTS/CTS equal to or higher than the fragmentation threshold to turn RTS/CTS off. Enter 0 to turn off this function.
Beacon Interval	When a wirelessly networked device sends a beacon, it includes with it a beacon interval. This specifies the time period before the device sends the beacon again. The interval tells receiving devices on the network how long they can wait in low-power mode before waking up to handle the beacon. A high value helps save current consumption of the access point.
DTIM	Delivery Traffic Indication Message (DTIM) is the time period after which broadcast and multicast packets are transmitted to mobile clients in the Active Power Management mode. A high DTIM value can cause clients to lose connectivity with the network. This value can be set from 1 to 255.
Enable Signal Threshold	Select the check box to use the signal threshold to ensure wireless clients receive good throughput. This allows only wireless clients with a strong signal to connect to the AP. Clear the check box to not require wireless clients to have a minimum signal strength to connect to the AP.
Station Signal Threshold	Set a minimum client signal strength. A wireless client is allowed to connect to the AP only when its signal strength is stronger than the specified threshold. -20 dBm is the strongest signal you can require and -76 is the weakest.
Disassociate Station Threshold	Set a minimum kick-off signal strength. When a wireless client's signal strength is lower than the specified threshold, the NXC disconnects the wireless client from the AP. -20 dBm is the strongest signal you can require and -90 is the weakest.
Allow Station Connection after Multiple Retries	Select this option to allow a wireless client to try to associate with the AP again after it is disconnected due to weak signal strength.
Station Retry Count	Set the maximum number of times a wireless client can attempt to re-connect to the AP
Allow 802.11n/ac/ax stations only	Select this option to allow only 802.11 n/ac/ax stations to connect, and reject 802.11a/b/g stations.
Multicast Settings	Use this section to set a transmission mode and maximum rate for multicast traffic.
Transmission Mode	Set how the AP handles multicast traffic. Select **Multicast to Unicast** to broadcast wireless multicast traffic to all of the wireless clients as unicast traffic. Unicast traffic dynamically changes the data rate based on the application's bandwidth requirements. The retransmit mechanism of unicast traffic provides more reliable transmission of the multicast traffic, although it also produces duplicate packets. Select **Fixed Multicast Rate** to send wireless multicast traffic at a single data rate. You must know the multicast application's bandwidth requirements and set it in the following field.

Table 123 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

LABEL	DESCRIPTION
Multicast Rate (Mbps)	If you set the multicast transmission mode to fixed multicast rate, set the data rate for multicast traffic here. For example, to deploy 4 Mbps video, select a fixed multicast rate higher than 4 Mbps.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

19.3 SSID

The **SSID** screens allow you to configure three different types of profiles for your networked APs: an SSID list, which can assign specific SSID configurations to your APs; a security list, which can assign specific encryption methods to the APs when allowing wireless clients to connect to them; and a MAC filter list, which can limit connections to an AP based on wireless clients MAC addresses.

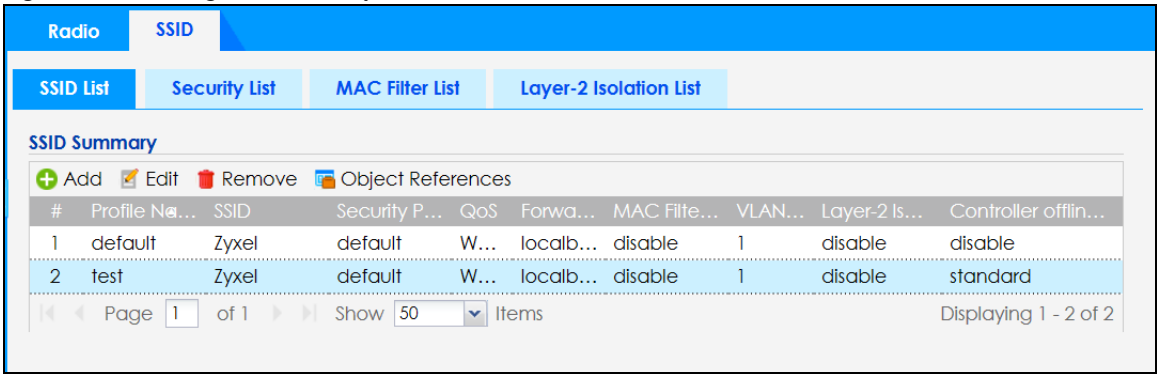
19.3.1 SSID List

This screen allows you to create and manage SSID configurations that can be used by the APs. An SSID, or Service Set IDentifier, is basically the name of the wireless network to which a wireless client can connect. The SSID appears as readable text to any device capable of scanning for wireless frequencies (such as the WiFi adapter in a laptop), and is displayed as the wireless network name when a person makes a connection to it.

To access this screen click **Configuration > Object > AP Profile > SSID**.

Note: You can have a maximum of 32 SSID profiles on the NXC.

Figure 153 Configuration > Object > AP Profile > SSID List



The following table describes the labels in this screen.

Table 124 Configuration > Object > AP Profile > SSID List

LABEL	DESCRIPTION
Add	Click this to add a new SSID profile.
Edit	Click this to edit the selected SSID profile.
Remove	Click this to remove the selected SSID profile.

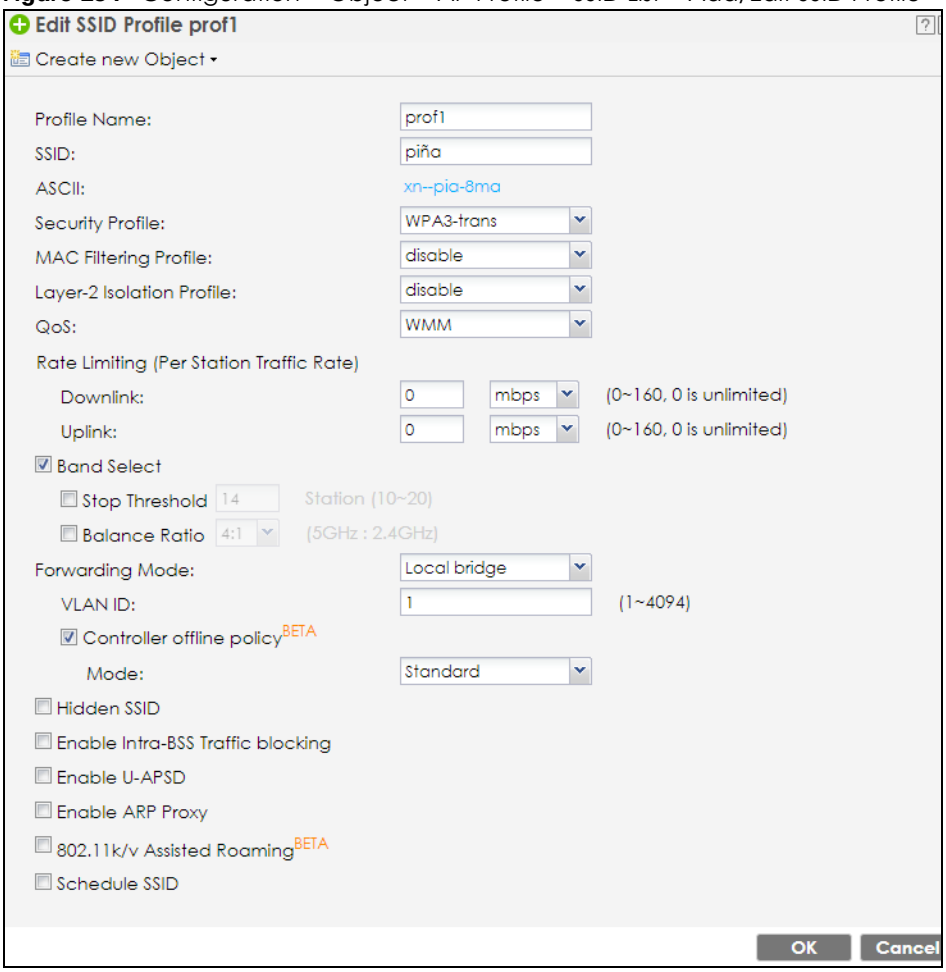
Table 124 Configuration > Object > AP Profile > SSID List (continued)

LABEL	DESCRIPTION
Object References	Click this to view which other objects are linked to the selected SSID profile (for example, radio profile).
#	This field is a sequential value, and it is not associated with a specific profile.
Profile Name	This field indicates the name assigned to the SSID profile.
SSID	This field indicates the SSID name as it appears to wireless clients.
Security Profile	This field indicates which (if any) security profile is associated with the SSID profile.
QoS	This field indicates the QoS type associated with the SSID profile.
Forwarding Mode	This field indicates the forwarding mode (**local bridge** or **tunnel**) associated with the SSID profile.
MAC Filtering Profile	This field indicates which (if any) MAC filtering profile is associated with the SSID profile.
Layer-2 Isolation Profile	This field indicates which (if any) layer-2 isolation profile is associated with the SSID profile.
VLAN ID	This field indicates the VLAN ID associated with the SSID profile.
Controller offline policy	This field indicates whether the controller offline policy is enabled and which mode is used in the SSID profile. This field is left blank if the forwarding mode is set to **Tunnel**.

19.3.1.1 Add/Edit SSID Profile

This screen allows you to create a new SSID profile or edit an existing one. To access this screen, click the **Add** button or select an SSID profile from the list and click the **Edit** button.

Figure 154 Configuration > Object > AP Profile > SSID List > Add/Edit SSID Profile



The following table describes the labels in this screen.

Table 125 Configuration > Object > AP Profile > SSID List > Add/Edit SSID Profile

LABEL	DESCRIPTION
Create new Object	Select an object type from the list to create a new one associated with this SSID profile.
Profile Name	Enter up to 31 alphanumeric characters for the profile name. This name is only visible in the Web Configurator and is only for management purposes. Spaces are not allowed.
SSID	Enter the SSID name for this profile. This is the name visible on the network to wireless clients. Enter up to 32 bytes of UTF-8 characters, including spaces and underscores. You cannot begin the SSID with the Punycode prefix "xn--". Special characters may not display properly on platforms that do not support UTF-8 on SSIDs.
ASCII	This field appears when you enter non-ASCII, UTF-8 characters. It represents the SSID in ASCII-only characters using Punycode.
Security Profile	Select a security profile from this list to associate with this SSID. If none exist, you can use the **Create new Object** menu to create one. Note: It is highly recommended that you create security profiles for all of your SSIDs to enhance your network security.

Table 125 Configuration > Object > AP Profile > SSID List > Add/Edit SSID Profile (continued)

LABEL	DESCRIPTION
MAC Filtering Profile	Select a MAC filtering profile from the list to associate with this SSID. If none exist, you can use the **Create new Object** menu to create one. MAC filtering allows you to limit the wireless clients connecting to your network through a particular SSID by wireless client MAC addresses. Any clients that have MAC addresses not in the MAC filtering profile of allowed addresses are denied connections. The **disable** setting means no MAC filtering is used.
Layer-2 Isolation Profile	Select a layer-2 isolation profile from the list to associate with this SSID. If none exist, you can use the **Create new Object** menu to create one. The **disable** setting means no layer-2 isolation is used.
QoS	Select a Quality of Service (QoS) access category to associate with this SSID. Access categories minimize the delay of data packets across a wireless network. Certain categories, such as video or voice, are given a higher priority due to the time sensitive nature of their data packets. QoS access categories are as follows: **disable**: Turns off QoS for this SSID. All data packets are treated equally and not tagged with access categories. **WMM**: Enables automatic tagging of data packets. The NXC assigns access categories to the SSID by examining data as it passes through it and making a best guess effort. If something looks like video traffic, for instance, it is tagged as such. **WMM_VOICE**: All wireless traffic to the SSID is tagged as voice data. This is recommended if an SSID is used for activities like placing and receiving VoIP phone calls. **WMM_VIDEO**: All wireless traffic to the SSID is tagged as video data. This is recommended for activities like video conferencing. **WMM_BEST_EFFORT**: All wireless traffic to the SSID is tagged as "best effort," meaning the data travels the best route it can without displacing higher priority traffic. This is good for activities that do not require the best bandwidth throughput, such as surfing the Internet. **WMM_BACKGROUND**: All wireless traffic to the SSID is tagged as low priority or "background traffic", meaning all other access categories take precedence over this one. If traffic from an SSID does not have strict throughput requirements, then this access category is recommended. For example, an SSID that only has network printers connected to it.
Rate Limiting	
Downlink	Define the maximum incoming transmission data rate (either in mbps or kbps) on a per-station basis.
Uplink	Define the maximum outgoing transmission data rate (either in mbps or kbps) on a per-station basis.
Band Select	To improve network performance and avoid interference in the 2.4 GHz frequency band, you can enable this feature to use the 5 GHz band first. You should set 2.4GHz and 5 GHz radio profiles to use the same SSID and security settings. Select the check box to turn on **Band Select**. Connections to an SSID using the 2.4GHz band are still allowed. If you enable IEEE 802.11k/v assisted roaming on the AP, • when a client connecting to the 2.4 GHz WiFi network can also function in the 5 GHz band and supports 802.11v, and its 5 GHz WiFi signal strength is good, the AP sends 802.11v messages to suggest preferred 5 GHz SSIDs to the client. • when a client connecting to the 2.4 GHz WiFi network can also function in the 5 GHz band but doesn't support 802.11v, the AP disconnects the client after it has been idle longer than 5 seconds. The client then can change to connect to a 5 GHz WiFi network. Otherwise, clear the check box to turn off this feature.

Table 125 Configuration > Object > AP Profile > SSID List > Add/Edit SSID Profile (continued)

LABEL	DESCRIPTION
Stop Threshold	This field is available when you enable **Band Select**. Select this option and set the threshold number of the connected wireless clients at which the NXC disables the band select feature.
Balance Ratio	This field is available when you enable **Band Select**. Select this option and set a ratio of the wireless clients using the 5 GHz band to the wireless clients using the 2.4 GHz band.
Forwarding Mode	Select a forwarding mode for traffic from this SSID.
VLAN ID	If you selected the **Local Bridge** forwarding mode, enter the VLAN ID that will be used to tag all traffic originating from this SSID if the VLAN is different from the native VLAN. All the station's traffic goes through the AP's gateway.
VLAN Interface	If you selected the **Tunnel** forwarding mode, select a VLAN interface. All the station's traffic is forwarded to the NXC first.
Controller offline policy	This field is available only when the forwarding mode is **Local Bridge**. When the AP cannot connect to the NXC and **Radius Server Type** is set to **Internal** in the applied security profile, 802.1x authentication will fail. Select this to turn on the controller offline policy and specify the action the AP takes when the AP controller (the NXC) is not reachable.
Mode	This field is available when you enable **Controller offline policy**. If you select **Standard,** the AP hides the SSID when the AP fails to connect to the NXC. The SSID stays up when the NXC is reachable. If you select **Fallback**, the SSID appears only when the NXC is not reachable and is hidden when the AP can connect to the NXC. Note: It is highly recommended that you associate this SSID with a security profile using WPA2-Personal when the mode is set to **Fallback**. This way wireless clients can still connect to the SSID without 802.1x authentication when the NXC is not reachable.
Hidden SSID	Select this if you want to "hide" your SSID from wireless clients. This tells any wireless clients in the vicinity of the AP using this SSID profile not to display its SSID name as a potential connection. Not all wireless clients respect this flag and display it anyway. When an SSID is "hidden" and a wireless client cannot see it, the only way you can connect to the SSID is by manually entering the SSID name in your wireless connection setup screen(s) (these vary by client, client connectivity software, and operating system).
Enable Intra-BSS Traffic Blocking	Select this option to prevent crossover traffic from within the same SSID on an AP. Note: If you associate a layer-2 isolation profile with the SSID, this option will be selected automatically and cannot be configured.
Enable U-APSD	Select this option to enable Automatic Power Save Delivery. This helps increase battery life for battery-powered wireless clients connected to the AP using this SSID profile.
Enable ARP Proxy	The Address Resolution Protocol (ARP) is a protocol for mapping an IP address to a MAC address. An ARP broadcast is sent to all devices in the same Ethernet network to request the MAC address of a target IP address. Select this option to allow the AP to answer ARP requests for an IP address on behalf of a client associated with this SSID. This can reduce broadcast traffic and improve network performance.
802.11k/v Assisted Roaming	Select this option to enable IEEE 802.11k/v assisted roaming on the AP. When the connected clients request 802.11k neighbor lists, the AP will response with a list of neighbor APs that can be candidates for roaming. When the 802.11v capable clients are using the 2.4 GHz band, the AP can send 802.11v messages to steer clients to the 5 GHz band.

Table 125 Configuration > Object > AP Profile > SSID List > Add/Edit SSID Profile (continued)

LABEL	DESCRIPTION
Schedule SSID	Select this option and set whether the SSID is enabled or disabled on each day of the week. You also need to select the hour and minute (in 24-hour format) to specify the time period of each day during which the SSID is enabled/enabled.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

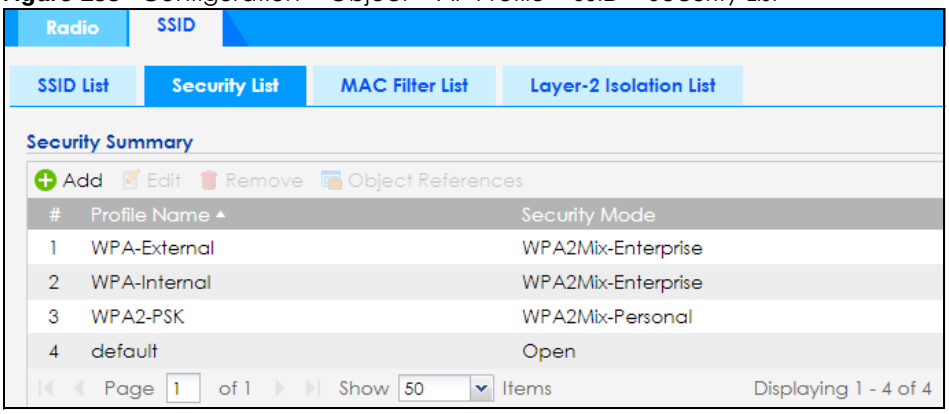
19.3.2 Security List

This screen allows you to manage wireless security configurations that can be used by your SSIDs. Wireless security is implemented strictly between the AP broadcasting the SSID and the stations that are connected to it.

To access this screen click **Configuration > Object > AP Profile > SSID > Security List**.

Note: You can have a maximum of 32 security profiles on the NXC.

Figure 155 Configuration > Object > AP Profile > SSID > Security List



The following table describes the labels in this screen.

Table 126 Configuration > Object > AP Profile > SSID > Security List

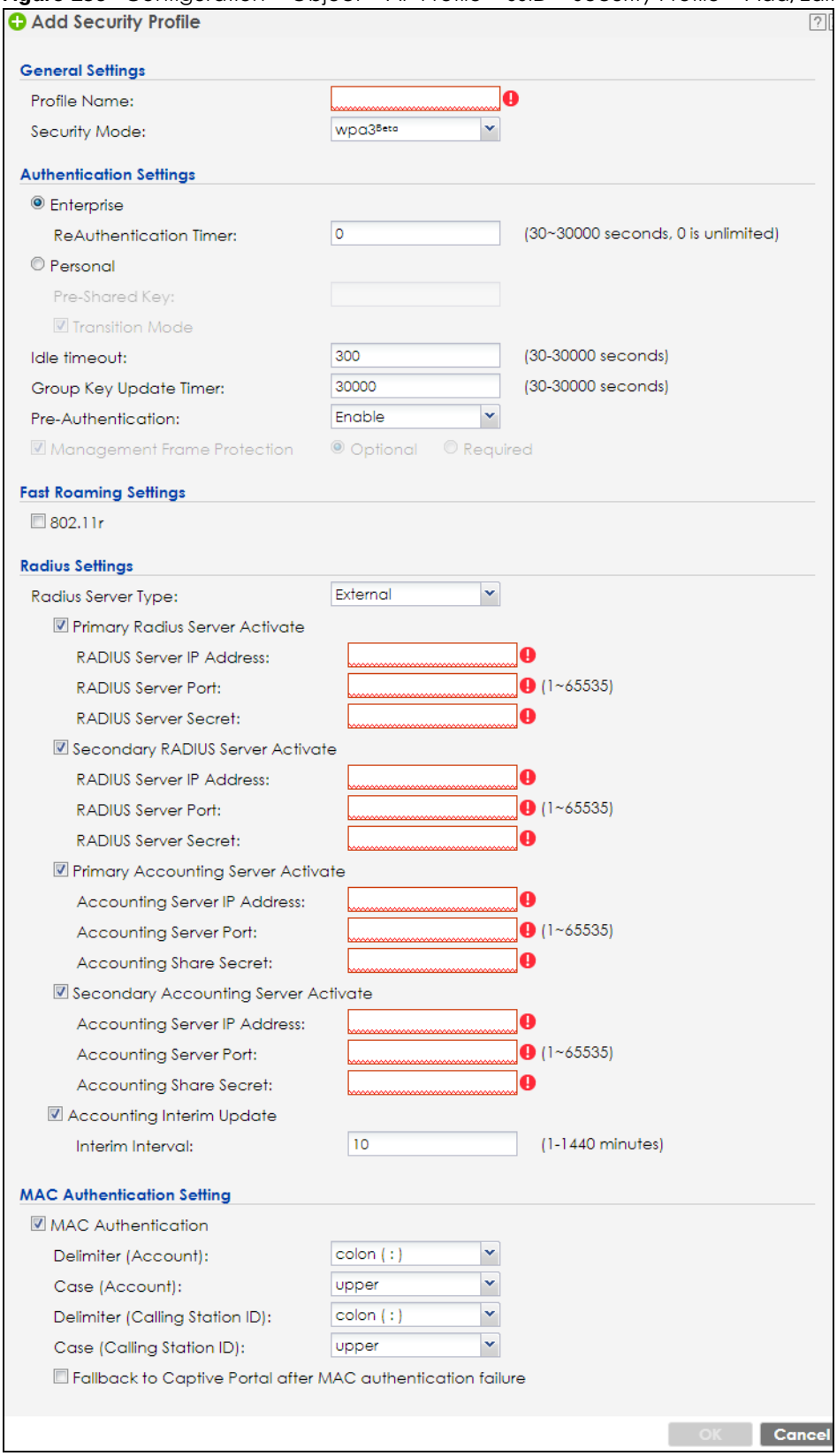
LABEL	DESCRIPTION
Add	Click this to add a new security profile.
Edit	Click this to edit the selected security profile.
Remove	Click this to remove the selected security profile.
Object References	Click this to view which other objects are linked to the selected security profile (for example, SSID profile).
#	This field is a sequential value, and it is not associated with a specific profile.
Profile Name	This field indicates the name assigned to the security profile.
Security Mode	This field indicates this profile's security mode.

19.3.2.1 Add/Edit Security Profile

This screen allows you to create a new security profile or edit an existing one. To access this screen, click the **Add** button or select a security profile from the list and click the **Edit** button.

Note: This screen's options change based on the **Security Mode** selected.

Figure 156 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile



The following table describes the labels in this screen.

Table 127 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

LABEL	DESCRIPTION
General Settings	
Profile Name	Enter up to 31 alphanumeric characters for the profile name. This name is only visible in the Web Configurator and is only for management purposes. Spaces and underscores are allowed.
Security Mode	Select a security mode from the list: **open**, **enhanced open**, **wep**, **wpa2**, **wpa2-mix**, or **wpa3**. **enhanced open** uses Opportunistic Wireless Encryption (OWE) which encrypts the wireless connection when possible.
Authentication Settings	
Enterprise	Select this to integrate back-end authentication with a RADIUS server.
Auth. Method	This field is available only when you set the RADIUS server type to **Internal**. Select an authentication method if you have created any in the **Configuration > Object > Auth. Method** screen.
Reauthentication Timer	Enter the interval (in seconds) between authentication requests. Enter a 0 for unlimited requests.
Idle Timeout	Enter the idle interval (in seconds) that a client can be idle before authentication is discontinued.
Authentication Type	Select a WEP authentication method. Choices are **Open** or **Share** key.
Key Length	Select the bit-length of the encryption key to be used in WEP connections. If you select **WEP-64**: • Enter 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0x11AA22BB33) for each **Key** used. or • Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for each **Key** used. If you select **WEP-128**: • Enter 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0x00112233445566778899AABBCC) for each **Key** used. or • Enter 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey12345678) for each **Key** used.
Key 1~4	Based on your **Key Length** selection, enter the appropriate length hexadecimal or ASCII key.
Personal	Select this option to use a Pre-Shared Key (PSK) with WPA2 encryption or Simultaneous Authentication of Equals (SAE) with WPA3 encryption.
Pre-Shared Key	Enter a pre-shared key of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols) or 64 hexadecimal characters.
Transition Mode	Enable this for backwards compatibility. This option is only available if the **Security Mode** is **wpa3** or **enhanced open**. This creates two virtual APs (VAPs) with a primary (WPA3 or enhanced open) and fallback (WPA2 or open) security method. If **Security Mode** is **wpa3**, enabling this will force **Management Frame Protection** to be set to **Optional**. If this is disabled or if the **Security Mode** is **enhanced open**, **Management Frame Protection** will be set to **Required**.

Table 127 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

LABEL	DESCRIPTION
Cipher Type	Select an encryption cipher type from the list. WPA3 security mode uses AES only. • **auto** - This automatically chooses the best available cipher based on the cipher in use by the wireless client that is attempting to make a connection. • **aes** - This is the Advanced Encryption Standard encryption method. It is a more recent development over TKIP and considerably more robust. Not all wireless clients may support this.
Group Key Update Timer	Enter the interval (in seconds) at which the AP updates the group WPA encryption key.
Pre-Authentication	This field is available only when you set **Security Mode** to **wpa2** or **wpa2-mix** and enable 802.1x authentication. **Enable** or **Disable** pre-authentication to allow the AP to send authentication information to other APs on the network, allowing connected wireless clients to switch APs without having to re-authenticate their network connection.
Management Frame Protection	This field is available only when you select **wpa2** in the **Security Mode** field and set **Cipher Type** to **aes**. Data frames in 802.11 WLANs can be encrypted and authenticated with WEP, WPA or WPA2. But 802.11 management frames, such as beacon/probe response, association request, association response, de-authentication and disassociation are always unauthenticated and unencrypted. IEEE 802.11w Protected Management Frames allows APs to use the existing security mechanisms (encryption and authentication methods defined in IEEE 802.11i WPA/WPA2) to protect management frames. This helps prevent wireless DoS attacks. Select the check box to enable management frame protection (MFP) to add security to 802.11 management frames. Select **Optional** if you do not require the wireless clients to support MFP. Management frames will be encrypted if the clients support MFP. Select **Required** and wireless clients must support MFP in order to join the AP's wireless network.
Fast Roaming Settings	802.11r fast roaming reduces the delay when the clients switch from one AP to another by allowing security keys to be stored on all APs in a network. Information from the original association is passed to the new AP when the client roams. The client doesn't need to perform the whole 802.1x authentication process.
802.11r	This field is available only when you set **Security Mode** to **wpa2** or **wpa2-mix**. Select this to turn on IEEE 802.11r fast roaming on the AP.
Radius Settings	
Radius Server Type	Select **Internal** to use the NXC's internal authentication database, or **External** to use an external RADIUS server for authentication.
Primary / Secondary Radius Server Activate	Select this to have the AP use the specified RADIUS server.
Radius Server IP Address	Enter the IP address of the RADIUS server to be used for authentication.
Radius Server Port	Enter the port number of the RADIUS server to be used for authentication.
Radius Server Secret	Enter the shared secret password of the RADIUS server to be used for authentication.
Primary / Secondary Accounting Server Activate	Select the check box to enable user accounting through an external authentication server.
Accounting Server IP Address	Enter the IP address of the external accounting server in dotted decimal notation.

Table 127 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

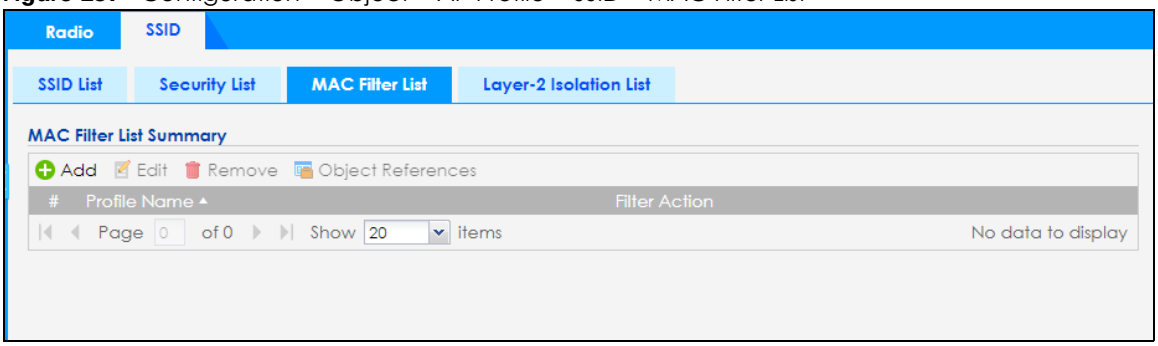
LABEL	DESCRIPTION
Accounting Server Port	Enter the port number of the external accounting server.
Accounting Share Secret	Enter a password (up to 128 alphanumeric characters) as the key to be shared between the external accounting server and the AP. The key must be the same on the external accounting server and your AP. The key is not sent over the network.
Accounting Interim Update	This field is available only when you enable user accounting through an external accounting server. Select this to have the AP send accounting update messages to the accounting server at the interval you specify.
Interim Interval	Specify the time interval for how often the AP is to send an interim update message with current client statistics to the accounting server.
MAC Authentication Setting	
MAC Authentication	Select this to use an external server or the NXC's local database to authenticate wireless clients by their MAC addresses. Users cannot get an IP address if the MAC authentication fails. See MAC Address Accounts on page 239 for information on MAC address user accounts. An external server can use the wireless client's account (username/password) or Calling Station ID for MAC authentication. Configure the ones the external server uses.
Auth. Method	This field is available only when you set the RADIUS server type to **Internal**. Select an authentication method if you have created any in the **Configuration > Object > Auth. Method** screen.
Delimiter (Account)	Select the separator the external server uses for the two-character pairs within account MAC addresses.
Case (Account)	Select the case (**upper** or **lower**) the external server requires for letters in the account MAC addresses.
Delimiter (Calling Station ID)	RADIUS servers can require the MAC address in the Calling Station ID RADIUS attribute. Select the separator the external server uses for the pairs in calling station MAC addresses.
Case (Calling Station ID)	Select the case (**upper** or **lower**) the external server requires for letters in the calling station MAC addresses.
Fallback to Captive Portal after MAC authentication failure	Select this to have the client change to authenticate his/her connection via the captive portal login page when MAC authentication fails and captive portal is enabled. If MAC authentication fails and captive portal is disabled, the client can log into the network without authentication.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

19.3.3 MAC Filter List

This screen allows you to create and manage MAC filtering profiles that can be used by your SSIDs. To access this screen click **Configuration > Object > AP Profile > SSID > MAC Filter List**.

Note: You can have a maximum of 32 MAC filtering profiles on the NXC.

Figure 157 Configuration > Object > AP Profile > SSID > MAC Filter List



The following table describes the labels in this screen.

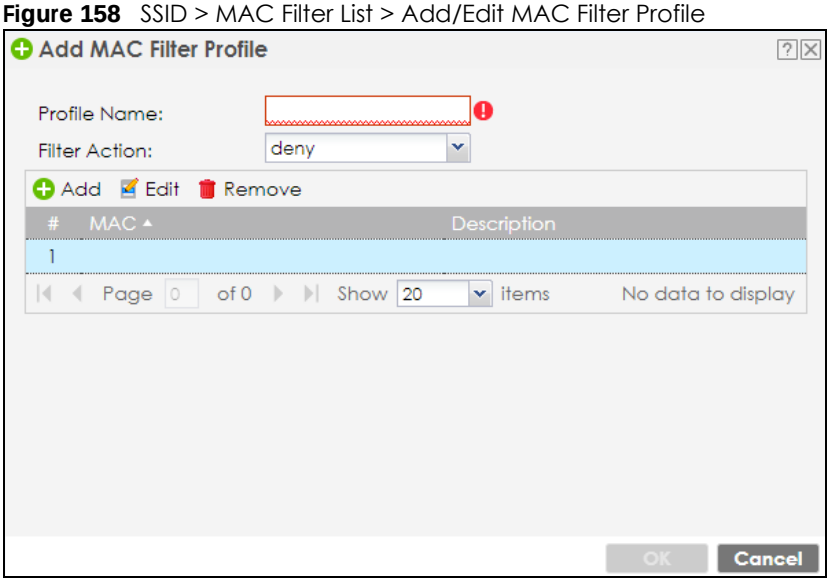
Table 128 Configuration > Object > AP Profile > SSID > MAC Filter List

LABEL	DESCRIPTION
Add	Click this to add a new MAC filtering profile.
Edit	Click this to edit the selected MAC filtering profile.
Remove	Click this to remove the selected MAC filtering profile.
Object References	Click this to view which other objects are linked to the selected MAC filtering profile (for example, SSID profile).
#	This field is a sequential value, and it is not associated with a specific profile.
Profile Name	This field indicates the name assigned to the MAC filtering profile.
Filter Action	This field indicates this profile's filter action (if any).

19.3.3.1 Add/Edit MAC Filter Profile

This screen allows you to create a new MAC filtering profile or edit an existing one. To access this screen, click the **Add** button or select a MAC filtering profile from the list and click the **Edit** button.

Figure 158 SSID > MAC Filter List > Add/Edit MAC Filter Profile



The following table describes the labels in this screen.

Table 129 SSID > MAC Filter List > Add/Edit MAC Filter Profile

LABEL	DESCRIPTION
Profile Name	Enter up to 31 alphanumeric characters for the profile name. This name is only visible in the Web Configurator and is only for management purposes. Spaces are not allowed.
Filter Action	Select **allow** to permit the wireless client with the MAC addresses in this profile to connect to the network through the associated SSID; select **deny** to block the wireless clients with the specified MAC addresses.
Add	Click this to add a MAC address to the profile's list.
Edit	Click this to edit the selected MAC address in the profile's list.
Remove	Click this to remove the selected MAC address from the profile's list.
#	This field is a sequential value, and it is not associated with a specific profile.
MAC	This field specifies a MAC address associated with this profile.
Description	This field displays a description for the MAC address associated with this profile. You can click the description to make it editable. Enter up to 60 characters, spaces and underscores allowed.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

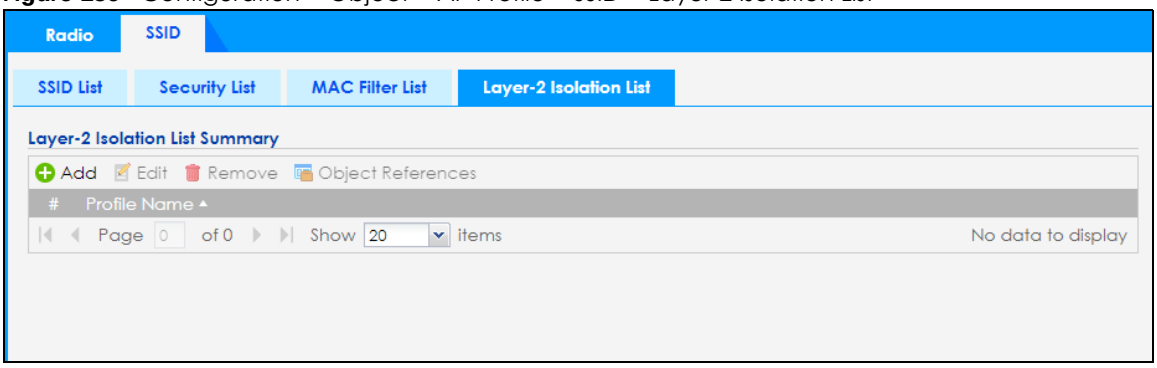
19.3.4 Layer-2 Isolation List

This screen allows you to create and manage layer-2 isolation profiles that can be used by your SSIDs. To access this screen click **Configuration > Object > AP Profile > SSID > Layer-2 Isolation List**.

If a device's MAC addresses is NOT listed in a layer-2 isolation profile, it is blocked from communicating with other devices in an SSID on which layer-2 isolation is enabled.

Note: You can have a maximum of 32 layer-2 isolation profiles on the NXC.

Figure 159 Configuration > Object > AP Profile > SSID > Layer-2 Isolation List



The following table describes the labels in this screen.

Table 130 Configuration > Object > AP Profile > SSID > Layer-2 Isolation List

LABEL	DESCRIPTION
Layer-2 Isolation List Summary	
Add	Click this to add a new layer-2 isolation profile.
Edit	Click this to edit the selected layer-2 isolation profile.
Remove	Click this to remove the selected layer-2 isolation profile.

Table 130 Configuration > Object > AP Profile > SSID > Layer-2 Isolation List (continued)

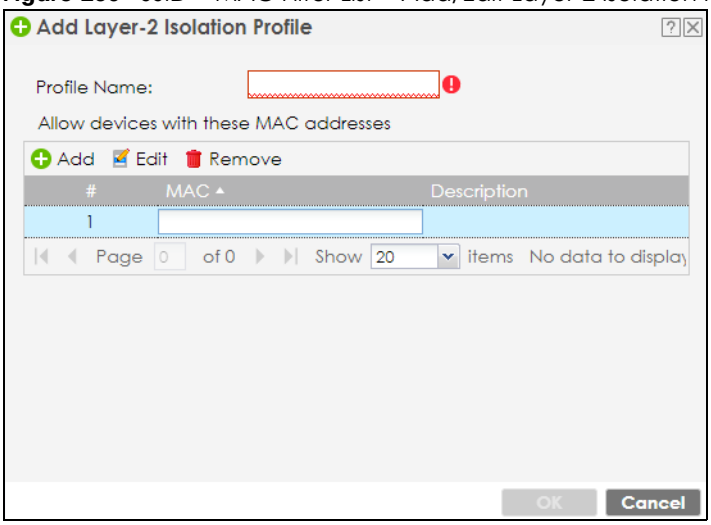
LABEL	DESCRIPTION
Object References	Click this to view which other objects are linked to the selected layer-2 isolation profile (for example, SSID profile).
#	This field is a sequential value, and it is not associated with a specific profile.
Profile Name	This field indicates the name assigned to the layer-2 isolation profile.

19.3.4.1 Add/Edit Layer-2 Isolation Profile

This screen allows you to create a new layer-2 isolation profile or edit an existing one. To access this screen, click the **Add** button or select a layer-2 isolation profile from the list and click the **Edit** button.

Note: You need to know the MAC address of each device that you want to allow to be accessed by other devices in the SSID to which the layer-2 isolation profile is applied.

Figure 160 SSID > MAC Filter List > Add/Edit Layer-2 Isolation Profile



The following table describes the labels in this screen.

Table 131 SSID > MAC Filter List > Add/Edit Layer-2 Isolation Profile

LABEL	DESCRIPTION
Profile Name	Enter up to 31 alphanumeric characters for the profile name. This name is only visible in the Web Configurator and is only for management purposes. Underscores are allowed.
Add	Click this to add a MAC address to the profile's list.
Edit	Click this to edit the selected MAC address in the profile's list.
Remove	Click this to remove the selected MAC address from the profile's list.
#	This field is a sequential value, and it is not associated with a specific profile.
MAC	This field specifies a MAC address associated with this profile.
Description	This field displays a description for the MAC address associated with this profile. You can click the description to make it editable. Enter up to 60 characters, spaces and underscores allowed.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 20
MON Profile

20.1 Overview

This screen allows you to set up monitor mode configurations that allow your connected APs to scan for other wireless devices in the vicinity. Once detected, you can use the **Rogue AP** screen (Section 8.4 on page 140) to classify them as either rogue or friendly and then manage them accordingly.

20.1.1 What You Can Do in this Chapter

The **MON Profile** screen (Section 20.2 on page 279) creates preset monitor mode configurations that can be used by the APs.

20.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Active Scan

An active scan is performed when an 802.11-compatible wireless monitoring device is explicitly triggered to scan a specified channel or number of channels for other wireless devices broadcasting on the 802.11 frequencies by sending probe request frames.

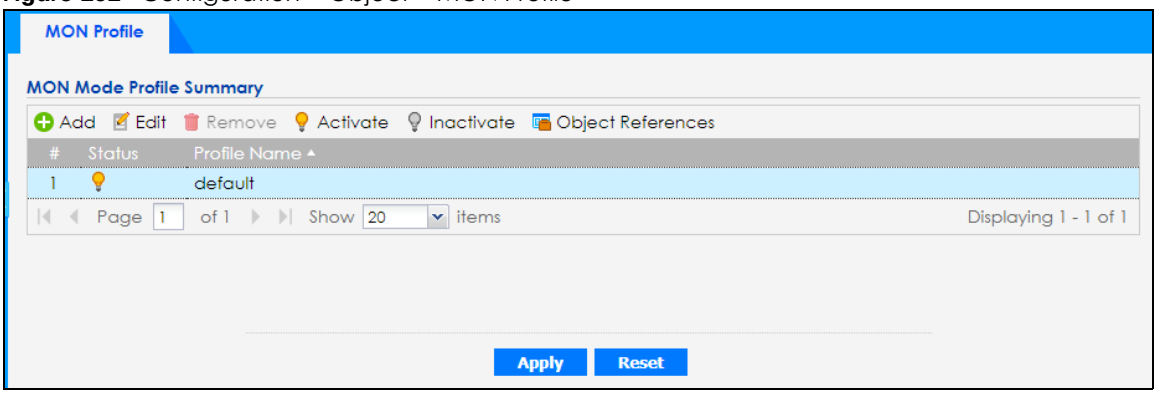
Passive Scan

A passive scan is performed when an 802.11-compatible monitoring device is set to periodically listen to a specified channel or number of channels for other wireless devices broadcasting on the 802.11 frequencies.

20.2 MON Profile

This screen allows you to create monitor mode configurations that can be used by the APs. To access this screen, login to the Web Configurator, and click **Configuration > Object > MON Profile**.

Figure 161 Configuration > Object > MON Profile



The following table describes the labels in this screen.

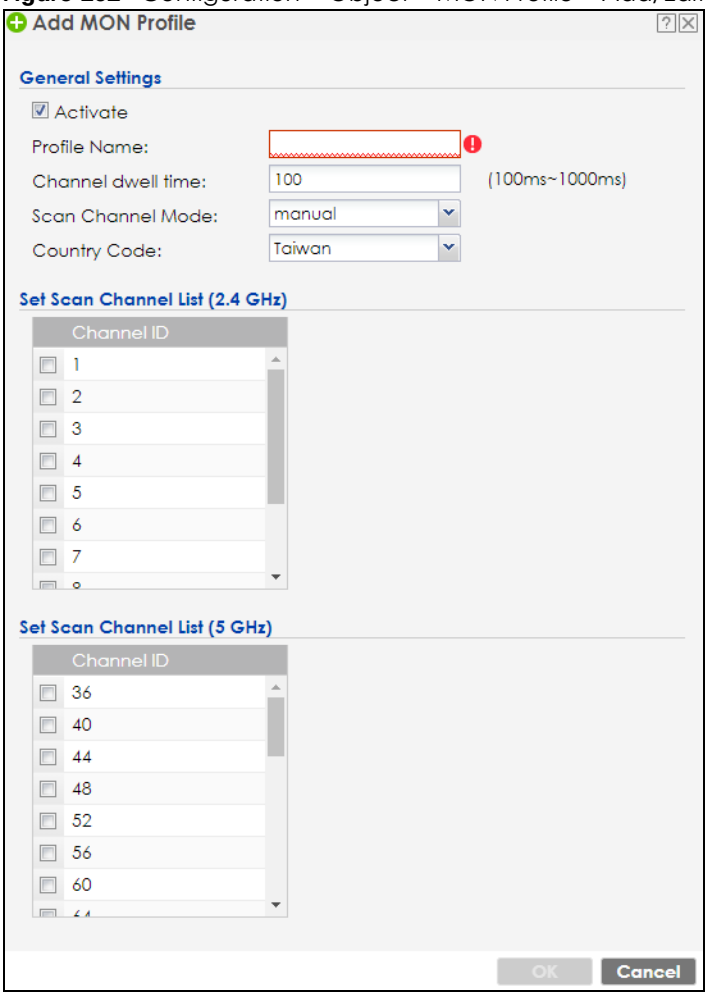
Table 132 Configuration > Object > MON Profile

LABEL	DESCRIPTION
Add	Click this to add a new monitor mode profile.
Edit	Click this to edit the selected monitor mode profile.
Remove	Click this to remove the selected monitor mode profile.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
Object References	Click this to view which other objects are linked to the selected monitor mode profile (for example, an AP management profile).
#	This field is a sequential value, and it is not associated with a specific user.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Profile Name	This field indicates the name assigned to the monitor profile.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

20.2.1 Add/Edit MON Profile

This screen allows you to create a new monitor mode profile or edit an existing one. To access this screen, click the **Add** button or select and existing monitor mode profile and click the **Edit** button.

Figure 162 Configuration > Object > MON Profile > Add/Edit MON Profile



The following table describes the labels in this screen.

Table 133 Configuration > Object > MON Profile > Add/Edit MON Profile

LABEL	DESCRIPTION
General Settings	
Activate	Select this to activate this monitor mode profile.
Profile Name	This field indicates the name assigned to the monitor mode profile.
Channel dwell time	Enter the interval (in milliseconds) before the AP switches to another channel for monitoring.
Scan Channel Mode	Select **auto** to have the AP switch to the next sequential channel once the **Channel dwell time** expires. Select **manual** to set specific channels through which to cycle sequentially when the **Channel dwell time** expires. Selecting this options makes the **Scan Channel List** options available.
Country Code	Select the country where the NXC is located/installed. The available channels vary depending on the country you selected. Be sure to select the correct/same country for both radios on an AP and all APs connected to the NXC, in order to prevent roaming failure and interference to other systems.

Table 133 Configuration > Object > MON Profile > Add/Edit MON Profile (continued)

LABEL	DESCRIPTION
Set Scan Channel List (2.4 GHz)	Select a channel's check box to have the APs using this profile scan that channel when **Scan Channel Mode** is set to **manual**. These channels are limited to the 2 GHz range (802.11 ax/b/g/n).
Set Scan Channel List (5 GHz)	Select a channel's check box to have the APs using this profile scan that channel when **Scan Channel Mode** is set to **manual**. These channels are limited to the 5 GHz range (802.11 ax/ac/a/n).
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

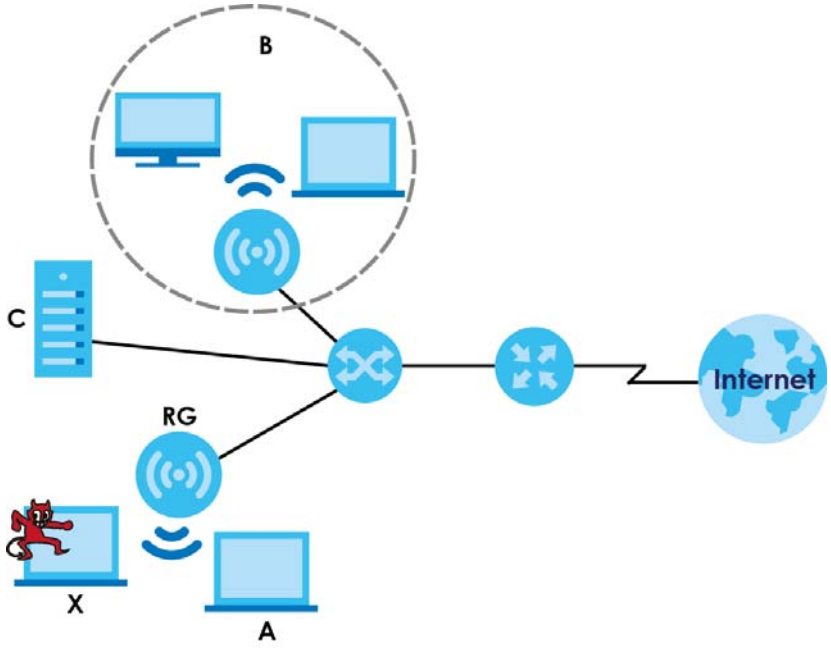
20.3 Technical Reference

The following section contains additional technical information about the features described in this chapter.

Rogue APs

Rogue APs are wireless access points operating in a network's coverage area that are not under the control of the network's administrators, and can open up holes in a network's security. Attackers can take advantage of a rogue AP's weaker (or non-existent) security to gain access to the network, or set up their own rogue APs in order to capture information from wireless clients. If a scan reveals a rogue AP, you can use commercially-available software to physically locate it.

Figure 163 Rogue AP Example



In the example above, a corporate network's security is compromised by a rogue AP (**RG**) set up by an employee at his workstation in order to allow him to connect his notebook computer wirelessly (**A**). The

company's legitimate wireless network (the dashed ellipse **B**) is well-secured, but the rogue AP uses inferior security that is easily broken by an attacker (**X**) running readily available encryption-cracking software. In this example, the attacker now has access to the company network, including sensitive data stored on the file server (**C**).

Friendly APs

If you have more than one AP in your wireless network, you should also configure a list of "friendly" APs. Friendly APs are other wireless access points that are detected in your network, as well as any others that you know are not a threat (those from recognized networks, for example). It is recommended that you export (save) your list of friendly APs often, especially if you have a network with a large number of access points.

CHAPTER 21
ZyMesh Profile

21.1 Overview

This chapter shows you how to configure ZyMesh profiles for the NXC to apply to the managed APs.

ZyMesh is a Zyxel proprietary protocol that creates wireless mesh links between managed APs to expand the wireless network. Managed APs can provide services or forward traffic between the NXC and wireless clients. ZyMesh also allows the NXC to use CAPWAP to automatically update the configuration settings on the managed APs (in repeater mode) through wireless connections. The managed APs (in repeater mode) are provisioned hop by hop.

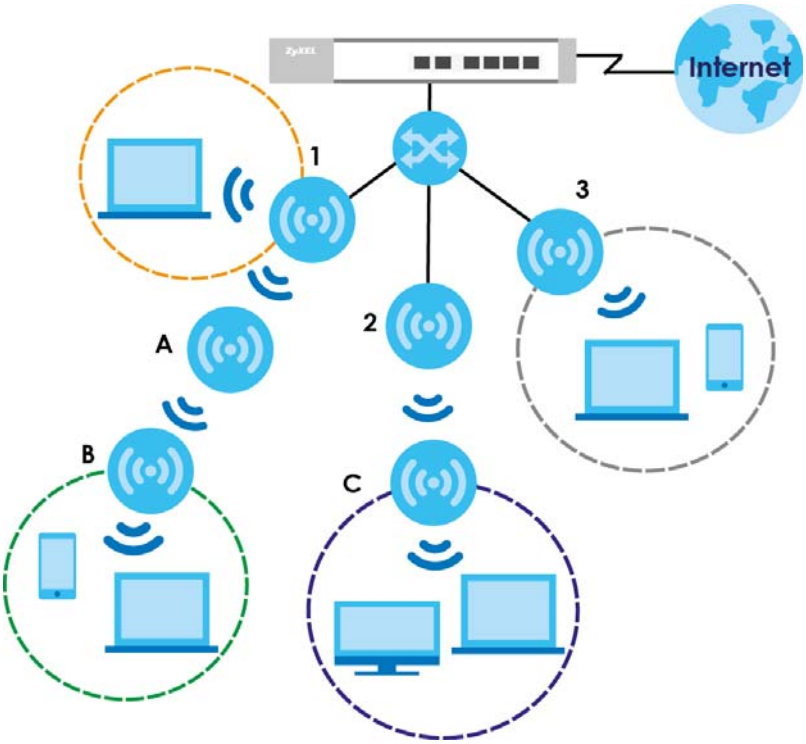
The managed APs in a ZyMesh must use the same SSID, channel number and pre-shared key. A manged AP can be either a root AP or repeater in a ZyMesh.

Note: All managed APs should be connected to the NXC directly to get the configuration file before being deployed to build a ZyMesh. Ensure you restart the managed AP after you change its operating mode using the **Configuration > Wireless > AP Management** screen (see Section 8.3 on page 120).

- Root AP: a managed AP that can transmit and receive data from the NXC via a wired Ethernet connection.
- Repeater: a managed AP that transmits and/or receives data from the NXC via a wireless connection through a root AP.

Note: When managed APs are deployed to form a ZyMesh for the first time, the root AP must be connected to an AP controller (the NXC).

In the following example, managed APs **1** and **2** act as a root AP and managed APs **A**, **B** and **C** are repeaters.



The maximum number of hops (the repeaters between a wireless client and the root AP) you can have in a ZyMesh varies according to how many wireless clients a managed AP can support.

Note: A ZyMesh link with more hops has lower throughput.

Note: When the wireless connection between the root AP and the repeater is up, in order to prevent bridge loops, the repeater would not be able to transmit data through its Ethernet port(s). The repeater then could only receive power from a PoE device if you use PoE to provide power to the managed AP via an 8-ping Ethernet cable.

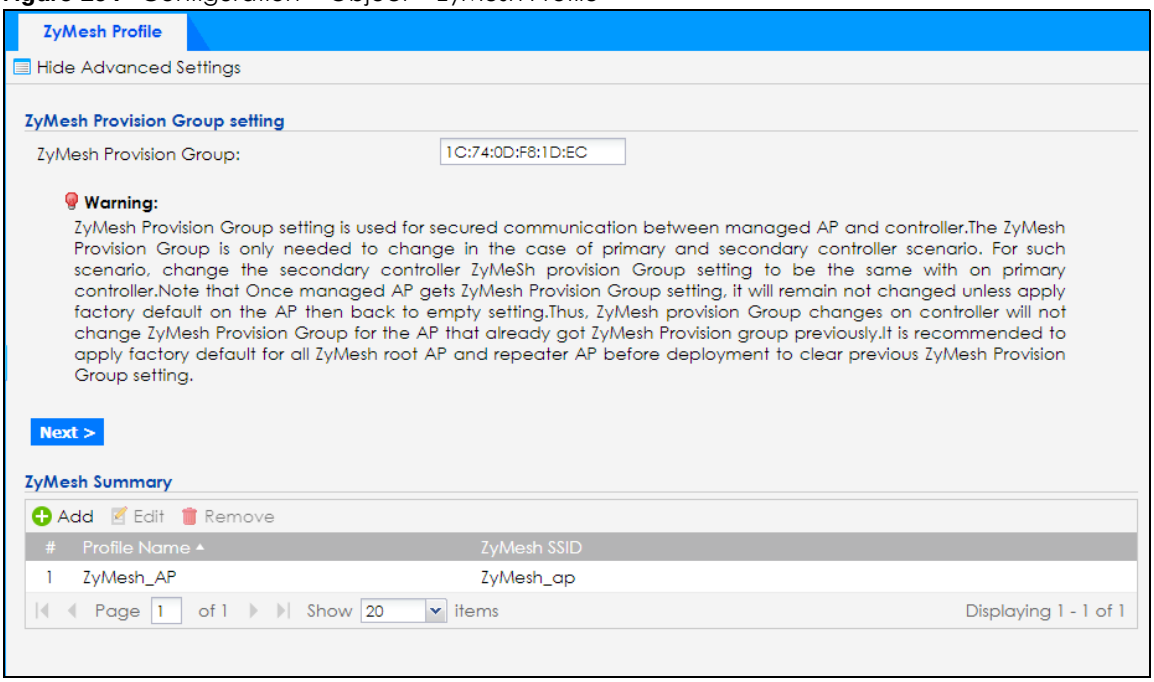
21.1.1 What You Can Do in this Chapter

The **ZyMesh Profile** screen (Section 21.2 on page 285) creates preset ZyMesh configurations that can be used by the NXC.

21.2 ZyMesh Profile

This screen allows you to manage and create ZyMesh profiles that can be used by the APs. To access this screen, click **Configuration > Object > ZyMesh Profile**.

Figure 164 Configuration > Object > ZyMesh Profile



The following table describes the labels in this screen.

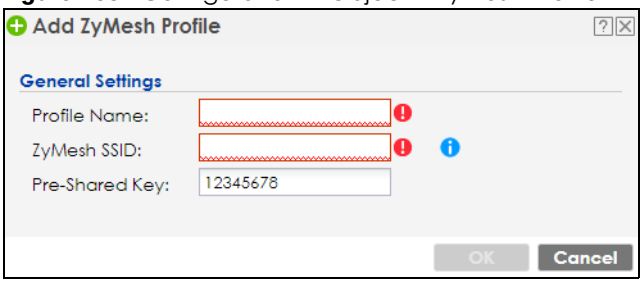
Table 134 Configuration > Object > ZyMesh Profile

LABEL	DESCRIPTION
Hide / Show Advanced Settings	Click this to display a greater or lesser number of configuration fields.
ZyMesh Provision Group	By default, this shows the MAC address used by the NXC's first Ethernet port. Say you have two AP controllers (NXCs) in your network and the primary AP controller is not reachable. You may want to deploy the second/backup AP controller in your network to replace the primary AP controller. In this case, it is recommended that you enter the primary AP controller's **ZyMesh Provision Group** MAC address in the second AP controller's **ZyMesh Provision Group** field. If you didn't change the second AP controller's MAC address, managed APs in an existing ZyMesh can still access the networks through the second AP controller and communicate with each other. But new managed APs will not be able to communicate with the managed APs in the existing ZyMesh, which is set up with the primary AP controller's MAC address. To allow all managed APs to communicate in the same ZyMesh, you can just set the second AP controller to use the primary AP controller's MAC address. Otherwise, reset all managed APs to the factory defaults and set up a new ZyMesh with the second AP controller's MAC address.
Next	Click this button and follow the on-screen instructions to update the AP controller's MAC address.
Add	Click this to add a new profile.
Edit	Click this to edit the selected profile.
Remove	Click this to remove the selected profile.
#	This field is a sequential value, and it is not associated with a specific profile.
Profile Name	This field indicates the name assigned to the profile.
ZyMesh SSID	This field shows the SSID specified in this ZyMesh profile.

21.2.1 Add/Edit ZyMesh Profile

This screen allows you to create a new ZyMesh profile or edit an existing one. To access this screen, click the **Add** button or select and existing profile and click the **Edit** button.

Figure 165 Configuration > Object > ZyMesh Profile > Add/Edit ZyMesh Profile



The following table describes the labels in this screen.

Table 135 Configuration > Object > ZyMesh Profile > Add/Edit ZyMesh Profile

LABEL	DESCRIPTION
Profile Name	Enter up to 31 alphanumeric characters for the profile name.
ZyMesh SSID	Enter the SSID with which you want the managed AP to connect to a root AP or repeater to build a ZyMesh link. Note: The ZyMesh SSID is hidden in the outgoing beacon frame so a wireless device cannot obtain the SSID through scanning using a site survey tool.
Pre-Shared Key	Enter a pre-shared key of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols) or 64 hexadecimal characters. The key is used to encrypt the wireless traffic between the APs.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 22
Addresses

22.1 Overview

Address objects can represent a single IP address or a range of IP addresses.

22.1.1 What You Can Do in this Chapter

- The **Address** screen (Section 22.2 on page 288) provides a summary of all addresses in the NXC.
- The **Address Group** summary screen (Section 22.3 on page 290) and the **Address Group Add/Edit** screen maintain address groups in the NXC.

22.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Addresses

Address objects and address groups are used in dynamic routes and firewall rules. Please see the respective sections for more information about how address objects and address groups are used in each one.

Address groups are composed of address objects and address groups. The sequence of members in the address group is not important.

22.2 Address Summary

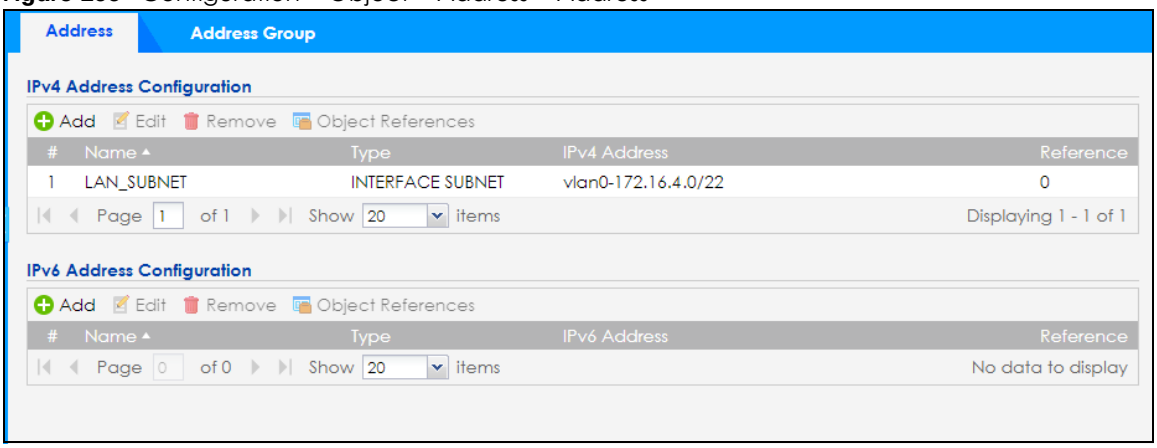
The address screens are used to create, maintain, and remove addresses. There are the types of address objects.

- **HOST** - a host address is defined by an **IP Address**.
- **RANGE** - a range address is defined by a **Starting IP Address** and an **Ending IP Address**.
- **SUBNET** - a network address is defined by a **Network** IP address and **Netmask** subnet mask.

The **Address** screen provides a summary of all addresses in the NXC. To access this screen, click **Configuration > Object** > **Address > Address**. Click a column's heading cell to sort the table entries by that column's criteria. Click the heading cell again to reverse the sort order.

If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also view and configure your IPv6 addresses on this screen.

Figure 166 Configuration > Object > Address > Address



The following table describes the labels in this screen.

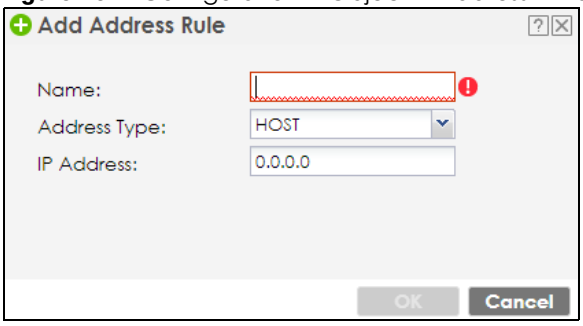
Table 136 Configuration > Object > Address > Address

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific address.
Name	This field displays the configured name of each address object.
Type	This field displays the type of each address object. "**INTERFACE**" means the object uses the settings of one of the NXC's interfaces.
IPv4/IPv6 Address	This field displays the IP addresses represented by each address object. If the object's settings are based on one of the NXC's interfaces, the name of the interface displays first followed by the object's current address settings.
Reference	This field displays the number of times an object reference is used in a profile.

22.2.1 Add/Edit Address

The **Add/Edit Address** screen allows you to create a new address or edit an existing one. To access this screen, go to the **Address** screen, and click either the **Add** icon or an **Edit** icon.

Figure 167 Configuration > Object > Address > Address > Add/Edit



The following table describes the labels in this screen.

Table 137 Configuration > Object > Address > Address > Add/Edit

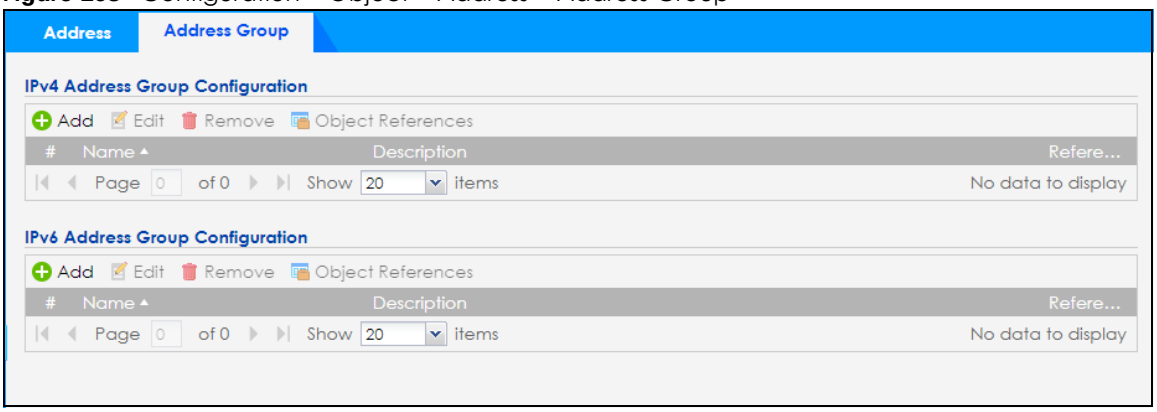
LABEL	DESCRIPTION
Name	Type the name used to refer to the address. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Address Type	Select the type of address you want to create. Choices are: **HOST**, **RANGE**, **SUBNET**, **INTERFACE IP**, **INTERFACE SUBNET**, and **INTERFACE GATEWAY**. Note: The NXC automatically updates address objects that are based on an interface's IP address, subnet, or gateway if the interface's IP address settings change. For example, if you change ge1's IP address, the NXC automatically updates the corresponding interface-based, LAN subnet address object.
IP/IPv6 Address	This field is only available if the **Address Type** is **HOST**. This field cannot be blank. Enter the IP address that this address object represents.
Starting IP Address/IPv6 Starting Address	This field is only available if the **Address Type** is **RANGE**. This field cannot be blank. Enter the beginning of the range of IP addresses that this address object represents.
Ending IP Address/IPv6 Ending Address	This field is only available if the **Address Type** is **RANGE**. This field cannot be blank. Enter the end of the range of IP address that this address object represents.
Network	This field is only available if the **Address Type** is **SUBNET**, in which case this field cannot be blank. Enter the IP address of the network that this address object represents.
Netmask	This field is only available if the **Address Type** is **SUBNET**, in which case this field cannot be blank. Enter the subnet mask of the network that this address object represents. Use dotted decimal format.
IPv6 Address Prefix	This field is only available if the **Address Type** is **SUBNET**. Enter the IPv6 prefix length of the network that this address object represents. The prefix length indicates what the left-most part of the IP address is the same for all computers in the network, that is, the network address.
Interface	If you selected **INTERFACE IP**, **INTERFACE SUBNET**, or **INTERFACE GATEWAY** as the **Address Type**, use this field to select the interface of the network that this address object represents.
IPv6 Address Type	This field is only available if the **Address Type** is **INTERFACE IP**, **INTERFACE SUBNET**, or **INTERFACE GATEWAY**. Specify whether the IP address is a static IP address (**STATIC**), link-local IP address (**LINK LOCAL**), dynamically assigned (**DHCPv6**), or an IPv6 StateLess Address AutoConfiguration IP address (**SLAAC**).
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

22.3 Address Group Summary

The **Address Group** screen provides a summary of all address groups. To access this screen, click **Configuration > Object** > **Address > Address Group**. Click a column's heading cell to sort the table entries by that column's criteria. Click the heading cell again to reverse the sort order.

If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also view and configure your IPv6 address groups on this screen.

Figure 168 Configuration > Object > Address > Address Group



The following table describes the labels in this screen.

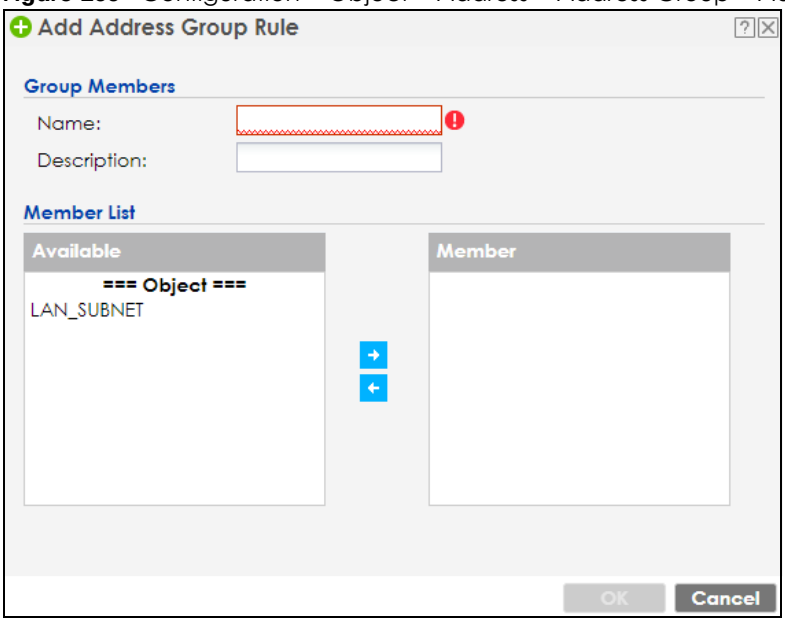
Table 138 Configuration > Object > Address > Address Group

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific address group.
Name	This field displays the name of each address group.
Description	This field displays the description of each address group, if any.
Reference	This field displays the number of times an object reference is used in a profile.

22.3.1 Add/Edit Address Group Rule

The **Add/Edit Address Group Rule** screen allows you to create a new address group or edit an existing one. To access this screen, go to the **Address Group** screen and click either the **Add** icon or an **Edit** icon.

Figure 169 Configuration > Object > Address > Address Group > Add/Edit



The following table describes the labels in this screen.

Table 139 Configuration > Object > Address > Address Group > Add/Edit

LABEL	DESCRIPTION
Name	Enter a name for the address group. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Description	This field displays the description of each address group, if any. You can use up to 60 characters, punctuation marks, and spaces.
Member List	The **Member** list displays the names of the address and address group objects that have been added to the address group. The order of members is not important. Select items from the **Available** list that you want to be members and move them to the **Member** list. You can double-click a single entry to move it or use the [Shift] or [Ctrl] key to select multiple entries and use the arrow button to move them. Move any members you do not want included to the **Available** list.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 23
Services

23.1 Overview

Use service objects to define TCP applications, UDP applications, and ICMP messages. You can also create service groups to refer to multiple service objects in other features.

23.1.1 What You Can Do in this Chapter

- The **Service** screens (Section 23.2 on page 294) display and configure the NXC's list of services and their definitions.
- The **Service Group** screens (Section 23.2 on page 294) display and configure the NXC's list of service groups.

23.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

IP Protocols

IP protocols are based on the eight-bit protocol field in the IP header. This field represents the next-level protocol that is sent in this packet. This section discusses three of the most common IP protocols.

Computers use Transmission Control Protocol (TCP, IP protocol 6) and User Datagram Protocol (UDP, IP protocol 17) to exchange data with each other. TCP guarantees reliable delivery but is slower and more complex. Some uses are FTP, HTTP, SMTP, and TELNET. UDP is simpler and faster but is less reliable. Some uses are DHCP, DNS, RIP, and SNMP.

TCP creates connections between computers to exchange data. Once the connection is established, the computers exchange data. If data arrives out of sequence or is missing, TCP puts it in sequence or waits for the data to be re-transmitted. Then, the connection is terminated.

In contrast, computers use UDP to send short messages to each other. There is no guarantee that the messages arrive in sequence or that the messages arrive at all.

Both TCP and UDP use ports to identify the source and destination. Each port is a 16-bit number. Some port numbers have been standardized and are used by low-level system processes; many others have no particular meaning.

Unlike TCP and UDP, Internet Control Message Protocol (ICMP, IP protocol 1) is mainly used to send error messages or to investigate problems. For example, ICMP is used to send the response if a computer cannot be reached. Another use is ping. ICMP does not guarantee delivery, but networks often treat ICMP messages differently, sometimes looking at the message itself to decide where to send it.

Service Objects and Service Groups

Use service objects to define IP protocols.

- TCP applications
- UDP applications
- ICMP messages
- user-defined services (for other types of IP protocols)

These objects are used in policy routes.

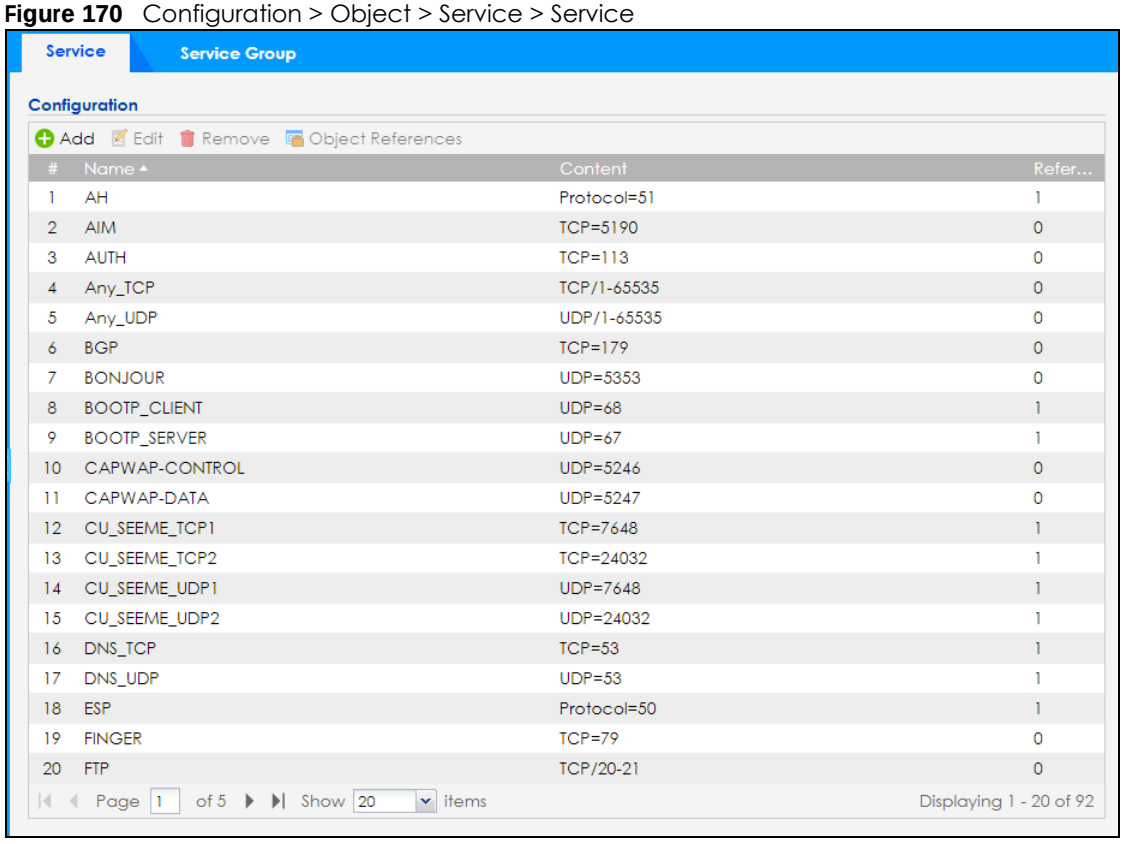
Use service groups when you want to create the same rule for several services, instead of creating separate rules for each service. Service groups may consist of services and other service groups. The sequence of members in the service group is not important.

23.2 Service Summary

The **Service** summary screen provides a summary of all services and their definitions. In addition, this screen allows you to add, edit, and remove services.

To access this screen, log in to the Web Configurator, and click **Configuration > Object > Service > Service**. Click a column's heading cell to sort the table entries by that column's criteria. Click the heading cell again to reverse the sort order.

Figure 170 Configuration > Object > Service > Service



The following table describes the labels in this screen.

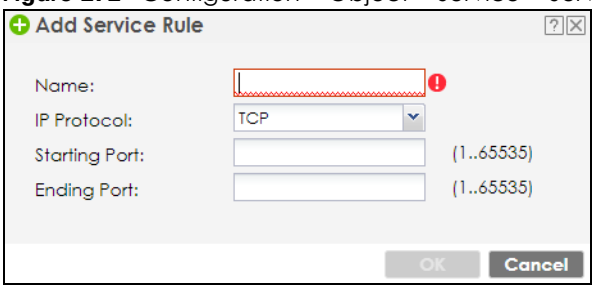
Table 140 Configuration > Object > Service > Service

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific service.
Name	This field displays the name of each service.
Content	This field displays a description of each service.
Reference	This field displays the number of times an object reference is used in a profile.

23.2.1 Add/Edit Service Rule

The **Add/Edit Service Rule** screen allows you to create a new service or edit an existing one. To access this screen, go to the **Service** screen and click either the **Add** icon or an **Edit** icon.

Figure 171 Configuration > Object > Service > Service > Add/Edit



The following table describes the labels in this screen.

Table 141 Configuration > Object > Service > Service > Add/Edit

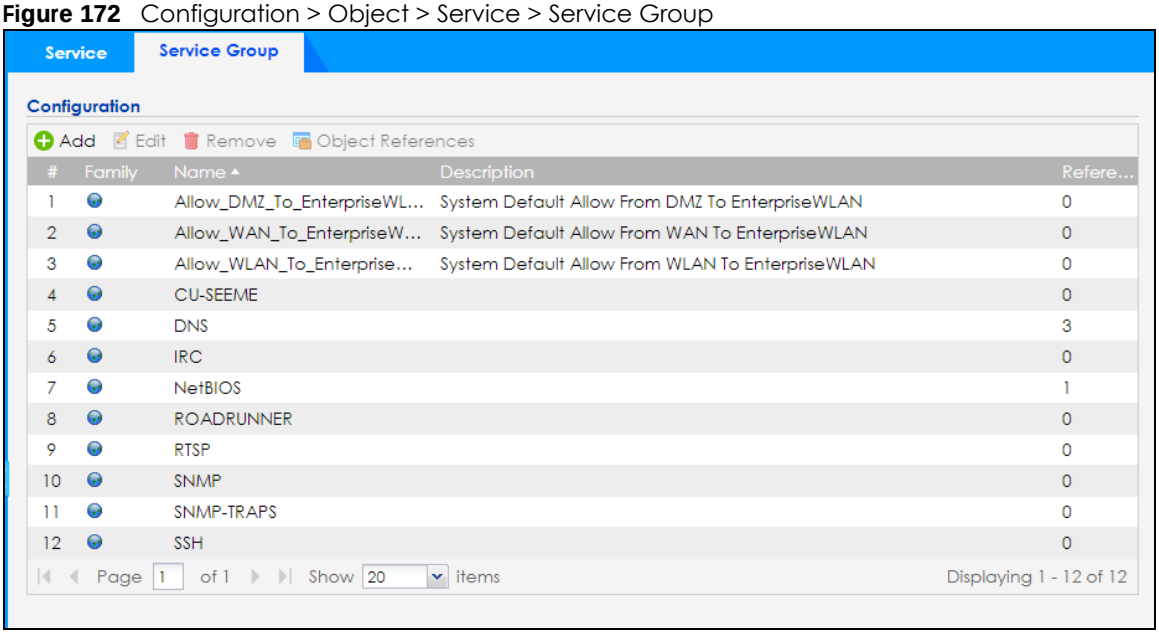
LABEL	DESCRIPTION
Name	Type the name used to refer to the service. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
IP Protocol	Select the protocol the service uses. Choices are: **TCP**, **UDP**, **ICMP**, **ICMPv6** and **User Defined**.
Starting Port Ending Port	This field appears if the **IP Protocol** is **TCP** or **UDP**. Specify the port number(s) used by this service. If you fill in one of these fields, the service uses that port. If you fill in both fields, the service uses the range of ports.
ICMP Type	This field appears if the **IP Protocol** is **ICMP** or **ICMPv6**. Select the ICMP/ICMPv6 message used by this service. This field displays the message text, not the message number.
IP Protocol Number	This field appears if the **IP Protocol** is **User Defined**. Enter the number of the next-level protocol (IP protocol). Allowed values are 0 - 255.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

23.3 Service Group Summary

The **Service Group** summary screen provides a summary of all service groups. In addition, this screen allows you to add, edit, and remove service groups.

To access this screen, log in to the Web Configurator, and click **Configuration > Object** > **Service** > **Service Group**.

Figure 172 Configuration > Object > Service > Service Group



The following table describes the labels in this screen.

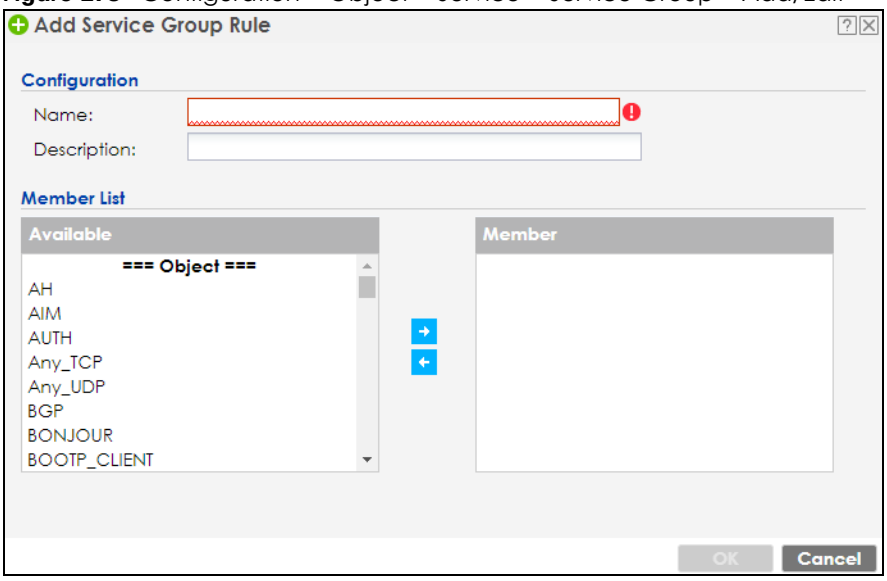
Table 142 Configuration > Object > Service > Service Group

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific service group.
Family	This field displays whether IPv4 and/or IPv6 is enabled for this service group.
Name	This field displays the name of each service group.
Description	This field displays the description of each service group, if any.
Reference	This field displays the number of times an object reference is used in a profile.

23.3.1 Add/Edit Service Group Rule

The **Add/Edit Service Group Rule** screen allows you to create a new service group or edit an existing one. To access this screen, go to the **Service Group** screen and click either the **Add** icon or an **Edit** icon.

Figure 173 Configuration > Object > Service > Service Group > Add/Edit



The following table describes the labels in this screen.

Table 143 Configuration > Object > Service > Service Group > Add/Edit

LABEL	DESCRIPTION
Name	Enter the name of the service group. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Description	Enter a description of the service group, if any. You can use up to 60 printable ASCII characters.
Member List	The **Member** list displays the names of the service and service group objects that have been added to the service group. The order of members is not important. Select items from the **Available** list that you want to be members and move them to the **Member** list. You can double-click a single entry to move it or use the [Shift] or [Ctrl] key to select multiple entries and use the arrow button to move them. Move any members you do not want included to the **Available** list.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 24
Schedules

24.1 Overview

Use schedules to set up one-time and recurring schedules for policy routes. The NXC supports one-time and recurring schedules. One-time schedules are effective only once, while recurring schedules usually repeat. Both types of schedules are based on the current date and time in the NXC.

Note: Schedules are based on the NXC's current date and time.

24.1.1 What You Can Do in this Chapter

- The **Schedule** screen (Section 24.2 on page 298) displays a list of all schedules in the NXC.
- The **One-Time Schedule Add/Edit** screen (Section 24.2.1 on page 300) creates or edits a one-time schedule.
- The **Recurring Schedule Add/Edit** screen (Section 24.2.2 on page 301) creates or edits a recurring schedule.

24.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

One-time Schedules

One-time schedules begin on a specific start date and time and end on a specific stop date and time. One-time schedules are useful for long holidays and vacation periods.

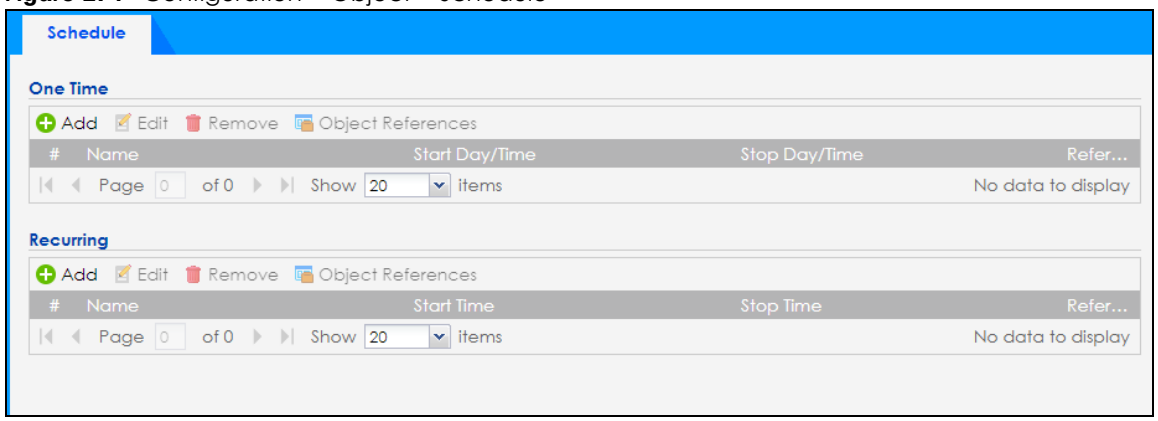
Recurring Schedules

Recurring schedules begin at a specific start time and end at a specific stop time on selected days of the week (Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday). Recurring schedules always begin and end in the same day. Recurring schedules are useful for defining the workday and off-work hours.

24.2 Schedule Summary

The **Schedule** summary screen provides a summary of all schedules in the NXC. To access this screen, click **Configuration > Object** > **Schedule**.

Figure 174 Configuration > Object > Schedule



The following table describes the labels in this screen.

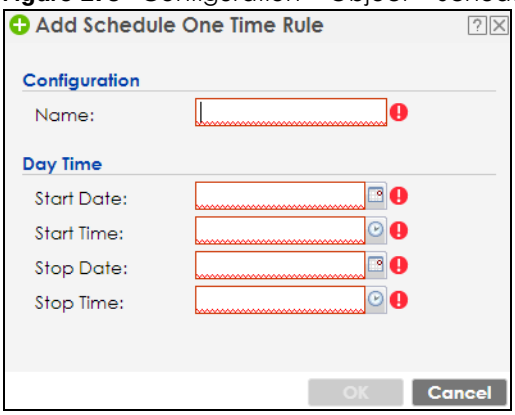
Table 144 Configuration > Object > Schedule

LABEL	DESCRIPTION
One Time	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific schedule.
Name	This field displays the name of the schedule, which is used to refer to the schedule.
Start Day / Time	This field displays the date and time at which the schedule begins.
Stop Day / Time	This field displays the date and time at which the schedule ends.
Reference	This field displays the number of times an object reference is used in a profile.
Recurring	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific schedule.
Name	This field displays the name of the schedule, which is used to refer to the schedule.
Start Time	This field displays the time at which the schedule begins.
Stop Time	This field displays the time at which the schedule ends.
Reference	This field displays the number of times an object reference is used in a profile.

24.2.1 Add/Edit Schedule One-Time Rule

The **Add/Edit Schedule One-Time Rule** screen allows you to define a one-time schedule or edit an existing one. To access this screen, go to the **Schedule** screen and click either the **Add** icon or an **Edit** icon in the **One Time** section.

Figure 175 Configuration > Object > Schedule > Add/Edit (One-Time)



The following table describes the labels in this screen.

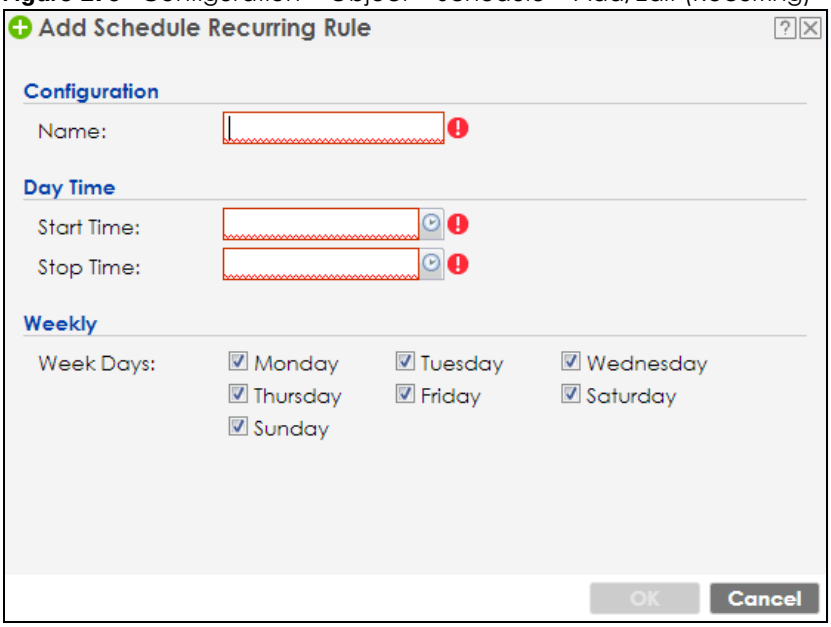
Table 145 Configuration > Object > Schedule > Add/Edit (One-Time)

LABEL	DESCRIPTION
Configuration	
Name	Type the name used to refer to the one-time schedule. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Date Time	
Start Date	Specify the year, month, and day when the schedule begins. **Year** - 1900 - 2999 **Month** - 1 - 12 **Day** - 1 - 31 (it is not possible to specify illegal dates, such as February 31.)
Start Time	Specify the hour and minute when the schedule begins. **Hour** - 0 - 23 **Minute** - 0 - 59
Stop Date	Specify the year, month, and day when the schedule ends. **Year** - 1900 - 2999 **Month** - 1 - 12 **Day** - 1 - 31 (it is not possible to specify illegal dates, such as February 31.)
Stop Time	Specify the hour and minute when the schedule ends. **Hour** - 0 - 23 **Minute** - 0 - 59
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

24.2.2 Add/Edit Schedule Recurring Rule

The **Add/Edit Schedule Recurring Rule** screen allows you to define a recurring schedule or edit an existing one. To access this screen, go to the **Schedule** screen and click either the **Add** icon or an **Edit** icon in the **Recurring** section.

Figure 176 Configuration > Object > Schedule > Add/Edit (Recurring)



The **Year**, **Month**, and **Day** columns are not used in recurring schedules and are disabled in this screen. The following table describes the remaining labels in this screen.

Table 146 Configuration > Object > Schedule > Add/Edit (Recurring)

LABEL	DESCRIPTION
Configuration	
Name	Type the name used to refer to the recurring schedule. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Date Time	
Start Time	Specify the hour and minute when the schedule begins each day. **Hour** - 0 - 23 **Minute** - 0 - 59
Stop Time	Specify the hour and minute when the schedule ends each day. **Hour** - 0 - 23 **Minute** - 0 - 59
Weekly	
Week Days	Select each day of the week the recurring schedule is effective.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 25
AAA Server

25.1 Overview

You can use a AAA (Authentication, Authorization, Accounting) server to provide access control to your network. The AAA server can be a Active Directory, LDAP, or RADIUS server. Use the **AAA Server** screens to create and manage objects that contain settings for using AAA servers. You use AAA server objects in configuring ext-group-user user objects and authentication method objects.

25.1.1 What You Can Do in this Chapter

- The **Active Directory** / **LDAP** screens (Section 25.2 on page 305) configure Active Directory or LDAP server objects.
- The **RADIUS** screen (Section 25.3 on page 309) configures the default external RADIUS server to use for user authentication.

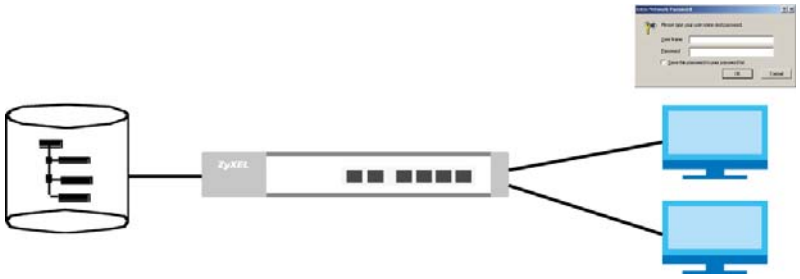
25.1.2 What You Need To Know

The following terms and concepts may help as you read this chapter.

Directory Service (AD/LDAP)

LDAP/AD allows a client (the NXC) to connect to a server to retrieve information from a directory. A network example is shown next.

Figure 177 Example: Directory Service Client and Server



The following describes the user authentication procedure via an LDAP/AD server.

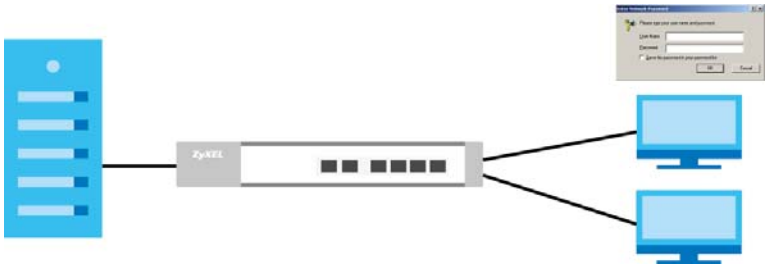
1. A user logs in with a user name and password pair.
2. The NXC tries to bind (or log in) to the LDAP/AD server.
3. When the binding process is successful, the NXC checks the user information in the directory against the user name and password pair.

4 If it matches, the user is allowed access. Otherwise, access is blocked.

RADIUS Server

RADIUS (Remote Authentication Dial-In User Service) authentication is a popular protocol used to authenticate users by means of an external server instead of (or in addition to) an internal device user database that is limited to the memory capacity of the device. In essence, RADIUS authentication allows you to validate a large number of users from a central location.

Figure 178 RADIUS Server Network Example



Authentication Capability List

This list displays the NXC's authentication capabilities:

Table 147 Authentication Capability List

	INTERNAL AUTHENTICATION METHOD			EXTERNAL RADIUS
	AD	LDAP	RADIUS	
EAP-TLS	O	O	O	O
EAP-TTLS (Mschapv2/Mschap)	O[A]	O	O	O
EAP-TTLS (eap)	X	X	X	O
EAP-TTLS (pap)	O	O	O	O
EAP-PEAP (Mschapv2)	O[A]	O	O	O
EAP-PEAP (TLS)	X	X	X	O
EAP-MD5	X	X	X	O

A. Must set domain authentication.

AAA Servers Supported by the NXC

The following lists the types of authentication server the NXC supports.

- Local user database

  The NXC uses the built-in local user database to authenticate administrative users logging into the NXC's Web Configurator or network access users logging into the network through the NXC.

- Directory Service (LDAP/AD)

  LDAP (Lightweight Directory Access Protocol)/AD (Active Directory) is a directory service that is both a directory and a protocol for controlling access to a network. The directory consists of a database specialized for fast information retrieval and filtering activities. You create and store user profile and login information on the external server.

- RADIUS

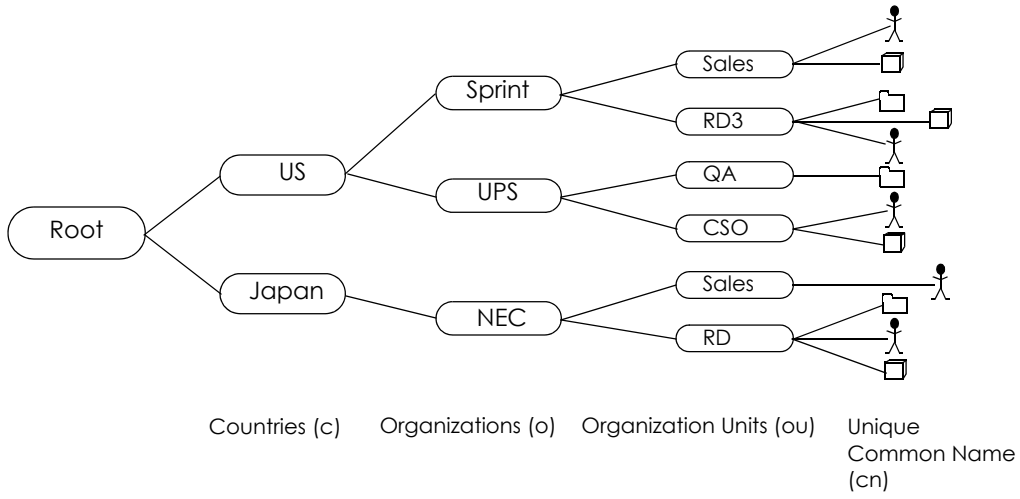
  RADIUS (Remote Authentication Dial-In User Service) authentication is a popular protocol used to authenticate users by means of an external or built-in RADIUS server. RADIUS authentication allows you to validate a large number of users from a central location.

Note: Because the NXC has an internal authentication database, you can create local login accounts on it without needing to rely on an external authentication server. The built-in authentication server supports PEAP/EAP-TLS/EAP-TTLS.

Directory Structure

The directory entries are arranged in a hierarchical order much like a tree structure. Normally, the directory structure reflects the geographical or organizational boundaries. The following figure shows a basic directory structure branching from countries to organizations to organizational units to individuals.

Figure 179 Basic Directory Structure



Distinguished Name (DN)

A DN uniquely identifies an entry in a directory. A DN consists of attribute-value pairs separated by commas. The leftmost attribute is the Relative Distinguished Name (RDN). This provides a unique name for entries that have the same "parent DN" ("`cn=domain1.com`, `ou=Sales`, `o=MyCompany`" in the following examples).

```
cn=domain1.com, ou = Sales, o=MyCompany, c=US
cn=domain1.com, ou = Sales, o=MyCompany, c=JP
```

Base DN

A base DN specifies a directory. A base DN usually contains information such as the name of an organization, a domain name and/or country. For example, `o=MyCompany, c=UK` where `o` means organization and `c` means country.

Bind DN

A bind DN is used to authenticate with an LDAP/AD server. For example a bind DN of `cn=zyAdmin` allows the NXC to log into the LDAP/AD server using the user name of `zyAdmin`. The bind DN is used in conjunction with a bind password. When a bind DN is not specified, the NXC will try to log in as an anonymous user. If the bind password is incorrect, the login will fail.

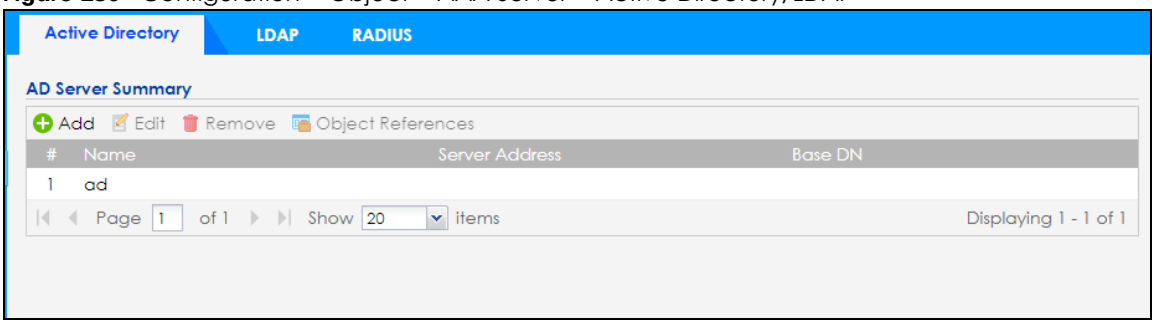
25.2 Active Directory / LDAP

Use the **Active Directory** or **LDAP** screen to manage the list of AD or LDAP servers the NXC can use in authenticating users.

Note: Both the Active Directory and LDAP screens, while on separate tabs, are identical in configuration. This section applies to both equally.

Click **Configuration > Object > AAA Server > Active Directory/LDAP** to display the **Active Directory** / **LDAP** screen.

Figure 180 Configuration > Object > AAA Server > Active Directory/LDAP



The following table describes the labels in this screen.

Table 148 Configuration > Object > AAA Server > Active Directory/LDAP

LABEL	DESCRIPTION
AD Server Summary	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field displays the index number.
Name	This is the name that you specified to identify the server.

Table 148 Configuration > Object > AAA Server > Active Directory/LDAP (continued)

LABEL	DESCRIPTION
Server Address	This is the address of the AD or LDAP server.
Base DN	This specifies a directory. For example, o=Zyxel, c=US.

25.2.1 Add/Edit Active Directory / LDAP Server

Click **Object > AAA Server > Active Directory/LDAP** to display the **Active Directory** (or **LDAP**) screen. Click the **Add** icon or an **Edit** icon to display the following screen. Use this screen to create a new entry or edit an existing one.

Note: The Active Directory and LDAP server setup screens are almost identical, so the features for both screens are described in this section.

Figure 181 Configuration > Object > AAA Server > Active Directory > Add/Edit

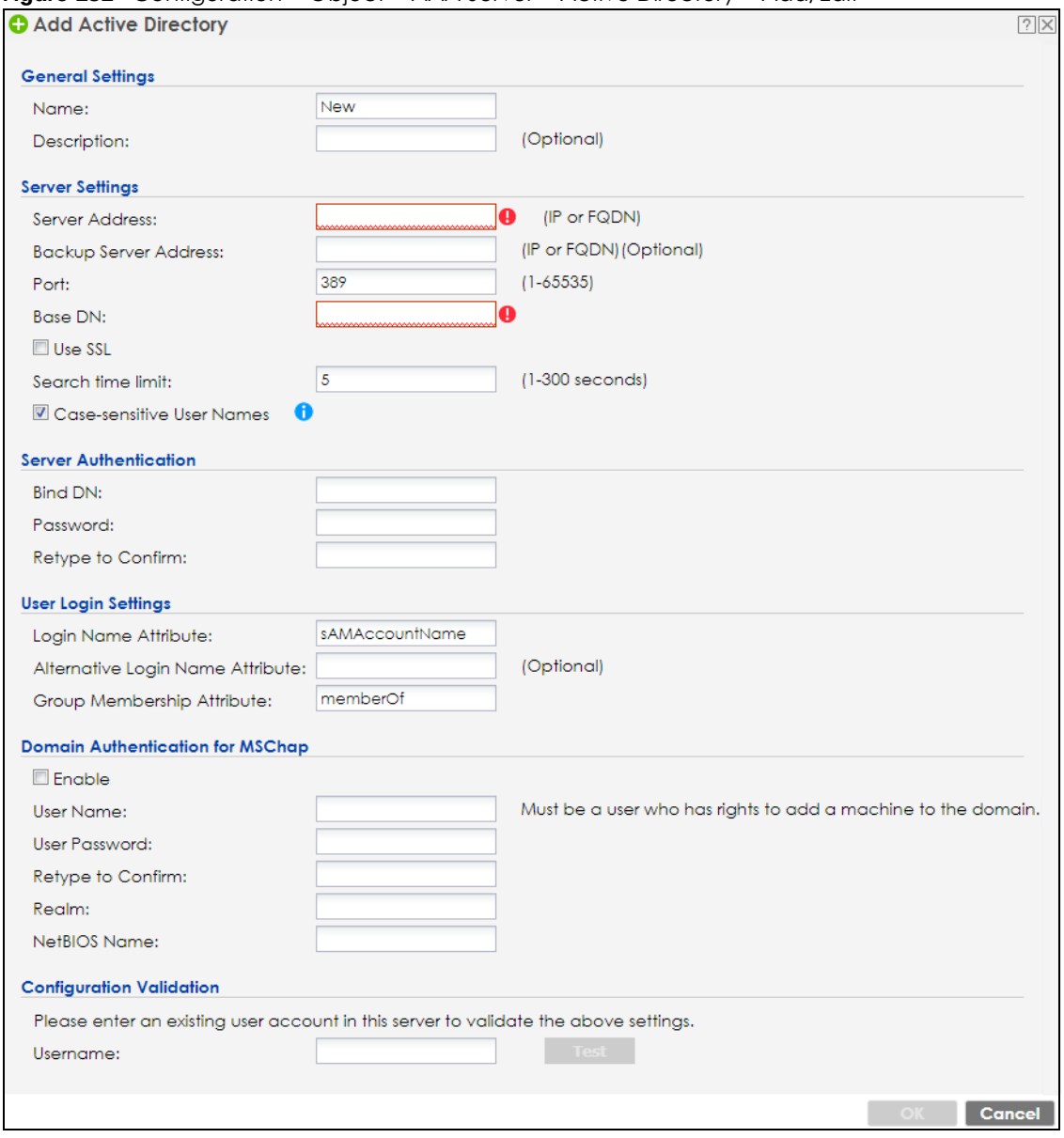
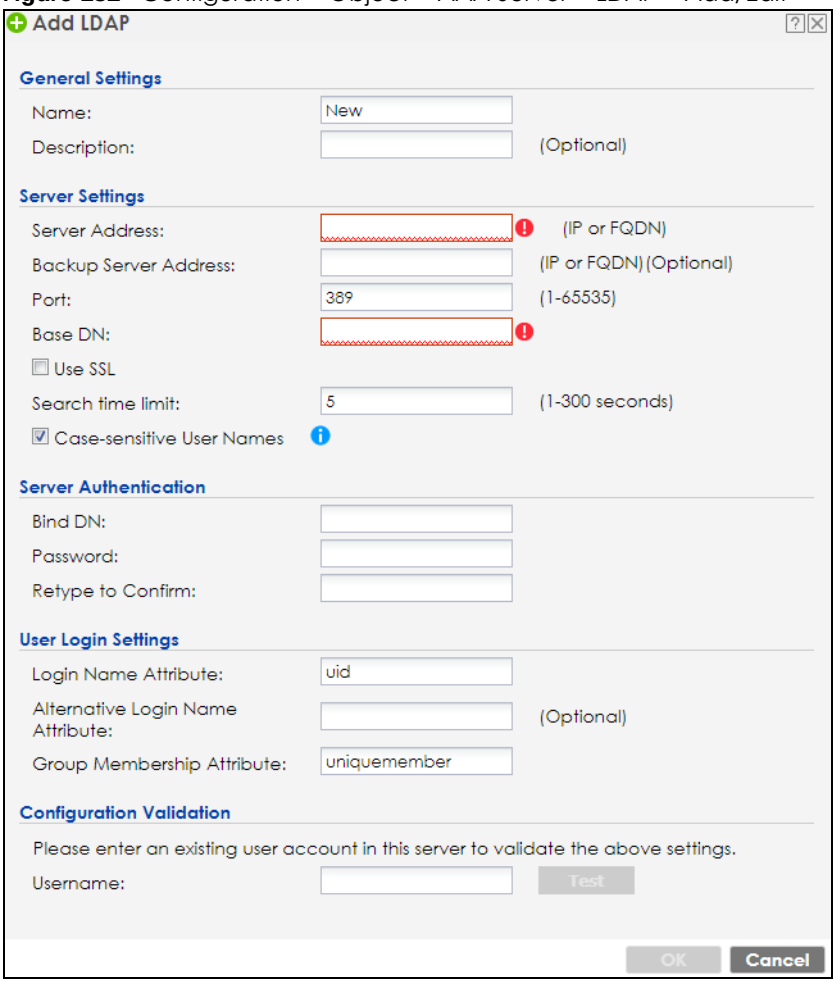


Figure 182 Configuration > Object > AAA Server > LDAP > Add/Edit



The following table describes the labels in these screens.

Table 149 Configuration > Object > AAA Server > Active Directory (or LDAP) > Add/Edit

LABEL	DESCRIPTION
General Settings	
Name	Enter a descriptive name (up to 63 alphanumerical characters) for identification purposes.
Description	Enter the description of each server, if any. You can use up to 60 printable ASCII characters.
Server Settings	
Server Address	Enter the address of the AD or LDAP server.
Backup Server Address	If the AD or LDAP server has a backup server, enter its address here.
Port	Specify the port number on the AD or LDAP server to which the NXC sends authentication requests. Enter a number between 1 and 65535. This port number should be the same on all AD or LDAP server(s) in this group.
Base DN	Specify the directory (up to 127 alphanumerical characters). For example, `o=Zyxel, c=US`.
Use SSL	Select **Use SSL** to establish a secure connection to the AD or LDAP server(s).

Table 149 Configuration > Object > AAA Server > Active Directory (or LDAP) > Add/Edit (continued)

LABEL	DESCRIPTION
Search time limit	Specify the timeout period (between 1 and 300 seconds) before the NXC disconnects from the AD server. In this case, user authentication fails. Search timeout occurs when either the user information is not in the AD or LDAP server or the AD or LDAP server is down.
Case-sensitive User Names	Select this if the server checks the case of the usernames.
Server Authentication	
Bind DN	Specify the bind DN for logging into the AD or LDAP server. Enter up to 127 alphanumerical characters. For example, `cn=zyAdmin` specifies `zyAdmin` as the user name.
Password	If required, enter the password (up to 15 alphanumerical characters) for the NXC to bind (or log in) to the AD or LDAP server.
Retype to Confirm	Retype your new password for confirmation.
User Login Settings	
Login Name Attribute	Enter the type of identifier the users are to use to log in. For example "name" or "e-mail address".
Alternative Login Name Attribute	If there is a second type of identifier that the users can use to log in, enter it here. For example "name" or "e-mail address".
Group Membership Attribute	Enter the name of the attribute that the NXC is to check to determine to which group a user belongs. The value for this attribute is called a group identifier; it determines to which group a user belongs. You can add **ext-group-user** user objects to identify groups based on these group identifier values. For example you could have an attribute named "memberOf" with values like "sales", "RD", and "management". Then you could also create a **ext-group-user** user object for each group. One with "sales" as the group identifier, another for "RD" and a third for "management".
Domain Authentication for MSChap	
Enable	Select this to enable domain authentication for MSChap. MS-CHAP Microsoft CHAP (Challenge Handshake Authentication Protocol) uses a challenge-response mechanism where the response is encrypted. Note: This is only for **Active Directory**.
User Name	Enter the user name for the user who has rights to add a machine to the domain. Note: This is only for **Active Directory**.
User Password	Enter the password for the associated user name. Note: This is only for **Active Directory**.
Retype to Confirm	Retype your new password for confirmation.
Realm	Enter the AD server's realm (network domain). Note: This is only for **Active Directory**.
NetBIOS Name	Enter the NetBIOS name of the AD or LDAP server. If you enter this, the NXC uses it with the user name in the format NetBIOS\USERNAME to do authentication. If you do not configure this, the NXC uses the format USERNAME@realm to do authentication.
Configuration Validation	Use a user account from the server specified above to test if the configuration is correct. Enter the account's user name in the **Username** field and click **Test**.

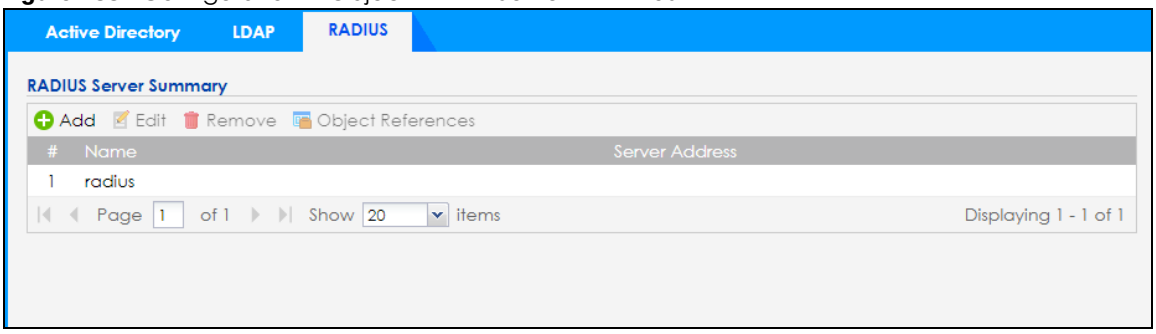
Table 149 Configuration > Object > AAA Server > Active Directory (or LDAP) > Add/Edit (continued)

LABEL	DESCRIPTION
OK	Click **OK** to save the changes.
Cancel	Click **Cancel** to discard the changes.

25.3 RADIUS

Use the **RADIUS** screen to manage the list of RADIUS servers the NXC can use in authenticating users. Click **Configuration > Object > AAA Server > RADIUS** to display the **RADIUS** screen.

Figure 183 Configuration > Object > AAA Server > RADIUS



The following table describes the labels in this screen.

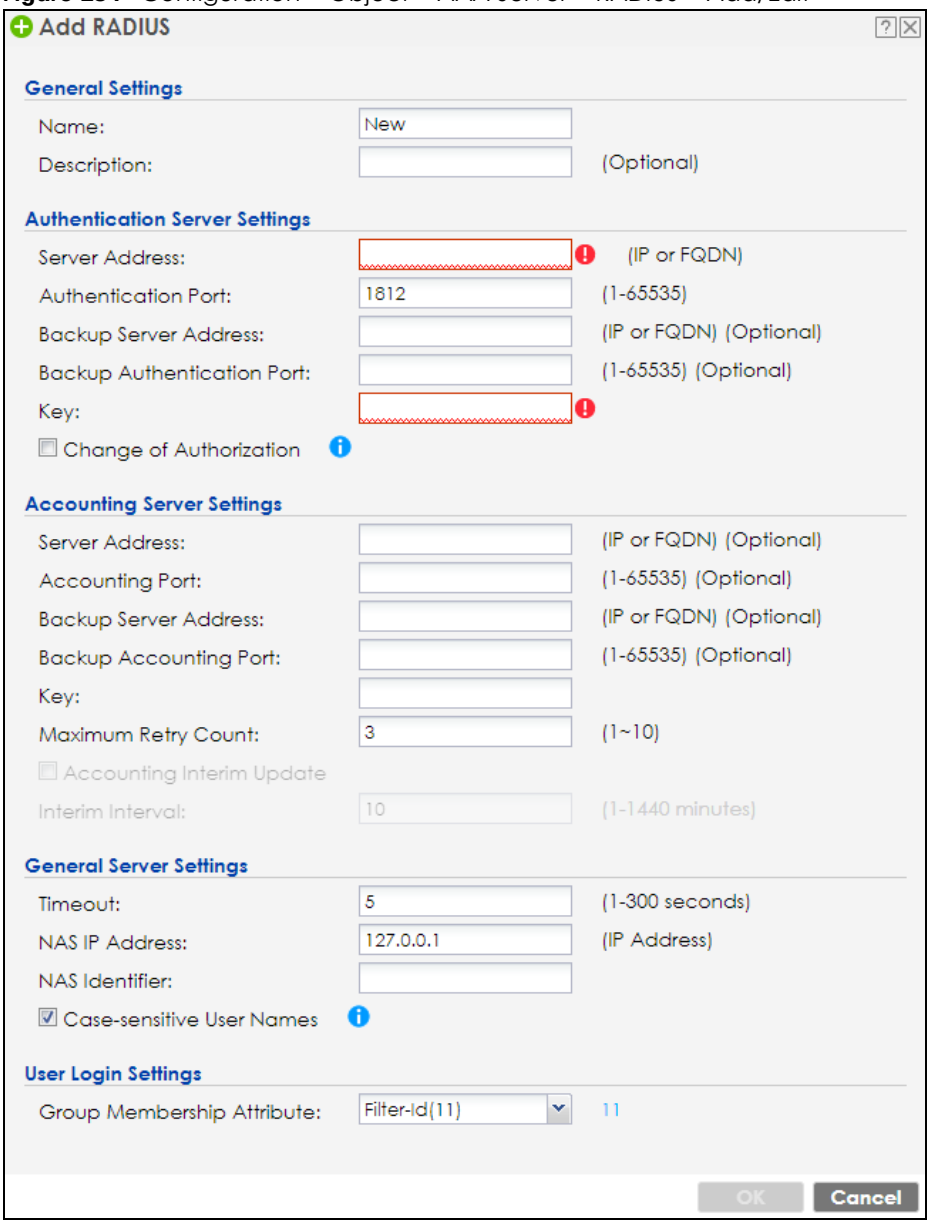
Table 150 Configuration > Object > AAA Server > RADIUS

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field displays the index number.
Name	This is the name of the RADIUS server entry.
Server Address	This is the address of the AD or LDAP server.

25.3.1 Add/Edit RADIUS

Click **Configuration > Object > AAA Server > RADIUS** to display the **RADIUS** screen. Click the **Add** icon or an **Edit** icon to display the following screen. Use this screen to create a new entry or edit an existing one.

Figure 184 Configuration > Object > AAA Server > RADIUS > Add/Edit



The following table describes the labels in this screen.

Table 151 Configuration > Object > AAA Server > RADIUS > Add/Edit

LABEL	DESCRIPTION
General Settings	
Name	Enter a descriptive name (up to 63 alphanumerical characters) for identification purposes.
Description	Enter the description of each server, if any. You can use up to 60 printable ASCII characters.
Authentication Server Settings	
Server Address	Enter the address of the RADIUS authentication server.
Authentication Port	Specify the port number on the RADIUS server to which the NXC sends authentication requests. Enter a number between 1 and 65535.

Table 151 Configuration > Object > AAA Server > RADIUS > Add/Edit (continued)

LABEL	DESCRIPTION
Backup Server Address	If the RADIUS server has a backup authentication server, enter its address here.
Backup Authentication Port	Specify the port number on the RADIUS server to which the NXC sends authentication requests. Enter a number between 1 and 65535.
Key	Enter a password (up to 32 alphanumeric characters) as the key to be shared between the external authentication server and the NXC. The key is not sent over the network. This key must be the same on the external authentication server and the NXC.
Change of Authorization	The external RADIUS server can change its authentication policy and send CoA (Change of Authorization) or RADIUS Disconnect messages in order to terminate the subscriber's service. Select this option to allow the NXC to disconnect wireless clients based on the information (such as client's user name and MAC address) specified in CoA or RADIUS Disconnect messages sent by the RADIUS server.
Accounting Server Settings	
Server Address	Enter the IP address or Fully-Qualified Domain Name (FQDN) of the RADIUS accounting server.
Accounting Port	Specify the port number on the RADIUS server to which the NXC sends accounting information. Enter a number between 1 and 65535.
Backup Server Address	If the RADIUS server has a backup accounting server, enter its address here.
Backup Accounting Port	Specify the port number on the RADIUS server to which the NXC sends accounting information. Enter a number between 1 and 65535.
Key	Enter a password (up to 32 alphanumeric characters) as the key to be shared between the external authentication server and the NXC. The key is not sent over the network. This key must be the same on the external authentication server and the NXC.
Maximum Retry Count	At times the NXC may not be able to use the primary RADIUS accounting server. Specify the number of times the NXC should reattempt to use the primary RADIUS server before attempting to use the secondary RADIUS server. This also sets how many times the NXC will attempt to use the secondary RADIUS server. For example, you set this field to 3. If the NXC does not get a response from the primary RADIUS server, it tries again up to three times. If there is no response, the NXC tries the secondary RADIUS server up to three times. If there is also no response from the secondary RADIUS server, the NXC stops attempting to authenticate the subscriber. The subscriber will see a message that says the RADIUS server was not found.
Accounting Interim update	This field is configurable only after you configure a RADIUS accounting server address. Select this to have the NXC send subscriber status updates to the RADIUS server at the interval you specify.
Interim Interval	Specify the time interval for how often the NXC is to send a subscriber status update to the RADIUS server.
General Server Settings	
Timeout	Specify the timeout period (between 1 and 300 seconds) before the NXC disconnects from the RADIUS server. In this case, user authentication fails. Search timeout occurs when either the user information is not in the RADIUS server or the RADIUS server is down.
NAS IP Address	If the RADIUS server requires the NXC to provide the Network Access Server IP address attribute with a specific value, enter it here.

Table 151 Configuration > Object > AAA Server > RADIUS > Add/Edit (continued)

LABEL	DESCRIPTION
NAS Identifier	If the RADIUS server requires the NXC to provide the Network Access Server identifier attribute with a specific value, enter it here.
Case-sensitive User Names	Select this if the server checks the case of the usernames.
User Login Settings	
Group Membership Attribute	A RADIUS server defines attributes for its accounts. Select the name and number of the attribute that the NXC is to check to determine to which group a user belongs. If it does not display, select **User Defined** and specify the attribute's number. This attribute's value is called a group identifier; it determines to which group a user belongs. You can add **ext-group-user** user objects to identify groups based on these group identifier values. For example you could have an attribute named "memberOf" with values like "sales", "RD", and "management". Then you could also create a **ext-group-user** user object for each group. One with "sales" as the group identifier, another for "RD" and a third for "management".
OK	Click **OK** to save the changes.
Cancel	Click **Cancel** to discard the changes.

CHAPTER 26
Authentication Method

26.1 Overview

Authentication method objects set how the NXC authenticates wireless, HTTP/HTTPS clients, and captive portal clients. Configure authentication method objects to have the NXC use the local user database, and/or the authentication servers and authentication server groups specified by AAA server objects. By default, user accounts created and stored on the NXC are authenticated locally.

26.1.1 What You Can Do in this Chapter

The **Auth. Method** screens (Section 26.2 on page 313) create and manage authentication method objects.

26.1.2 Before You Begin

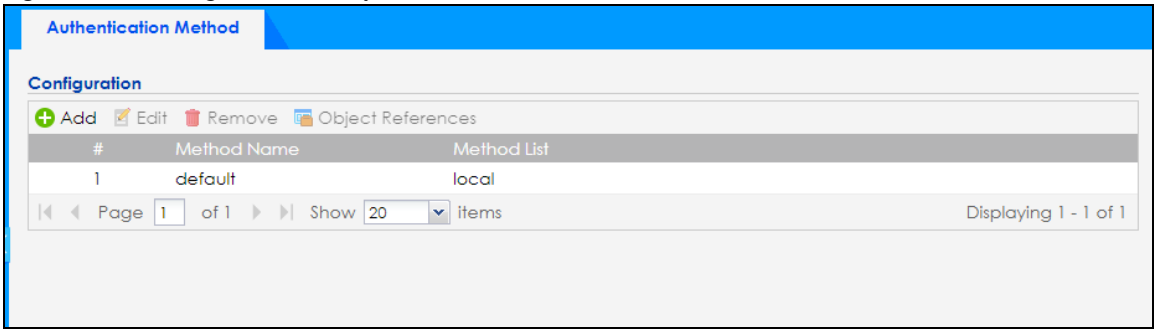
Configure AAA server objects before you configure authentication method objects.

26.2 Authentication Method

Click **Configuration > Object > Auth. Method** to display this screen.

Note: You can create up to 16 authentication method objects.

Figure 185 Configuration > Object > Auth. Method



The following table describes the labels in this screen.

Table 152 Configuration > Object > Auth. Method

LABEL	DESCRIPTION
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field displays the index number.
Method Name	This field displays a descriptive name for identification purposes.
Method List	This field displays the authentication method(s) for this entry.

26.2.1 Add Authentication Method

Follow the steps below to create an authentication method object.

1 Click **Configuration > Object > Auth. Method**.

2 Click **Add**.

3 Specify a descriptive name for identification purposes in the **Name** field. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. For example, "My_Device".

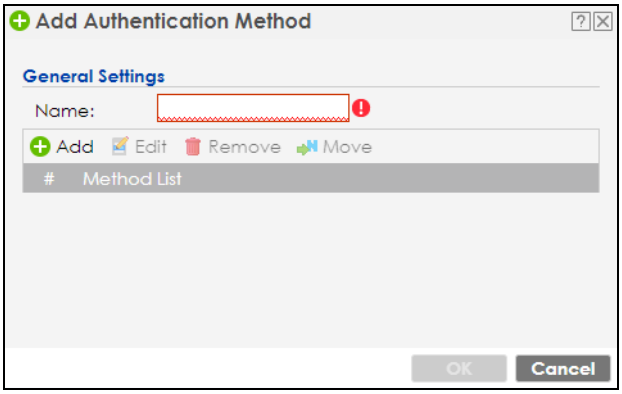
4 Click **Add** to insert an authentication method in the table.

5 Select a server object from the **Method List** drop-down list box.

6 You can add up to four server objects to the table. The ordering of the **Method List** column is important. The NXC authenticates the users using the databases (in the local user database or the external authentication server) in the order they appear in this screen.

If two accounts with the same username exist on two authentication servers you specify, the NXC does not continue the search on the second authentication server when you enter the username and password that doesn't match the one on the first authentication server.

7 Click **OK** to save the settings or click **Cancel** to discard all changes and return to the previous screen.



The following table describes the labels in this screen.

Table 153 Configuration > Object > Auth. Method > Add

LABEL	DESCRIPTION
Name	Specify a descriptive name for identification purposes. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. For example, "My_Device".
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so.
Move	To change a method's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed. The ordering of your methods is important as NXC authenticates the users using the authentication methods in the order they appear in this screen.
#	This field displays the index number.
Method List	Select a server object from the drop-down list box. You can create a server object in the **AAA Server** screen. The NXC authenticates the users using the databases (in the local user database or the external authentication server) in the order they appear in this screen. If two accounts with the same username exist on two authentication servers you specify, the NXC does not continue the search on the second authentication server when you enter the username and password that doesn't match the one on the first authentication server.
OK	Click **OK** to save the changes.
Cancel	Click **Cancel** to discard the changes.

CHAPTER 27
Certificates

27.1 Overview

The NXC can use certificates (also called digital IDs) to authenticate users. Certificates are based on public-private key pairs. A certificate contains the certificate owner's identity and public key. Certificates provide a way to exchange public keys for use in authentication.

27.1.1 What You Can Do in this Chapter

- The **My Certificates** screens (Section 27.2 on page 319) generate and export self-signed certificates or certification requests and import the NXC's CA-signed certificates.
- The **Trusted Certificates** screens (Section 27.3 on page 325) save CA certificates and trusted remote host certificates to the NXC. The NXC trusts any valid certificate that you have imported as a trusted certificate. It also trusts any valid certificate signed by any of the certificates that you have imported as a trusted certificate.

27.1.2 What You Need to Know

The following terms and concepts may help as you read this chapter.

When using public-key cryptology for authentication, each host has two keys. One key is public and can be made openly available. The other key is private and must be kept secure.

These keys work like a handwritten signature (in fact, certificates are often referred to as "digital signatures"). Only you can write your signature exactly as it should look. When people know what your signature looks like, they can verify whether something was signed by you, or by someone else. In the same way, your private key "writes" your digital signature and your public key allows people to verify whether data was signed by you, or by someone else.

This process works as follows:

1. Tim wants to send a message to Jenny. He needs her to be sure that it comes from him, and that the message content has not been altered by anyone else along the way. Tim generates a public key pair (one public key and one private key).
2. Tim keeps the private key and makes the public key openly available. This means that anyone who receives a message seeming to come from Tim can read it and verify whether it is really from him or not.
3. Tim uses his private key to sign the message and sends it to Jenny.
4. Jenny receives the message and uses Tim's public key to verify it. Jenny knows that the message is from Tim, and that although other people may have been able to read the message, no-one can have altered it (because they cannot re-sign the message with Tim's private key).

5 Additionally, Jenny uses her own private key to sign a message and Tim uses Jenny's public key to verify the message.

The NXC uses certificates based on public-key cryptology to authenticate users attempting to establish a connection, not to encrypt the data that you send after establishing a connection. The method used to secure the data that you send through an established connection depends on the type of connection.

The certification authority uses its private key to sign certificates. Anyone can then use the certification authority's public key to verify the certificates.

A certification path is the hierarchy of certification authority certificates that validate a certificate. The NXC does not trust a certificate if any certificate on its path has expired or been revoked.

Certification authorities maintain directory servers with databases of valid and revoked certificates. A directory of certificates that have been revoked before the scheduled expiration is called a CRL (Certificate Revocation List). The NXC can check a peer's certificate against a directory server's list of revoked certificates. The framework of servers, software, procedures and policies that handles keys is called PKI (public-key infrastructure).

Advantages of Certificates

Certificates offer the following benefits.

- The NXC only has to store the certificates of the certification authorities that you decide to trust, no matter how many devices you need to authenticate.
- Key distribution is simple and very secure since you can freely distribute public keys and you never need to transmit private keys.

Self-signed Certificates

You can have the NXC act as a certification authority and sign its own certificates.

Factory Default Certificate

The NXC generates its own unique self-signed certificate when you first turn it on. This certificate is referred to in the GUI as the factory default certificate.

Certificate File Formats

Any certificate that you want to import has to be in one of these file formats:

- Binary X.509: This is an ITU-T recommendation that defines the formats for X.509 certificates.
- PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses lowercase letters, uppercase letters and numerals to convert a binary X.509 certificate into a printable form.
- Binary PKCS#7: This is a standard that defines the general syntax for data (including digital signatures) that may be encrypted. A PKCS #7 file is used to transfer a public key certificate. The private key is not included. The NXC currently allows the importation of a PKS#7 file that contains a single certificate.
- PEM (Base-64) encoded PKCS#7: This Privacy Enhanced Mail (PEM) format uses lowercase letters, uppercase letters and numerals to convert a binary PKCS#7 certificate into a printable form.

- Binary PKCS#12: This is a format for transferring public key and private key certificates.The private key in a PKCS #12 file is within a password-encrypted envelope. The file's password is not connected to your certificate's public or private passwords. Exporting a PKCS #12 file creates this and you must provide it to decrypt the contents when you import the file into the NXC.

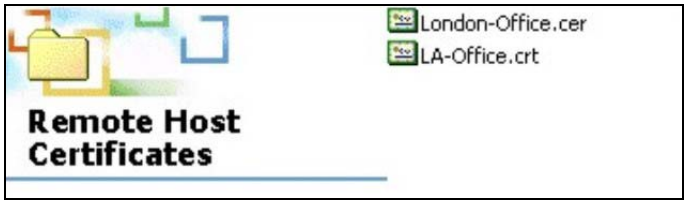
Note: Be careful not to convert a binary file to text during the transfer process. It is easy for this to occur since many programs use text files by default.

27.1.3 Verifying a Certificate

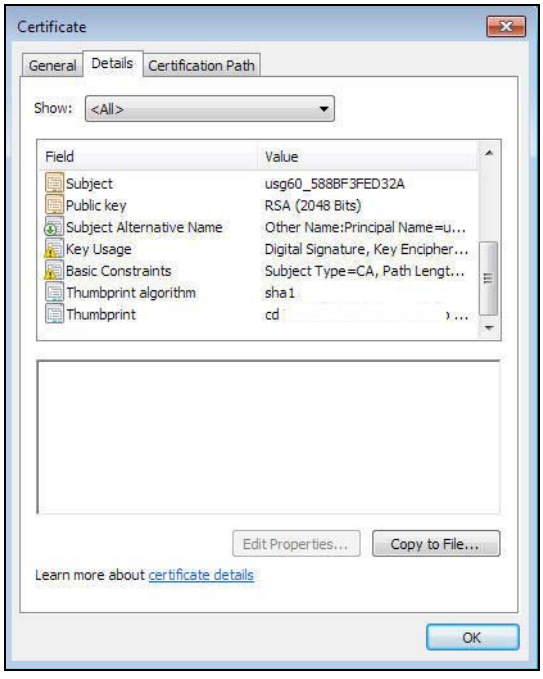
Before you import a trusted certificate into the NXC, you should verify that you have the correct certificate. You can do this using the certificate's fingerprint. A certificate's fingerprint is a message digest calculated using the MD5 or SHA1 algorithm. The following procedure describes how to check a certificate's fingerprint to verify that you have the actual certificate.

1 Browse to where you have the certificate saved on your computer.

2 Make sure that the certificate has a ".cer" or ".crt" file name extension.



3 Double-click the certificate's icon to open the **Certificate** window. Click the **Details** tab and scroll down to the **Thumbprint Algorithm** and **Thumbprint** fields.

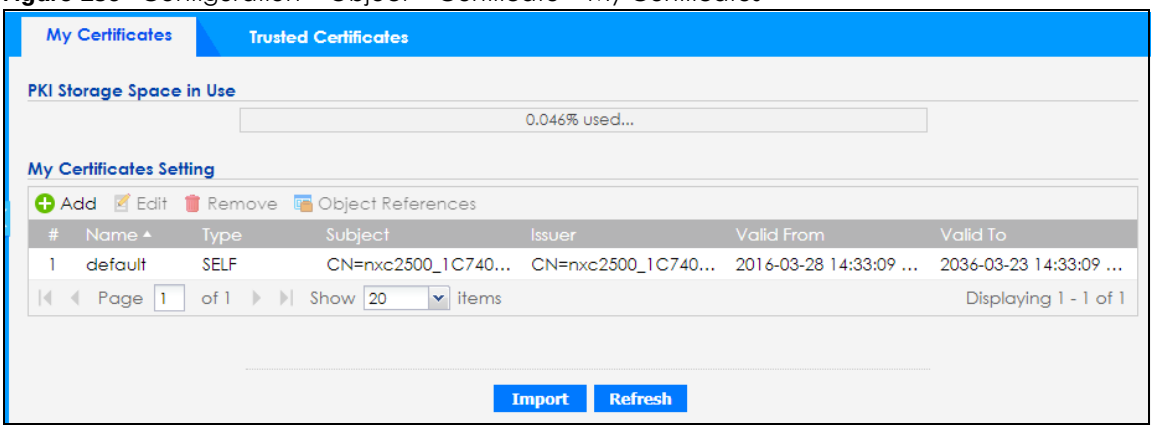


4 Use a secure method to verify that the certificate owner has the same information in the **Thumbprint Algorithm** and **Thumbprint** fields. The secure method may very based on your situation. Possible examples would be over the telephone or through an HTTPS connection.

27.2 My Certificates

Click **Configuration > Object > Certificate > My Certificates** to open this screen. This is the NXC's summary list of certificates and certification requests.

Figure 186 Configuration > Object > Certificate > My Certificates



The following table describes the labels in this screen.

Table 154 Configuration > Object > Certificate > My Certificates

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the NXC's PKI storage space that is currently in use. When the storage space is almost full, you should consider deleting expired or unnecessary certificates before adding more certificates.
My Certificate Setting	
Add	Click this to go to the screen where you can have the NXC generate a certificate or a certification request.
Edit	Double-click an entry or select it and click **Edit** to open a screen with an in-depth list of information about the certificate.
Remove	The NXC keeps all of your certificates unless you specifically delete them. Uploading a new firmware or default configuration file does not delete your certificates. To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Subsequent certificates move up by one when you take this action.
Object References	You cannot delete certificates that any of the NXC's features are configured to use. Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field displays the certificate index number. The certificates are listed in alphabetical order.
Name	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
Type	This field displays what kind of certificate this is. **REQ** represents a certification request and is not yet a valid certificate. Send a certification request to a certification authority, which then issues a certificate. Use the **My Certificate Import** screen to import the certificate and replace the request. **SELF** represents a self-signed certificate. **CERT** represents a certificate issued by a certification authority.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.

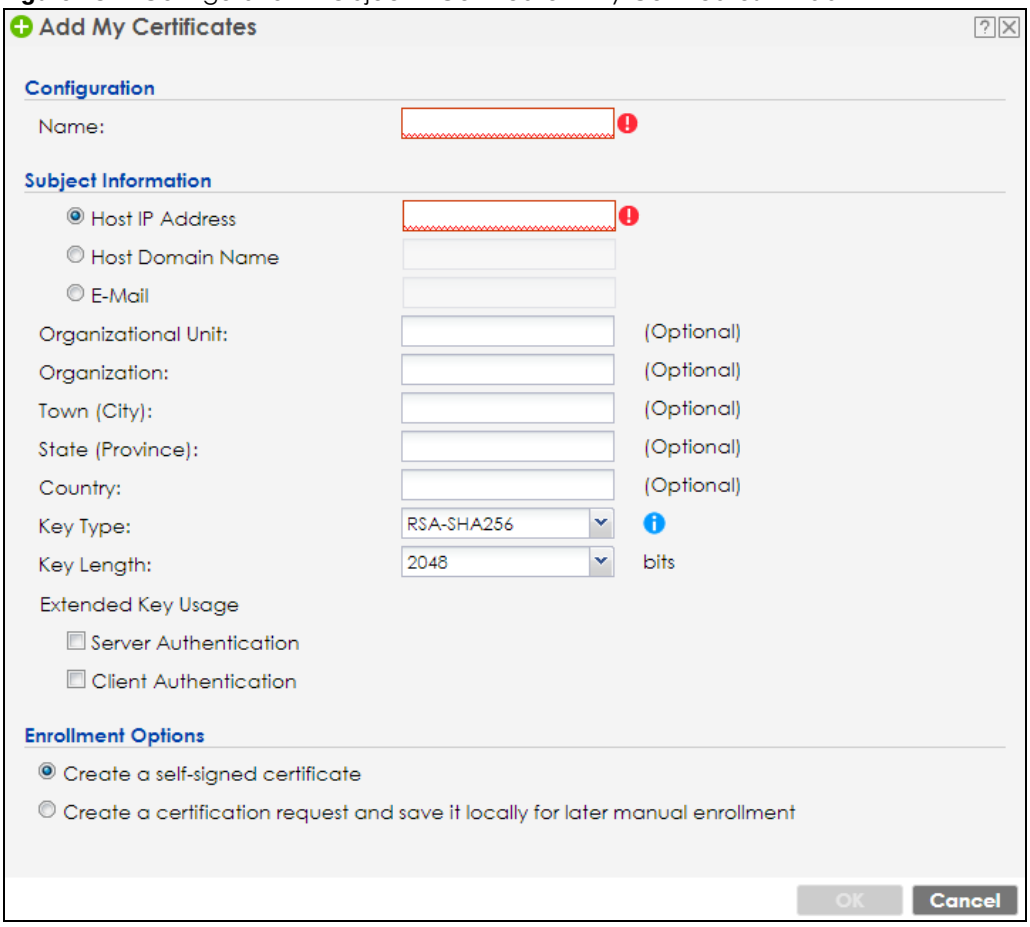
Table 154 Configuration > Object > Certificate > My Certificates (continued)

LABEL	DESCRIPTION
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired.
Import	Click **Import** to open a screen where you can save a certificate to the NXC.
Refresh	Click **Refresh** to display the current validity status of the certificates.

27.2.1 Adding My Certificates

Click **Configuration > Object > Certificate > My Certificates** and then the **Add** icon to open the **My Certificates Add** screen. Use this screen to have the NXC create a self-signed certificate, enroll a certificate with a certification authority or generate a certification request.

Figure 187 Configuration > Object > Certificate > My Certificates > Add



The following table describes the labels in this screen.

Table 155 Configuration > Object > Certificate > My Certificates > Add

LABEL	DESCRIPTION
Configuration	
Name	Type a name to identify this certificate. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Subject Information	Use these fields to record information that identifies the owner of the certificate. You do not have to fill in every field, although you must specify a **Host IP Address**, **Host Domain Name**, or **E-Mail**. The certification authority may add fields (such as a serial number) to the subject information when it issues a certificate. It is recommended that each certificate have unique subject information. Select a radio button to identify the certificate's owner by IP address, domain name or e-mail address. Type the IP address (in dotted decimal notation), domain name or e-mail address in the field provided. The domain name or e-mail address is for identification purposes only and can be any string. A domain name can be up to 255 characters. You can use alphanumeric characters, the hyphen and periods. An e-mail address can be up to 63 characters. You can use alphanumeric characters, the hyphen, the @ symbol, periods and the underscore.
Organizational Unit	Identify the organizational unit or department to which the certificate owner belongs. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
Organization	Identify the company or group to which the certificate owner belongs. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
Town (City)	Identify the town or city where the certificate owner is located. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
State (Province)	Identify the state or province where the certificate owner is located. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
Country	Identify the nation where the certificate owner is located. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
Key Type	The NXC uses the RSA (Rivest, Shamir and Adleman) public-key encryption algorithm. SHA1 (Secure Hash Algorithm) and SHA2 are hash algorithms used to authenticate packet data. SHA2-256 or SHA2-512 are part of the SHA2 set of cryptographic functions and they are considered even more secure than SHA1. Select a key type from **RSA-SHA256** and **RSA-SHA512**.
Key Length	Select a number from the drop-down list box to determine how many bits the key should use. The longer the key, the more secure it is. A longer key also uses more PKI storage space.
Extended Key Usage	Select **Server Authentication** to allow a web server to send clients the certificate to authenticate itself. Select **Client Authentication** to use the certificate's key to authenticate clients to the secure gateway.
Enrollment Options	These radio buttons deal with how and when the certificate is to be generated.
Create a self-signed certificate	Select this to have the NXC generate the certificate and act as the Certification Authority (CA) itself. This way you do not need to apply to a certification authority for certificates.
Create a certification request and save it locally for later manual enrollment	Select this to have the NXC generate and store a request for a certificate. Use the **My Certificate Details** screen to view the certification request and copy it to send to the certification authority. Copy the certification request from the **My Certificate Details** screen and then send it to the certification authority.

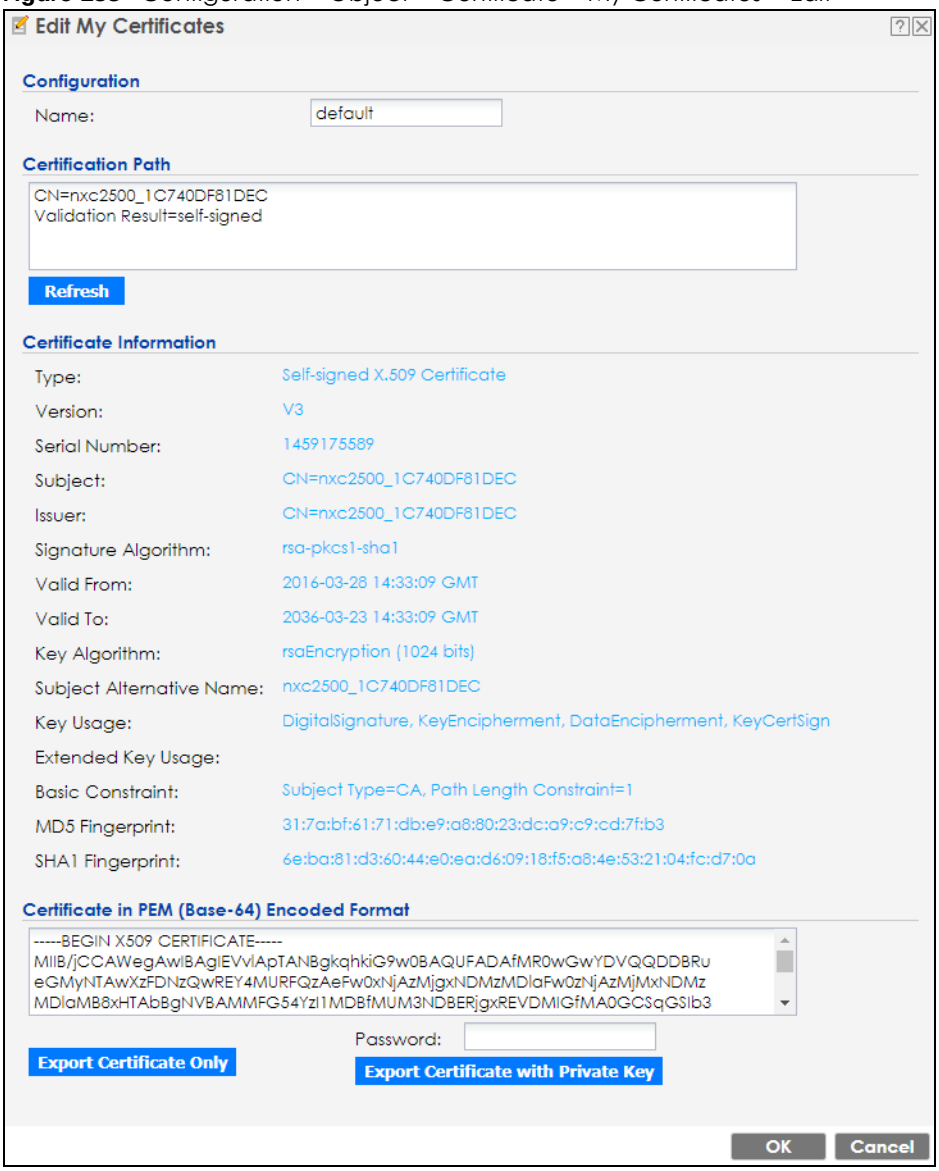
Table 155 Configuration > Object > Certificate > My Certificates > Add (continued)

LABEL	DESCRIPTION
OK	Click **OK** to begin certificate or certification request generation.
Cancel	Click **Cancel** to quit and return to the **My Certificates** screen.

27.2.2 Editing My Certificates

Click **Configuration > Object > Certificate > My Certificates** and then the **Edit** icon to open the **My Certificate Edit** screen. You can use this screen to view in-depth certificate information and change the certificate's name.

Figure 188 Configuration > Object > Certificate > My Certificates > Edit



The following table describes the labels in this screen.

Table 156 Configuration > Object > Certificate > My Certificates > Edit

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Certification Path	This field displays for a certificate, not a certification request. Click the **Refresh** button to have this read-only text box display the hierarchy of certification authorities that validate the certificate (and the certificate itself). If the issuing certification authority is one that you have imported as a trusted certification authority, it may be the only certification authority in the list (along with the certificate itself). If the certificate is a self-signed certificate, the certificate itself is the only one in the list. The NXC does not trust the certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click **Refresh** to display the certification path.
Certificate Information	These read-only fields display detailed information about the certificate.
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). "X.509" means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number.
Serial Number	This field displays the certificate's identification number given by the certification authority or generated by the NXC.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O), State (ST), and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same as the **Subject Name** field. "none" displays for a certification request.
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate.
Valid From	This field displays the date that the certificate becomes applicable. "none" displays for a certification request.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired. "none" displays for a certification request.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the NXC uses RSA encryption) and the length of the key set in bits (2048 bits for example).
Subject Alternative Name	This field displays the certificate owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path. This field does not display for a certification request.
MD5 Fingerprint	This is the certificate's message digest that the NXC calculated using the MD5 algorithm.
SHA1 Fingerprint	This is the certificate's message digest that the NXC calculated using the SHA1 algorithm.

Table 156 Configuration > Object > Certificate > My Certificates > Edit

LABEL	DESCRIPTION
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses lowercase letters, uppercase letters and numerals to convert a binary certificate into a printable form. You can copy and paste a certification request into a certification authority's web page, an e-mail that you send to the certification authority or a text editor and save the file on a management computer for later manual enrollment. You can copy and paste a certificate into an e-mail to send to friends or colleagues or you can copy and paste a certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Export	This button displays for a certification request. Use this button to save a copy of the request without its private key. Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
Export Certificate Only	Use this button to save a copy of the certificate without its private key. Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
Password	If you want to export the certificate with its private key, create a password and type it here. Make sure you keep this password in a safe place. You will need to use it if you import the certificate to another device.
Export Certificate with Private Key	Use this button to save a copy of the certificate with its private key. Type the certificate's password and click this button. Click **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
OK	Click **OK** to save your changes back to the NXC. You can only change the name.
Cancel	Click **Cancel** to quit and return to the **My Certificates** screen.

27.2.3 Importing Certificates

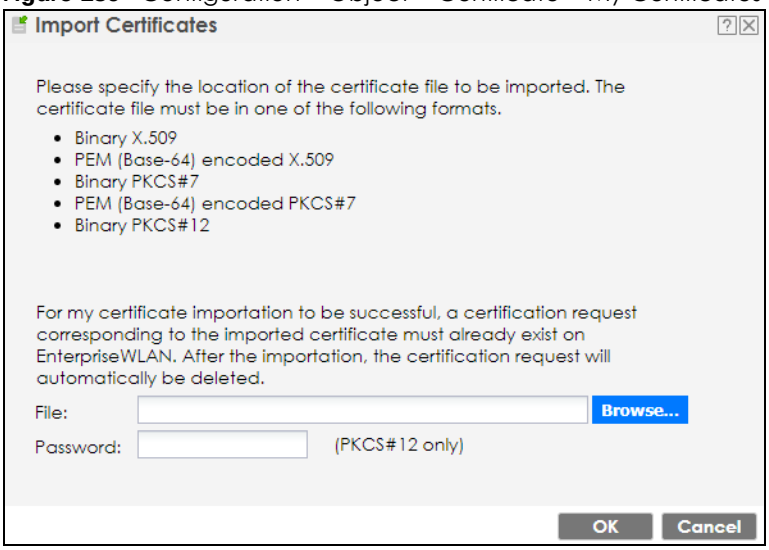
Click **Configuration > Object > Certificate > My Certificates > Import** to open the **My Certificate Import** screen. Follow the instructions in this screen to save an existing certificate to the NXC.

Note: You can import a certificate that matches a corresponding certification request that was generated by the NXC. You can also import a certificate in PKCS#12 format, including the certificate's public and private keys.

The certificate you import replaces the corresponding request in the **My Certificates** screen.

You must remove any spaces in the certificate's filename before you can import it.

Figure 189 Configuration > Object > Certificate > My Certificates > Import



The following table describes the labels in this screen.

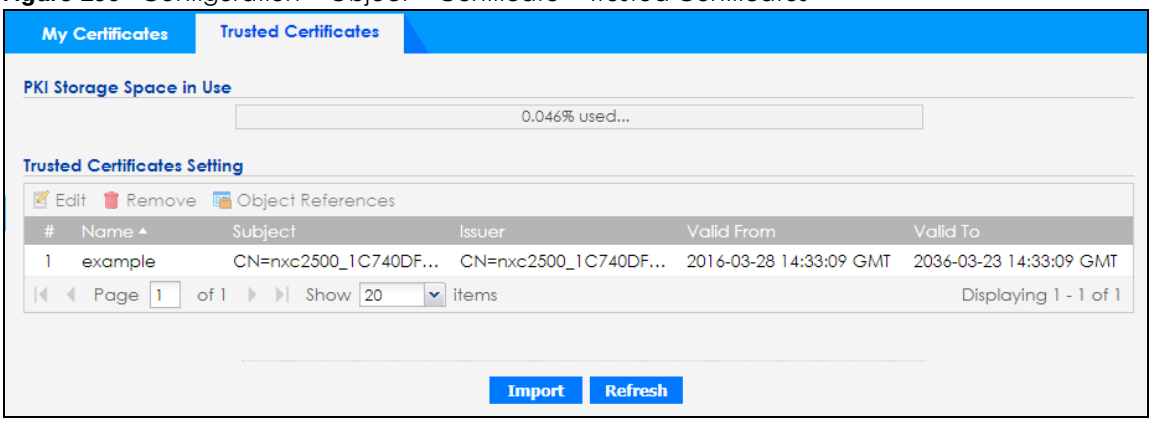
Table 157 Configuration > Object > Certificate > My Certificates > Import

LABEL	DESCRIPTION
File	Type in the location of the file you want to upload in this field or click **Browse** to find it. You cannot import a certificate with the same name as a certificate that is already in the NXC.
Browse	Click **Browse** to find the certificate file you want to upload.
Password	This field only applies when you import a binary PKCS#12 format file. Type the file's password that was created when the PKCS #12 file was exported.
OK	Click **OK** to save the certificate on the NXC.
Cancel	Click **Cancel** to quit and return to the **My Certificates** screen.

27.3 Trusted Certificates

Click **Configuration > Object > Certificate > Trusted Certificates** to open the **Trusted Certificates** screen. This screen displays a summary list of certificates that you have set the NXC to accept as trusted. The NXC also accepts any valid certificate signed by a certificate on this list as being trustworthy; thus you do not need to import any certificate that is signed by one of these certificates.

Figure 190 Configuration > Object > Certificate > Trusted Certificates



The following table describes the labels in this screen.

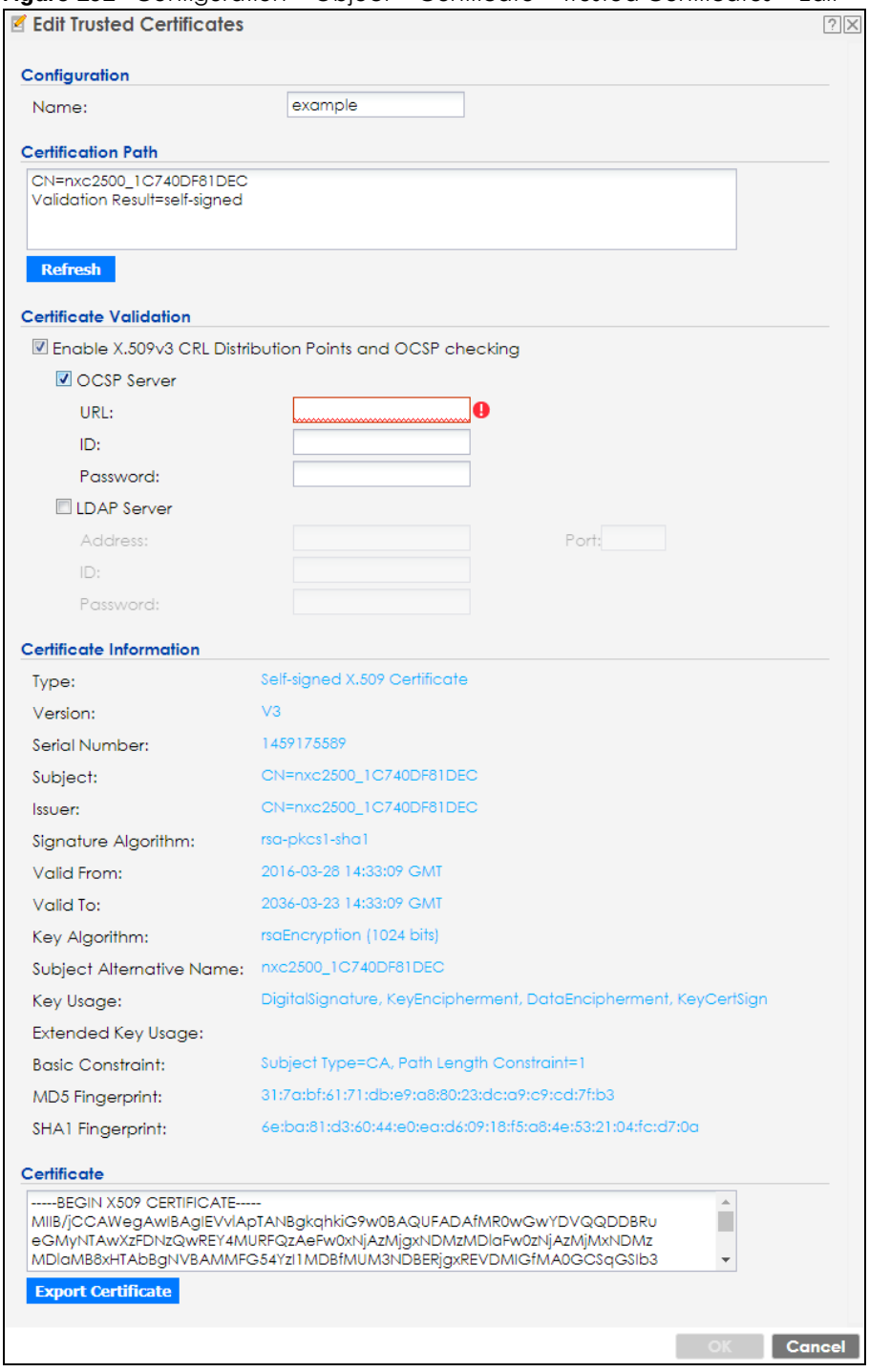
Table 158 Configuration > Object > Certificate > Trusted Certificates

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the NXC's PKI storage space that is currently in use. When the storage space is almost full, you should consider deleting expired or unnecessary certificates before adding more certificates.
Edit	Double-click an entry or select it and click **Edit** to open a screen with an in-depth list of information about the certificate.
Remove	The NXC keeps all of your certificates unless you specifically delete them. Uploading a new firmware or default configuration file does not delete your certificates. To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Subsequent certificates move up by one when you take this action.
Object References	You cannot delete certificates that any of the NXC's features are configured to use. Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field displays the certificate index number. The certificates are listed in alphabetical order.
Name	This field displays the name used to identify this certificate.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired.
Import	Click **Import** to open a screen where you can save the certificate of a certification authority that you trust, from your computer to the NXC.
Refresh	Click this button to display the current validity status of the certificates.

27.3.1 Editing Trusted Certificates

Click **Configuration > Object > Certificate > Trusted Certificates** and then a certificate's **Edit** icon to open the **Trusted Certificates Edit** screen. Use this screen to view in-depth information about the certificate, change the certificate's name and set whether or not you want the NXC to check a certification authority's list of revoked certificates before trusting a certificate issued by the certification authority.

Figure 191 Configuration > Object > Certificate > Trusted Certificates > Edit



The following table describes the labels in this screen.

Table 159 Configuration > Object > Certificate > Trusted Certificates > Edit

LABEL	DESCRIPTION
Configuration	
Name	This field displays the identifying name of this certificate. You can change the name. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Certification Path	Click the **Refresh** button to have this read-only text box display the end entity's certificate and a list of certification authority certificates that shows the hierarchy of certification authorities that validate the end entity's certificate. If the issuing certification authority is one that you have imported as a trusted certificate, it may be the only certification authority in the list (along with the end entity's own certificate). The NXC does not trust the end entity's certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click **Refresh** to display the certification path.
Certificate Validation	
Enable X.509v3 CRL Distribution Points and OCSP checking	Select this check box to have the NXC check incoming certificates that are signed by this certificate against a Certificate Revocation List (CRL) or an OCSP server. You also need to configure the OSCP or LDAP server details.
OCSP Server	Select this check box if the directory server uses OCSP (Online Certificate Status Protocol).
URL	Type the protocol, IP address and pathname of the OCSP server.
ID	The NXC may need to authenticate itself in order to assess the OCSP server. Type the login name (up to 31 ASCII characters) from the entity maintaining the server (usually a certification authority).
Password	Type the password (up to 31 ASCII characters) from the entity maintaining the OCSP server (usually a certification authority).
LDAP Server	Select this check box if the directory server uses LDAP (Lightweight Directory Access Protocol). LDAP is a protocol over TCP that specifies how clients access directories of certificates and lists of revoked certificates.
Address	Type the IP address (in dotted decimal notation) of the directory server.
Port	Use this field to specify the LDAP server port number. You must use the same server port number that the directory server uses. 389 is the default server port number for LDAP.
ID	The NXC may need to authenticate itself in order to assess the CRL directory server. Type the login name (up to 31 ASCII characters) from the entity maintaining the server (usually a certification authority).
Password	Type the password (up to 31 ASCII characters) from the entity maintaining the CRL directory server (usually a certification authority).
Certificate Information	These read-only fields display detailed information about the certificate.
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). X.509 means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number.
Serial Number	This field displays the certificate's identification number given by the certification authority.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same information as in the **Subject Name** field.

Table 159 Configuration > Object > Certificate > Trusted Certificates > Edit (continued)

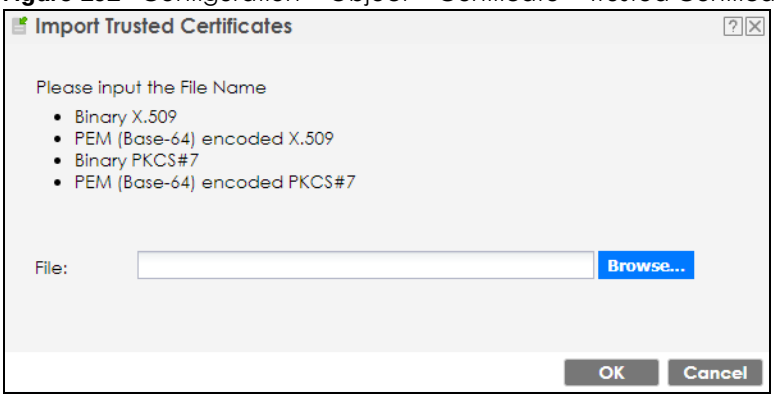
LABEL	DESCRIPTION
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate. Some certification authorities use rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm). Other certification authorities may use rsa-pkcs1-md5 (RSA public-private key encryption algorithm and the MD5 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the NXC uses RSA encryption) and the length of the key set in bits (1024 bits for example).
Subject Alternative Name	This field displays the certificate's owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path.
MD5 Fingerprint	This is the certificate's message digest that the NXC calculated using the MD5 algorithm. You can use this value to verify with the certification authority (over the phone for example) that this is actually their certificate.
SHA1 Fingerprint	This is the certificate's message digest that the NXC calculated using the SHA1 algorithm. You can use this value to verify with the certification authority (over the phone for example) that this is actually their certificate.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses lowercase letters, uppercase letters and numerals to convert a binary certificate into a printable form. You can copy and paste the certificate into an e-mail to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Export Certificate	Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
OK	Click **OK** to save your changes back to the NXC. You can only change the name.
Cancel	Click **Cancel** to quit and return to the **Trusted Certificates** screen.

27.3.2 Importing Trusted Certificates

Click **Configuration > Object > Certificate > Trusted Certificates > Import** to open the **Trusted Certificates Import** screen. Follow the instructions in this screen to save a trusted certificate to the NXC.

Note: You must remove any spaces from the certificate's filename before you can import the certificate.

Figure 192 Configuration > Object > Certificate > Trusted Certificates > Import



The following table describes the labels in this screen.

Table 160 Configuration > Object > Certificate > Trusted Certificates > Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it. You cannot import a certificate with the same name as a certificate that is already in the NXC.
Browse	Click **Browse** to find the certificate file you want to upload.
OK	Click **OK** to save the certificate on the NXC.
Cancel	Click **Cancel** to quit and return to the previous screen.

27.4 Technical Reference

The following section contains additional technical information about the features described in this chapter.

OCSP

OCSP (Online Certificate Status Protocol) allows an application or device to check whether a certificate is valid. With OCSP the NXC checks the status of individual certificates instead of downloading a Certificate Revocation List (CRL). OCSP has two main advantages over a CRL. The first is real-time status information. The second is a reduction in network traffic since the NXC only gets information on the certificates that it needs to verify, not a huge list. When the NXC requests certificate status information, the OCSP server returns a "expired", "current" or "unknown" response.

CHAPTER 28
DHCPv6

28.1 Overview

This chapter describes how to configure DHCPv6 request type objects.

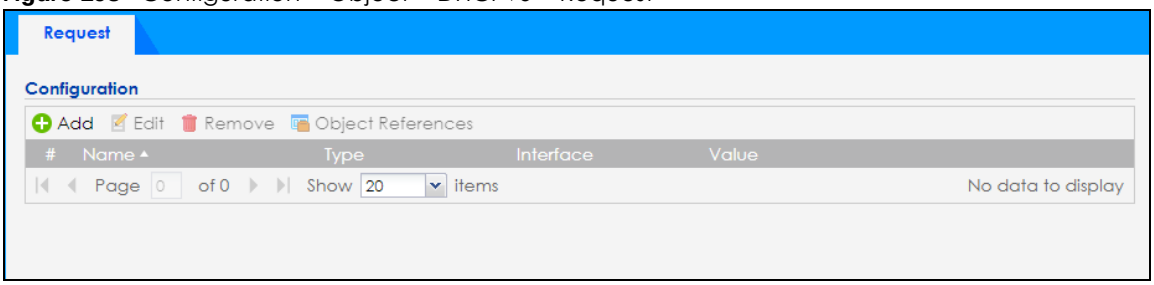
28.1.1 What You Can Do in this Chapter

The **Request** screen (Section 28.2 on page 331) allows you to configure DHCPv6 request type objects.

28.2 DHCPv6 Request

The **Request** screen allows you to add, edit, and remove DHCPv6 request type objects. To access this screen, click **Configuration > Object > DHCPv6 > Request**.

Figure 193 Configuration > Object > DHCPv6 > Request



The following table describes the labels in this screen.

Table 161 Configuration > Object > DHCPv6 > Request

LABEL	DESCRIPTION
Configuration	
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note: You cannot delete an entry which is in use.
Object References	Select an entry and click **Object References** to open a screen that shows which settings use the entry.
#	This field is a sequential value, and it is not associated with a specific object.
Name	This field displays the name of each request object.
Type	This field displays the request type of each request object.

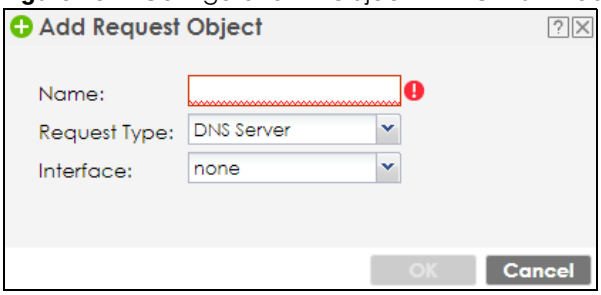
Table 161 Configuration > Object > DHCPv6 > Request (continued)

LABEL	DESCRIPTION
Interface	This field displays the interface used for each request object.
Value	This field displays the value for each request object.

28.2.1 Add/Edit DHCPv6 Request Object

The **Request Add/Edit** screen allows you to create a new request object or edit an existing one. To access this screen, go to the **Request** screen and click either the **Add** icon or an **Edit** icon.

Figure 194 Configuration > Object > DHCPv6 > Request > Add



The following table describes the labels in this screen.

Table 162 Configuration > Object > DHCPv6 > Request > Add/Edit

LABEL	DESCRIPTION
Name	Type the name for this request object. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive.
Request Type	Select the request type for this request object. You can choose from **DNS Server**, or **NTP Server**.
Interface	Select the interface for this request object.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

CHAPTER 29
System

29.1 Overview

Use the system screens to configure general NXC settings.

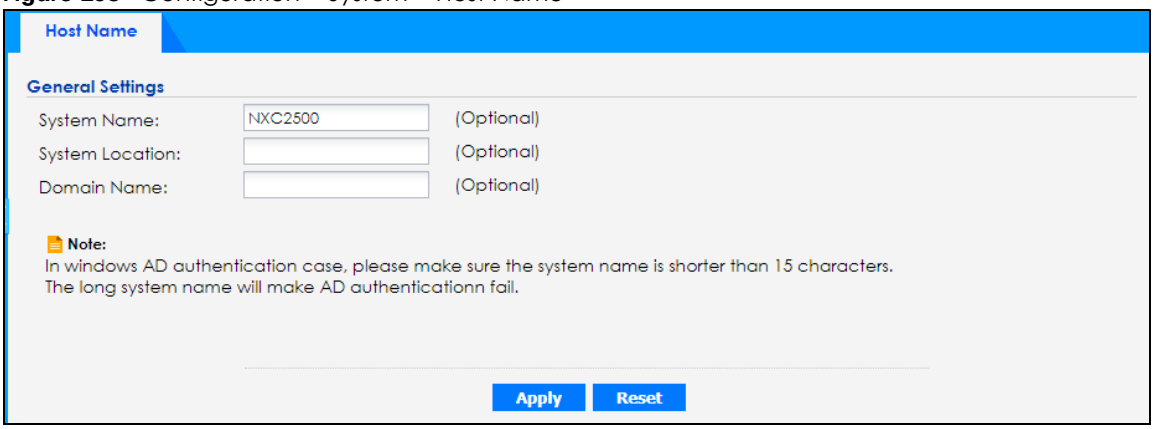
29.1.1 What You Can Do in this Chapter

- The **Host Name** screen (Section 29.2 on page 333) configures a unique name for the NXC in your network.
- The **USB Storage** screen (Section 29.3 on page 334) configures the settings for the connected USB devices.
- The **Date/Time** screen (Section 29.4 on page 335) configures the date and time for the NXC.
- The **Console Speed** screen (Section 29.5 on page 339) configures the console port speed when you connect to the NXC via the console port using a terminal emulation program.
- The **DNS** screen (Section 29.6 on page 340) configures the DNS (Domain Name System) server used for mapping a domain name to its corresponding IP address and vice versa.
- The **WWW** screens (Section 29.7 on page 345) configure settings for HTTP or HTTPS access to the NXC and how the login and access user screens look.
- The **SSH** screen (Section 29.8 on page 360) configures SSH (Secure SHell) for securely accessing the NXC's command line interface. You can specify which zones allow SSH access and from which IP address the access can come.
- The **Telnet** screen (Section 29.9 on page 364) configures Telnet for accessing the NXC's command line interface. Specify which zones allow Telnet access and from which IP address the access can come.
- The **FTP** screen (Section 29.10 on page 366) specifies from which zones FTP can be used to access the NXC. You can also specify from which IP addresses the access can come. You can upload and download the NXC's firmware and configuration files using FTP. Please also see Chapter 31 on page 390 for more information about firmware and configuration files.
- The **SNMP** screen (Section 29.11 on page 367) configures the device's SNMP settings, including from which zones SNMP can be used to access the NXC. You can also specify from which IP addresses the access can come.
- The **Auth. Server** screen (Section 29.12 on page 371) configures the device to operate as a RADIUS server.
- The **Language** screen (Section 29.13 on page 373) sets the user interface language for the NXC's Web Configurator screens.
- The **IPv6** screen (Section 29.14 on page 374) enables or disables IPv6 support on the NXC.

29.2 Host Name

A host name is the unique name by which a device is known on a network. Click **Configuration > System > Host Name** to open this screen.

Figure 195 Configuration > System > Host Name



The following table describes the labels in this screen.

Table 163 Configuration > System > Host Name

LABEL	DESCRIPTION
General Settings	
System Name	Enter a name to identify the NXC on a network. This is usually the NXC's fully qualified domain name. This name can be up to 64 alphanumeric characters long. Spaces are not allowed, but dashes (-) underscores (_) and periods (.) are accepted.
System Location	Specify the name of the place where the NXC is located. You can enter up to 61 alphanumeric and '()' ,:;?! +-*/= #$%@ characters. Spaces and underscores are allowed.
Domain Name	Enter the domain name (if you know it) here. This name is propagated to DHCP clients connected to interfaces with the DHCP server enabled. This name can be up to 254 alphanumeric characters long. Spaces are not allowed, but dashes "-" are accepted.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

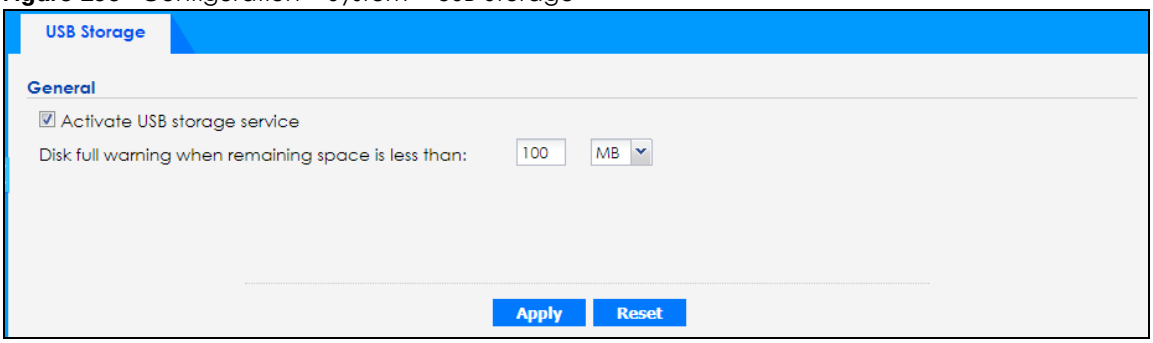
29.3 USB Storage

The NXC can use a connected USB device to store the system log and other diagnostic information. Use this screen to turn on this feature and set a disk full warning limit.

Note: Only connect one USB device. It must allow writing (it cannot be read-only) and use the FAT16, FAT32, EXT2, or EXT3 file system.

Click **Configuration > System > USB Storage** to open the screen as shown next.

Figure 196 Configuration > System > USB Storage



The following table describes the labels in this screen.

Table 164 Configuration > System > USB Storage

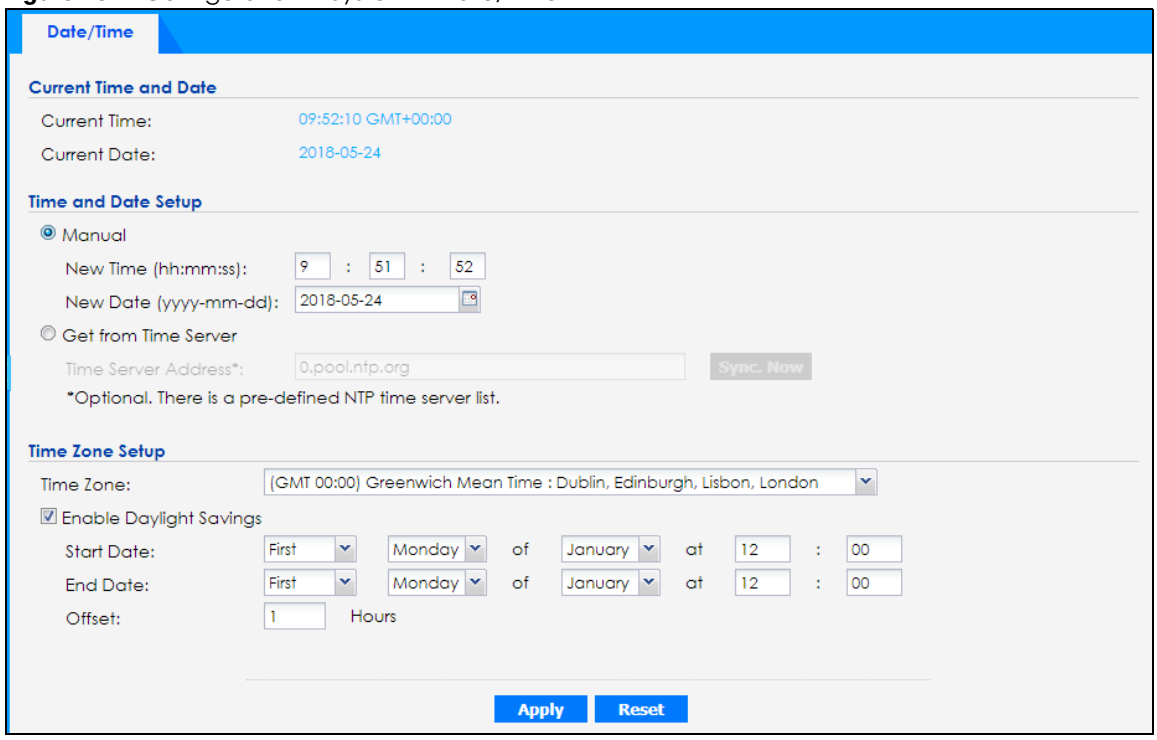
LABEL	DESCRIPTION
General	
Activate USB storage service	Select this if you want to use the connected USB device(s).
Disk full warning when remaining space is less than	Set a number and select a unit (**MB** or **%**) to have the NXC send a warning message when the remaining USB storage space is less than the value you set here.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.4 Date and Time

For effective scheduling and logging, the NXC system time must be accurate. The NXC's Real Time Chip (RTC) keeps track of the time and date. There is also a software mechanism to set the time manually or get the current time and date from an external server.

To change your NXC's time based on your local time zone and date, click **Configuration > System > Date/Time**. The screen displays as shown. You can manually set the NXC's time and date or have the NXC get the date and time from a time server.

Figure 197 Configuration > System > Date/Time



The following table describes the labels in this screen.

Table 165 Configuration > System > Date/Time

LABEL	DESCRIPTION
Current Time and Date	
Current Time	This field displays the present time of your NXC.
Current Date	This field displays the present date of your NXC.
Time and Date Setup	
Manual	Select this radio button to enter the time and date manually. If you configure a new time and date, time zone and daylight saving at the same time, the time zone and daylight saving will affect the new time and date you entered. When you enter the time settings manually, the NXC uses the new setting once you click **Apply**.
New Time (hh:mm:ss)	This field displays the last updated time from the time server or the last time configured manually. When you set **Time and Date Setup** to **Manual**, enter the new time in this field and then click **Apply**.
New Date (yyyy-mm-dd)	This field displays the last updated date from the time server or the last date configured manually. When you set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**.

Table 165 Configuration > System > Date/Time (continued)

LABEL	DESCRIPTION
Get from Time Server	Select this radio button to have the NXC get the time and date from the time server you specify below. The NXC requests time and date settings from the time server under the following circumstances. • When the NXC starts up. • When you click **Apply** or **Synchronize Now** in this screen. • 24-hour intervals after starting up.
Time Server Address	Enter the IP address or URL of your time server. Check with your ISP/network administrator if you are unsure of this information.
Sync. Now	Click this button to have the NXC get the time and date from a time server (see the **Time Server Address** field). This also saves your changes (except the daylight saving settings).
Time Zone Setup	
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Enable Daylight Savings	Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Enable Daylight Savings**. The **at** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Second**, **Sunday**, **March** and type 2 in the **at** field. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **March**. The time you type in the **at** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Enable Daylight Savings**. The **at** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, **November** and type 2 in the **at** field. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **October**. The time you type in the **at** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Offset	Specify how much the clock changes when daylight saving begins and ends. Enter a number from 1 to 5.5 (by 0.5 increments). For example, if you set this field to 3.5, a log occurred at 6 P.M. in local official time will appear as if it had occurred at 10:30 P.M.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.4.1 Pre-defined NTP Time Servers List

When you turn on the NXC for the first time, the date and time start at 2003-01-01 00:00:00. The NXC then attempts to synchronize with one of the following pre-defined list of Network Time Protocol (NTP) time servers.

The NXC continues to use the following pre-defined list of NTP time servers if you do not specify a time server or it cannot synchronize with the time server you specified.

Table 166 Default Time Servers

0.pool.ntp.org
1.pool.ntp.org
2.pool.ntp.org

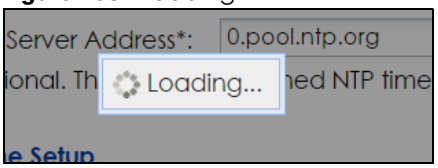
When the NXC uses the pre-defined list of NTP time servers, it randomly selects one server and tries to synchronize with it. If the synchronization fails, then the NXC goes through the rest of the list in order from the first one tried until either it is successful or all the pre-defined NTP time servers have been tried.

29.4.2 Time Server Synchronization

Click the **Synchronize Now** button to get the time and date from the time server you specified in the **Time Server Address** field.

When the **Loading** message appears, you may have to wait up to one minute.

Figure 198 Loading



The **Current Time** and **Current Date** fields will display the appropriate settings if the synchronization is successful.

If the synchronization was not successful, a log displays in the **View Log** screen. Try re-configuring the **Date/Time** screen.

To manually set the NXC date and time:

1. Click **System > Date/Time**.
2. Select **Manual** under **Time and Date Setup**.
3. Enter the NXC's time in the **New Time** field.
4. Enter the NXC's date in the **New Date** field.
5. Under **Time Zone Setup**, select your **Time Zone** from the list.
6. As an option you can select the **Enable Daylight Saving** check box to adjust the NXC clock for daylight savings.

7 Click **Apply**.

To get the NXC date and time from a time server:

1 Click **System > Date/Time**.

2 Select **Get from Time Server** under **Time and Date Setup**.

3 Under **Time Zone Setup**, select your **Time Zone** from the list.

4 Under **Time and Date Setup**, enter a **Time Server Address**.

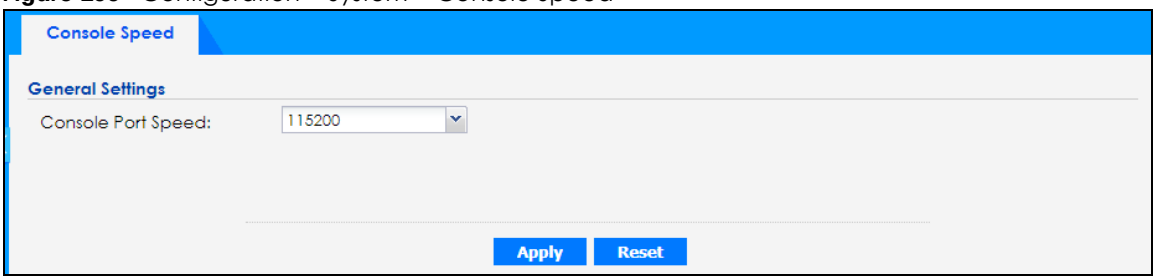
5 Click **Apply**.

29.5 Console Speed

This section shows you how to set the console port speed when you connect to the NXC via the console port using a terminal emulation program. See Table 4 on page 23 for default console port settings.

Click **Configuration > System > Console Speed** to open this screen.

Figure 199 Configuration > System > Console Speed



The following table describes the labels in this screen.

Table 167 Configuration > System > Console Speed

LABEL	DESCRIPTION
General Settings	
Console Port Speed	Use the drop-down list box to change the speed of the console port. Your NXC supports 9600, 19200, 38400, 57600, and 115200 bps (default) for the console port. The **Console Port Speed** applies to a console port connection using terminal emulation software and NOT the **Console** in the NXC Web Configurator **Status** screen.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.6 DNS Overview

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a machine before you can access it.

29.6.1 DNS Server Address Assignment

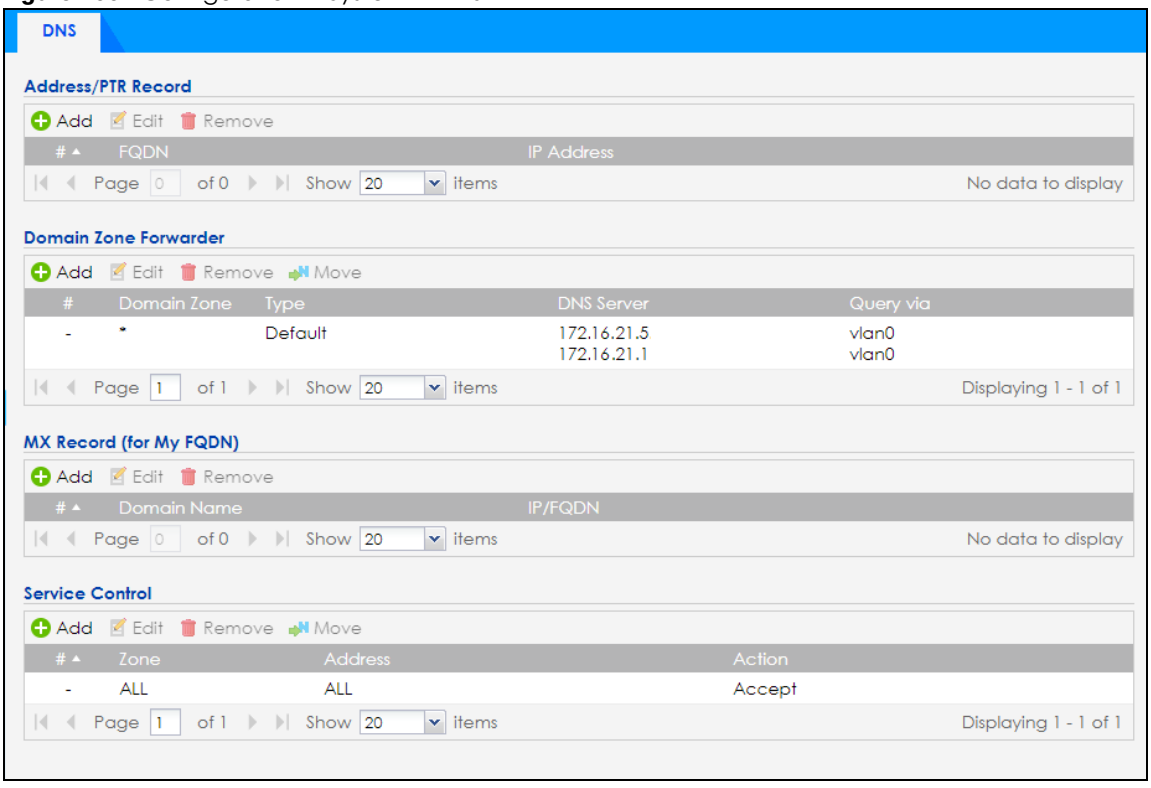
The NXC can get the DNS server addresses in the following ways.

- The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, manually enter them in the DNS server fields.
- If your ISP dynamically assigns the DNS server IP addresses (along with the NXC's WAN IP address), set the DNS server fields to get the DNS server address from the ISP.
- You can manually enter the IP addresses of other DNS servers.

29.6.2 Configuring the DNS Screen

Click **Configuration > System > DNS** to change your NXC's DNS settings. Use the **DNS** screen to configure the NXC to use a DNS server to resolve domain names for NXC system features like the time server. You can also configure the NXC to accept or discard DNS queries. Use the **Network > Interface** screens to configure the DNS server information that the NXC sends to the specified DHCP client devices.

Figure 200 Configuration > System > DNS



The following table describes the labels in this screen.

Table 168 Configuration > System > DNS

LABEL	DESCRIPTION
Address/PTR Record	This record specifies the mapping of a Fully-Qualified Domain Name (FQDN) to an IP address. An FQDN consists of a host and domain name. For example, www.zyxel.com.tw is a fully qualified domain name, where "www" is the host, "zyxel" is the third-level domain, "com" is the second-level domain, and "tw" is the top level domain.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
#	This is the index number of the address/PTR record.
FQDN	This is a host's fully qualified domain name.
IP Address	This is the IP address of a host.
Domain Zone Forwarder	This specifies a DNS server's IP address. The NXC can query the DNS server to resolve domain zones for features like the time server. When the NXC needs to resolve a domain zone, it checks it against the domain zone forwarder entries in the order that they appear in this list.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This is the index number of the domain zone forwarder record. The ordering of your rules is important as rules are applied in sequence. A hyphen (-) displays for the default domain zone forwarder record. The default record is not configurable. The NXC uses this default record if the domain zone that needs to be resolved does not match any of the other domain zone forwarder records.
Domain Zone	A domain zone is a fully qualified domain name without the host. For example, zyxel.com.tw is the domain zone for the www.zyxel.com.tw fully qualified domain name. A "*" means all domain zones.
Type	This displays whether the DNS server IP address is assigned by the ISP dynamically through a specified interface or configured manually (**User-Defined**).
DNS Server	This is the IP address of a DNS server. This field displays **N/A** if you have the NXC get a DNS server IP address from the ISP dynamically but the specified interface is not active.
Query Via	This is the interface through which the NXC sends DNS queries to the entry's DNS server.
MX Record (for My FQDN)	A MX (Mail eXchange) record identifies a mail server that handles the mail for a particular domain.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
#	This is the index number of the MX record.
Domain Name	This is the domain name where the mail is destined for.
IP/FQDN	This is the IP address or Fully-Qualified Domain Name (FQDN) of a mail server that handles the mail for the domain specified in the field above.

Table 168 Configuration > System > DNS (continued)

LABEL	DESCRIPTION
Service Control	This specifies from which computers and zones you can send DNS queries to the NXC.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This the index number of the service control rule. The ordering of your rules is important as rules are applied in sequence. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to send DNS queries.
Action	This displays whether the NXC accepts DNS queries from the computer with the IP address specified above through the specified zone (**Accept**) or discards them (**Deny**).

29.6.3 Address Record

An address record contains the mapping of a Fully-Qualified Domain Name (FQDN) to an IP address. An FQDN consists of a host and domain name. For example, www.zyxel.com is a fully qualified domain name, where "www" is the host, "zyxel" is the second-level domain, and "com" is the top level domain. mail.myZyxel.com.tw is also a FQDN, where "mail" is the host, "myZyxel" is the third-level domain, "com" is the second-level domain, and "tw" is the top level domain.

The NXC allows you to configure address records about the NXC itself or another device. This way you can keep a record of DNS names and addresses that people on your network may use frequently. If the NXC receives a DNS query for an FQDN for which the NXC has an address record, the NXC can send the IP address in a DNS response without having to query a DNS name server.

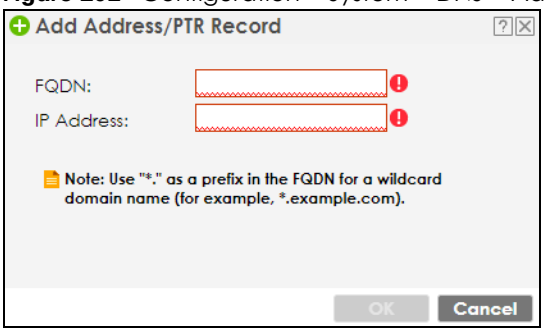
29.6.4 PTR Record

A PTR (pointer) record is also called a reverse record or a reverse lookup record. It is a mapping of an IP address to a domain name.

29.6.5 Adding an Address/PTR Record

Click the **Add** icon in the **Address/PTR Record** table to add an address/PTR record.

Figure 201 Configuration > System > DNS > Add Address/PTR Record



The following table describes the labels in this screen.

Table 169 Configuration > System > DNS > Add Address/PTR Record

LABEL	DESCRIPTION
FQDN	Type a Fully-Qualified Domain Name (FQDN) of a server. An FQDN starts with a host name and continues all the way up to the top-level domain name. For example, www.zyxel.com.tw is a fully qualified domain name, where "www" is the host, "zyxel" is the third-level domain, "com" is the second-level domain, and "tw" is the top level domain. Underscores are not allowed. Use "*." as a prefix in the FQDN for a wildcard domain name (for example, *.example.com).
IP Address	Enter the IP address of the host in dotted decimal notation.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

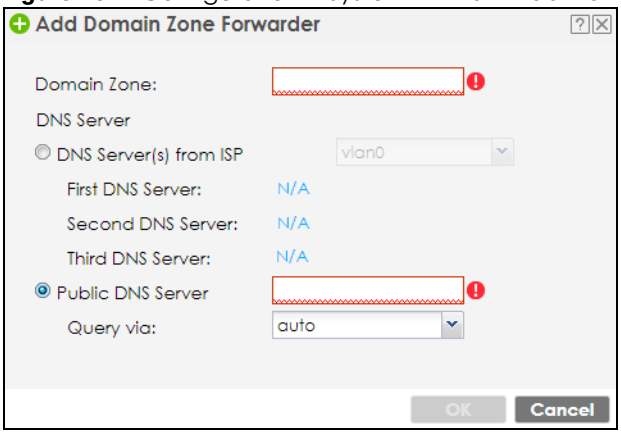
29.6.6 Domain Zone Forwarder

A domain zone forwarder contains a DNS server's IP address. The NXC can query the DNS server to resolve domain zones for features like the time server. A domain zone is a fully qualified domain name without the host. For example, zyxel.com is the domain zone for the www.zyxel.com fully qualified domain name.

29.6.7 Add Domain Zone Forwarder

Click the **Add** icon in the **Domain Zone Forwarder** table to add a domain zone forwarder record.

Figure 202 Configuration > System > DNS > Add Domain Zone Forwarder



The following table describes the labels in this screen.

Table 170 Configuration > System > DNS > Add Domain Zone Forwarder

LABEL	DESCRIPTION
Domain Zone	A domain zone is a fully qualified domain name without the host. For example, zyxel.com.tw is the domain zone for the www.zyxel.com.tw fully qualified domain name. For example, whenever the NXC receives needs to resolve a zyxel.com.tw domain name, it can send a query to the recorded name server IP address. Enter * if all domain zones are served by the specified DNS server(s).
DNS Server	Select **DNS Server(s) from ISP** if your ISP dynamically assigns DNS server information. You also need to select an interface through which the ISP provides the DNS server IP address(es). The interface should be activated and set to be a DHCP client. The fields below display the (read-only) DNS server IP address(es) that the ISP assigns. **N/A** displays for any DNS server IP address fields for which the ISP does not assign an IP address. Note: If all interfaces are static, then this field is hidden. Select **Public DNS Server** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. The NXC must be able to connect to the DNS server. The DNS server could be on the Internet or one of the NXC's local networks. You cannot use 0.0.0.0. Use the **Query via** field to select the interface through which the NXC sends DNS queries to a DNS server.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

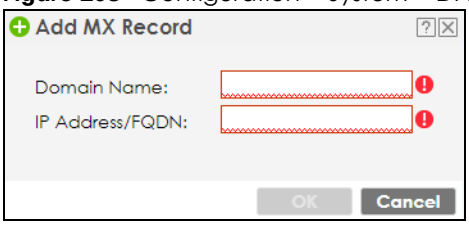
29.6.8 MX Record

A MX (Mail eXchange) record indicates which host is responsible for the mail for a particular domain, that is, controls where mail is sent for that domain. If you do not configure proper MX records for your domain or other domain, external e-mail from other mail servers will not be able to be delivered to your mail server and vice versa. Each host or domain can have only one MX record, that is, one domain is mapping to one host.

29.6.9 Add MX Record

Click the **Add** icon in the **MX Record** table to add a MX record.

Figure 203 Configuration > System > DNS > Add MX Record



The following table describes the labels in this screen.

Table 171 Configuration > System > DNS > Add MX Record

LABEL	DESCRIPTION
Domain Name	Enter the domain name where the mail is destined for.
IP Address/FQDN	Enter the IP address or Fully-Qualified Domain Name (FQDN) of a mail server that handles the mail for the domain specified in the field above.

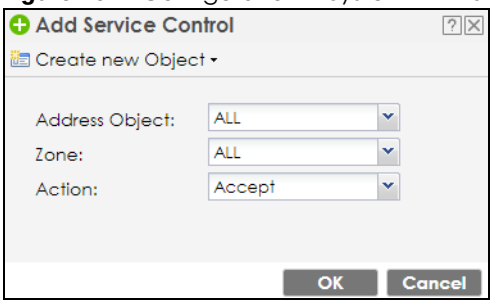
Table 171 Configuration > System > DNS > Add MX Record (continued)

LABEL	DESCRIPTION
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

29.6.10 Add Service Control

Click the **Add** icon in the **Service Control** table to add a service control rule.

Figure 204 Configuration > System > DNS > Add Service Control Rule



The following table describes the labels in this screen.

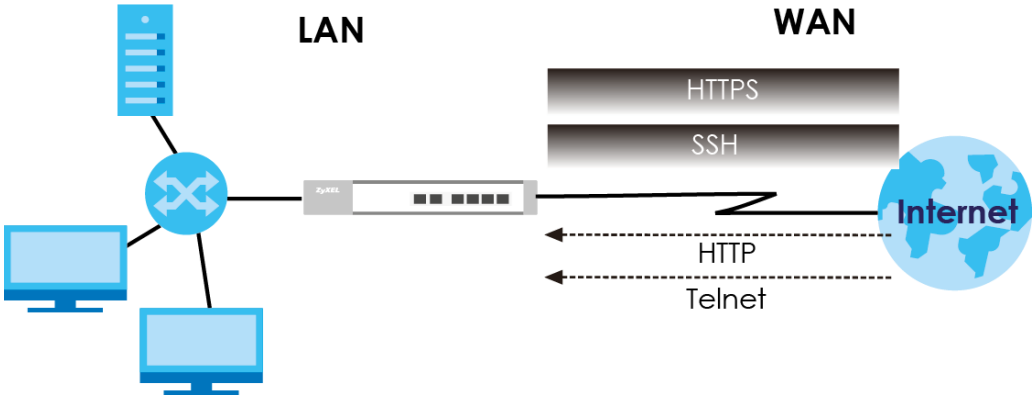
Table 172 Configuration > System > DNS > Add Service Control Rule

LABEL	DESCRIPTION
Create new Object	Use this to configure any new settings objects that you need to use in this screen.
Address Object	Select **ALL** to allow or deny any computer to send DNS queries to the NXC. Select a predefined address object to just allow or deny the computer with the IP address that you specified to send DNS queries to the NXC.
Zone	Select **ALL** to allow or prevent DNS queries through any zones. Select a predefined zone on which a DNS query to the NXC is allowed or denied.
Action	Select **Accept** to have the NXC allow the DNS queries from the specified computer. Select **Deny** to have the NXC reject the DNS queries from the specified computer.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

29.7 WWW Overview

The following figure shows secure and insecure management of the NXC coming in from the WAN. HTTPS and SSH access are secure. HTTP, and Telnet management access are not secure.

Figure 205 Secure and Insecure Service Access From the WAN



29.7.1 Service Access Limitations

A service cannot be used to access the NXC when:

1. You have disabled that service in the corresponding screen.
2. The allowed IP address (address object) in the **Service Control** table does not match the client IP address (the NXC disallows the session).
3. The IP address (address object) in the **Service Control** table is not in the allowed zone or the action is set to **Deny**.

29.7.2 System Timeout

There is a lease timeout for administrators. The NXC automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling.

Each user is also forced to log in the NXC for authentication again when the reauthentication time expires.

You can change the timeout settings in the **User/Group** screens.

29.7.3 HTTPS

You can set the NXC to use HTTP or HTTPS (HTTPS adds security) for Web Configurator sessions. Specify which zones allow Web Configurator access and from which IP address the access can come.

HTTPS (HyperText Transfer Protocol over Secure Socket Layer, or HTTP over SSL) is a web protocol that encrypts and decrypts web pages. Secure Socket Layer (SSL) is an application-level protocol that enables secure transactions of data by ensuring confidentiality (an unauthorized party cannot read the transferred data), authentication (one party can identify the other party) and data integrity (you know if data has been changed).

It relies upon certificates, public keys, and private keys (see Chapter 27 on page 316 for more information).

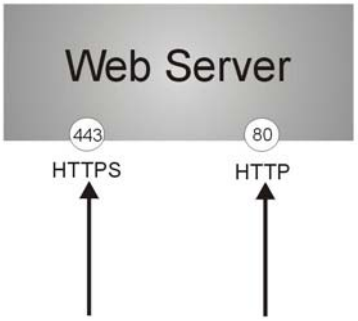
HTTPS on the NXC is used so that you can securely access the NXC using the Web Configurator. The SSL protocol specifies that the HTTPS server (the NXC) must always authenticate itself to the HTTPS client (the computer which requests the HTTPS connection with the NXC), whereas the HTTPS client only should authenticate itself when the HTTPS server requires it to do so (select **Authenticate Client Certificates** in the **WWW** screen). **Authenticate Client Certificates** is optional and if selected means the HTTPS client must send the NXC a certificate. You must apply for a certificate for the browser from a CA that is a trusted CA on the NXC.

Please refer to the following figure.

1 HTTPS connection requests from an SSL-aware web browser go to port 443 (by default) on the NXC's web server.

2 HTTP connection requests from a web browser go to port 80 (by default) on the NXC's web server.

Figure 206 HTTP/HTTPS Implementation



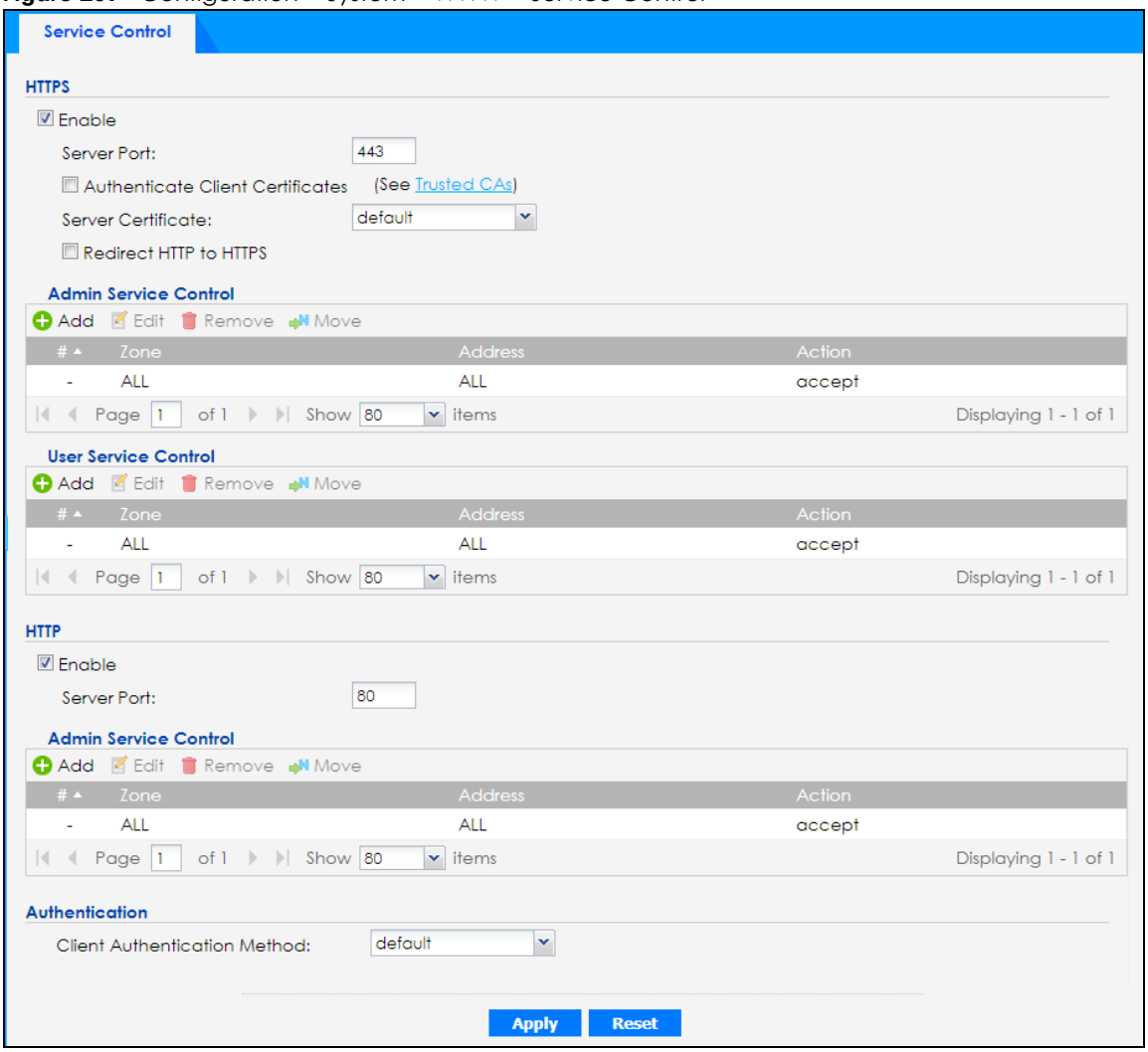
Note: If you disable **HTTP** in the **WWW** screen, then the NXC blocks all HTTP connection attempts.

29.7.4 Configuring WWW Service Control

Click **Configuration > System > WWW** to open the **WWW** screen. Use this screen to specify from which zones you can access the NXC using HTTP or HTTPS. You can also specify which IP addresses the access can come from.

Note: **Admin Service Control** deals with management access (to the Web Configurator). **User Service Control** deals with user access to the NXC.

Figure 207 Configuration > System > WWW > Service Control



The following table describes the labels in this screen.

Table 173 Configuration > System > WWW > Service Control

LABEL	DESCRIPTION
HTTPS	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC Web Configurator using secure HTTPs connections.
Server Port	The HTTPS server listens on port 443 by default. If you change the HTTPS server port to a different number on the NXC, for example 8443, then you must notify people who need to access the NXC Web Configurator to use "https://NXC IP Address:**8443**" as the URL.
Authenticate Client Certificates	Select **Authenticate Client Certificates** (optional) to require the SSL client to authenticate itself to the NXC by sending the NXC a certificate. To do that the SSL client must have a CA-signed certificate from a CA that has been imported as a trusted CA on the NXC.
Server Certificate	Select a certificate the HTTPS server (the NXC) uses to authenticate itself to the HTTPS client. You must have certificates already configured in the **My Certificates** screen.
Redirect HTTP to HTTPS	To allow only secure Web Configurator access, select this to redirect all HTTP connection requests to the HTTPS server.

Table 173 Configuration > System > WWW > Service Control (continued)

LABEL	DESCRIPTION
Admin/User Service Control	**Admin Service Control** specifies from which zones an administrator can use HTTPS to manage the NXC (using the Web Configurator). You can also specify the IP addresses from which the administrators can manage the NXC. **User Service Control** specifies from which zones a user can use HTTPS to log into the NXC. You can also specify the IP addresses from which the users can access the NXC.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This is the index number of the service control rule. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
HTTP	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC Web Configurator using HTTP connections.
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service to access the NXC.
Admin/User Service Control	**Admin Service Control** specifies from which zones an administrator can use HTTP to manage the NXC (using the Web Configurator). You can also specify the IP addresses from which the administrators can manage the NXC. **User Service Control** specifies from which zones a user can use HTTP to log into the NXC. You can also specify the IP addresses from which the users can access the NXC.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This is the index number of the service control rule. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.

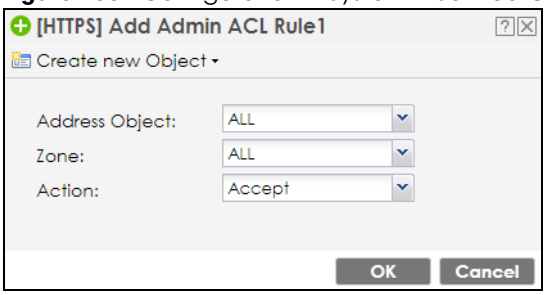
Table 173 Configuration > System > WWW > Service Control (continued)

LABEL	DESCRIPTION
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
Authentication	
Client Authentication Method	Select a method the HTTPS or HTTP server uses to authenticate a client. You must have configured the authentication methods in the **Auth. method** screen.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.7.5 Service Control Rules

Click **Add** or **Edit** in the **Service Control** table in a **WWW**, **SSH**, **TELNET**, **FTP** or **SNMP** screen to add a service control rule.

Figure 208 Configuration > System > Service Control Rule > Add/Edit



The following table describes the labels in this screen.

Table 174 Configuration > System > Service Control Rule > Add/Edit

LABEL	DESCRIPTION
Create new Object	Use this to configure any new settings objects that you need to use in this screen.
Address Object	Select **ALL** to allow or deny any computer to communicate with the NXC using this service. Select a predefined address object to just allow or deny the computer with the IP address that you specified to access the NXC using this service.
Zone	Select **ALL** to allow or prevent any NXC zones from being accessed using this service. Select a predefined NXC zone on which a incoming service is allowed or denied.
Action	Select **Accept** to allow the user to access the NXC from the specified computers. Select **Deny** to block the user's access to the NXC from the specified computers.
OK	Click **OK** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

29.7.6 HTTPS Example

If you haven't changed the default HTTPS port on the NXC, then in your browser enter "https://NXC IP Address/" as the web site address where "NXC IP Address" is the IP address or domain name of the NXC you wish to access.

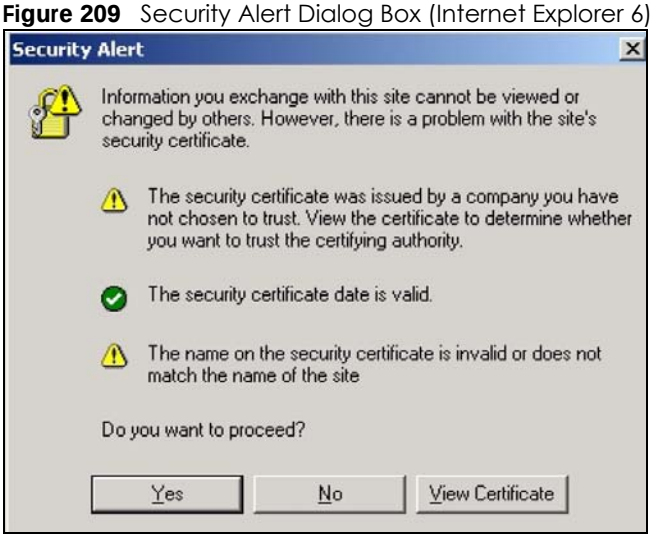
29.7.6.1 Internet Explorer Warning Messages

Internet Explorer 6

When you attempt to access the NXC HTTPS server, a Windows dialog box pops up asking if you trust the server certificate. Click **View Certificate** if you want to verify that the certificate is from the NXC.

You see the following **Security Alert** screen in Internet Explorer. Select **Yes** to proceed to the Web Configurator login screen; if you select **No**, then Web Configurator access is blocked.

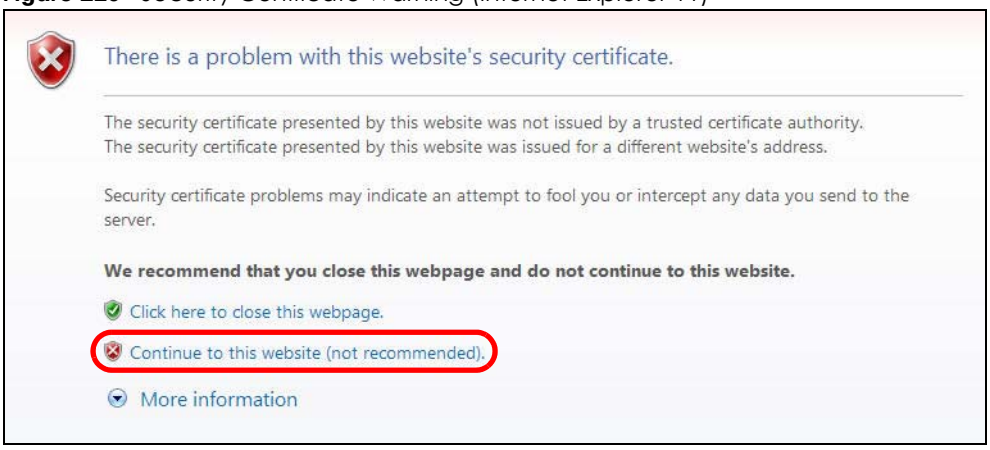
Figure 209 Security Alert Dialog Box (Internet Explorer 6)



Internet Explorer 7 or later version

When you attempt to access the NXC HTTPS server, a screen with the message "There is a problem with this website's security certificate." may display. If that is the case, click **Continue to this website (not recommended)** to proceed to the web configurator login screen.

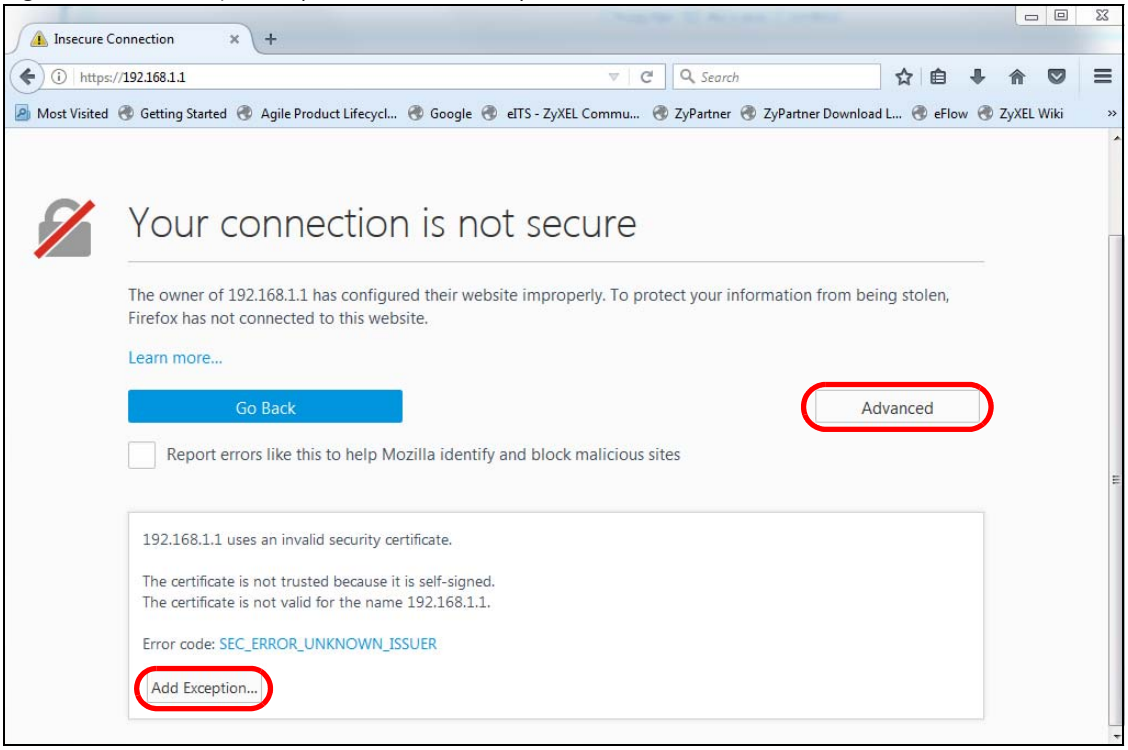
Figure 210 Security Certificate Warning (Internet Explorer 11)



29.7.7 Mozilla Firefox Warning Messages

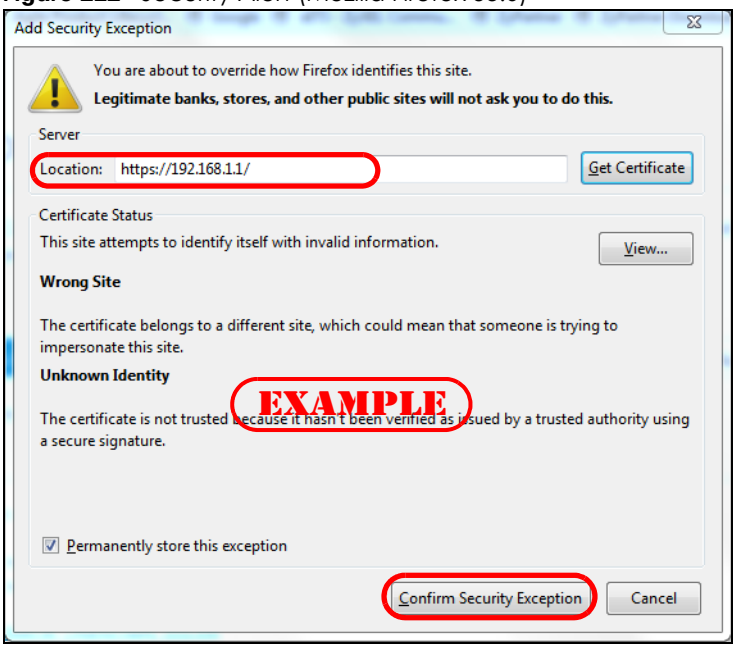
When you attempt to access the NXC HTTPS server, a **This Connection is Untrusted** or **Your connection is not secure** screen may display. If that is the case, click **I Understand the Risks** or **Advanced** and then the **Add Exception...** button.

Figure 211 Security Alert (Mozilla Firefox 53.0)



Confirm the HTTPS server URL matches. Click **Confirm Security Exception** to proceed to the web configurator login screen.

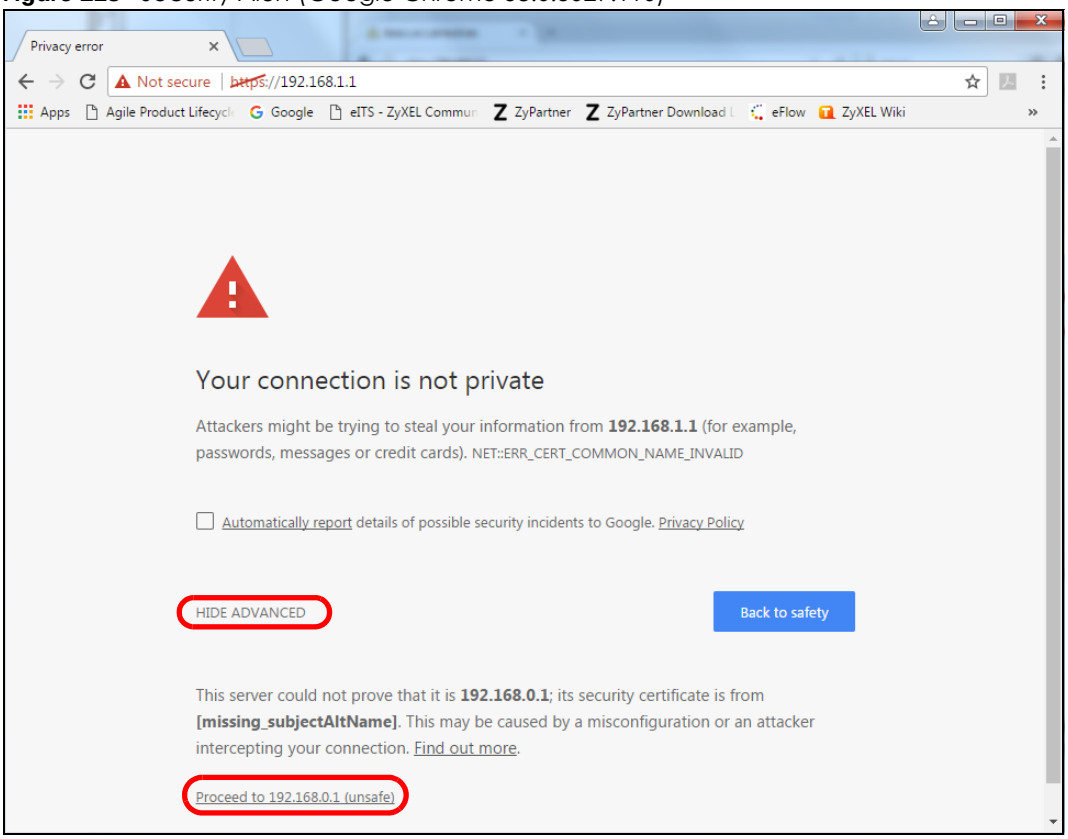
Figure 212 Security Alert (Mozilla Firefox 53.0)



29.7.8 Google Chrome Warning Messages

When you attempt to access the NXC HTTPS server, a **Your connection is not private** screen may display. If that is the case, click **Advanced** and then **Proceed to x.x.x.x (unsafe)** to proceed to the web configurator login screen.

Figure 213 Security Alert (Google Chrome 58.0.3029.110)



29.7.8.1 Avoiding Browser Warning Messages

Here are the main reasons your browser displays warnings about the NXC's HTTPS server certificate and what you can do to avoid seeing the warnings:

- The issuing certificate authority of the NXC's HTTPS server certificate is not one of the browser's trusted certificate authorities. The issuing certificate authority of the NXC's factory default certificate is the NXC itself since the certificate is a self-signed certificate.
- For the browser to trust a self-signed certificate, import the self-signed certificate into your operating system as a trusted certificate.
- To have the browser trust the certificates issued by a certificate authority, import the certificate authority's certificate into your operating system as a trusted certificate. Refer to Appendix C on page 460 for details.

29.7.8.2 Login Screen

After you accept the certificate, the NXC login screen appears. The lock displayed in the bottom of the browser status bar or next to the website address denotes a secure connection.

Figure 214 Login Screen (Internet Explorer)

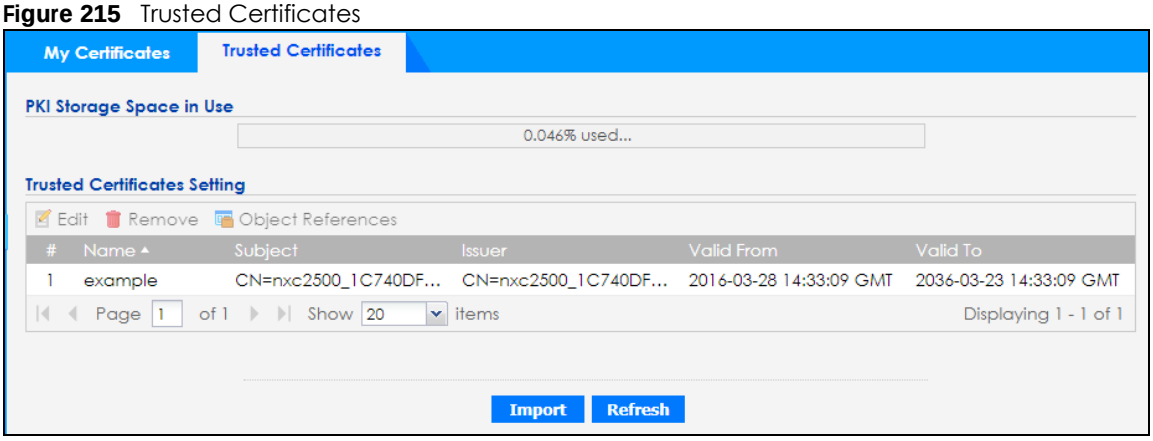
29.7.8.3 Enrolling and Importing SSL Client Certificates

The SSL client needs a certificate if **Authenticate Client Certificates** is selected on the NXC.

You must have imported at least one trusted CA to the NXC in order for the **Authenticate Client Certificates** to be active (see the Certificates chapter for details).

Apply for a certificate from a Certification Authority (CA) that is trusted by the NXC (see the NXC's **Trusted Certificates** Web Configurator screen).

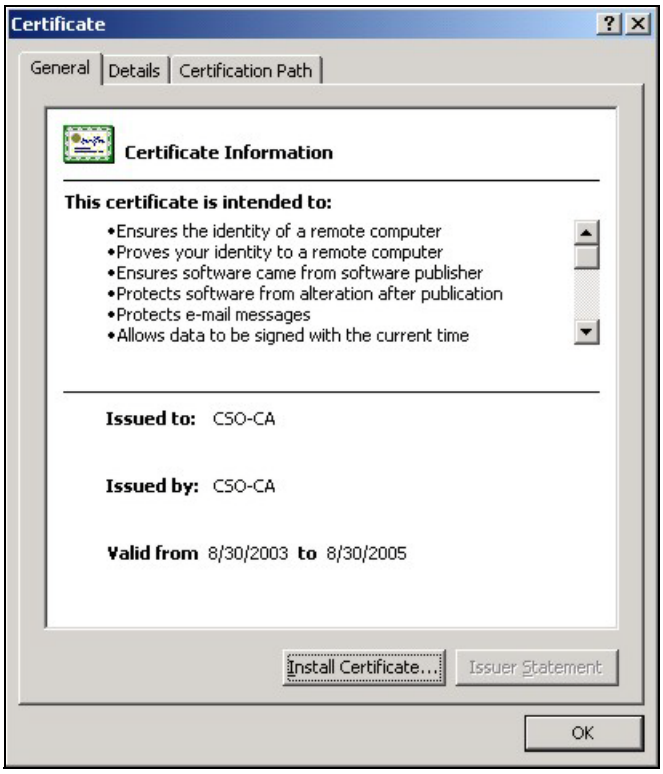
Figure 215 Trusted Certificates



The CA sends you a package containing the CA's trusted certificate(s), your personal certificate(s) and a password to install the personal certificate(s).

29.7.8.4 Installing the CA's Certificate

1 Double click the CA's trusted certificate to produce a screen similar to the one shown next.



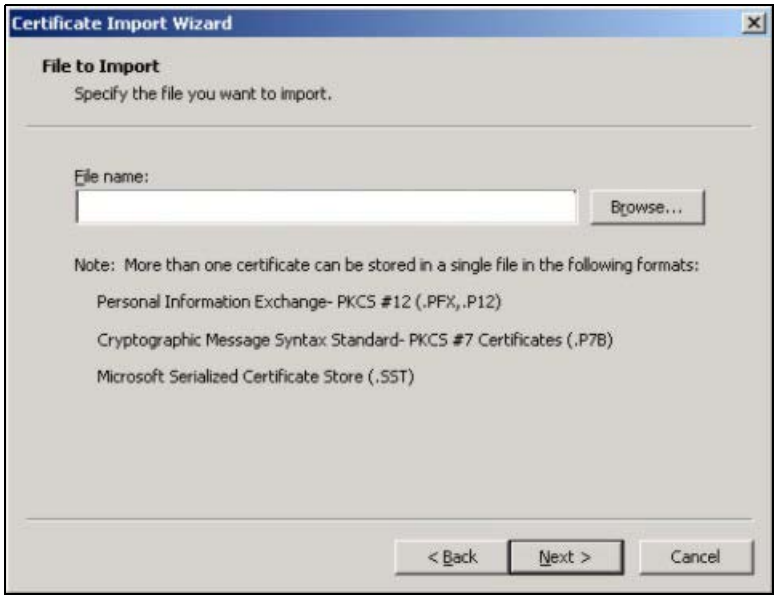
2 Click **Install Certificate** and follow the wizard as shown earlier in this appendix.

29.7.8.5 Installing a Personal Certificate

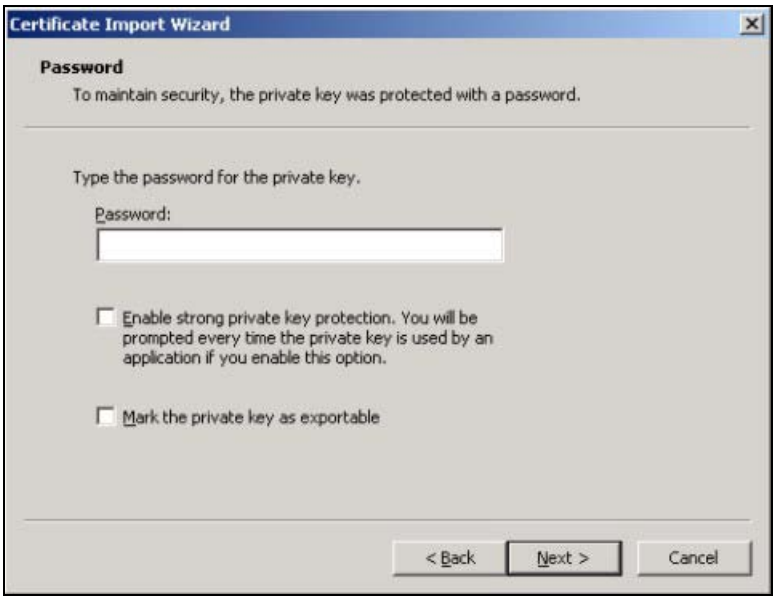
You need a password in advance. The CA may issue the password or you may have to specify it during the enrollment. Double-click the personal certificate given to you by the CA to produce a screen similar to the one shown next

1 Click **Next** to begin the wizard.

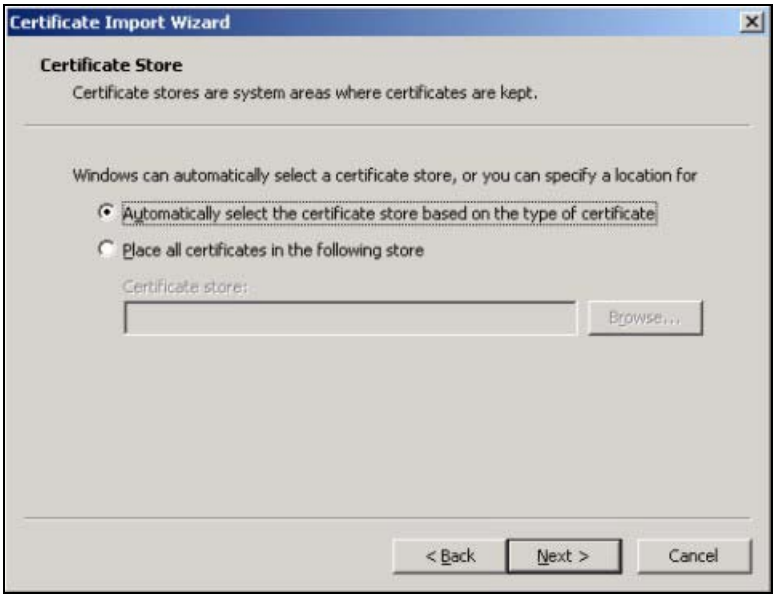
2 The file name and path of the certificate you double-clicked should automatically appear in the **File name** text box. Click **Browse** if you wish to import a different certificate.



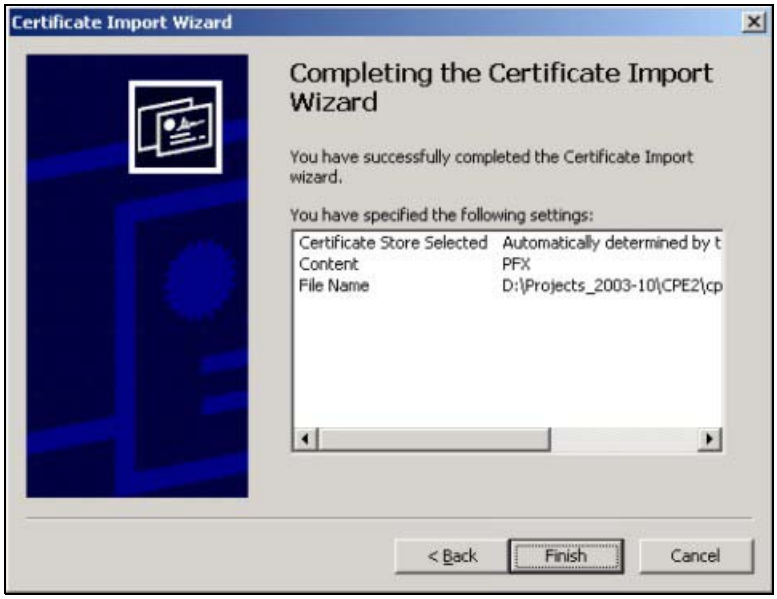
3 Enter the password given to you by the CA.



4 Have the wizard determine where the certificate should be saved on your computer or select **Place all certificates in the following store** and choose a different location.



5 Click **Finish** to complete the wizard and begin the import process.



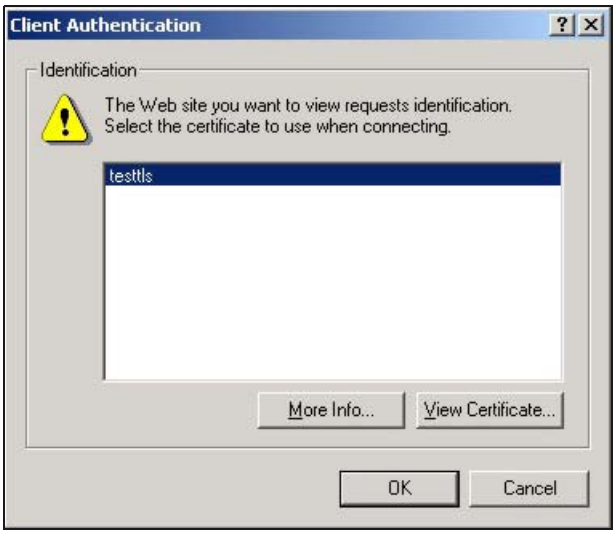
6 You should see the following screen when the certificate is correctly installed on your computer.

29.7.8.6 Using a Certificate When Accessing the NXC

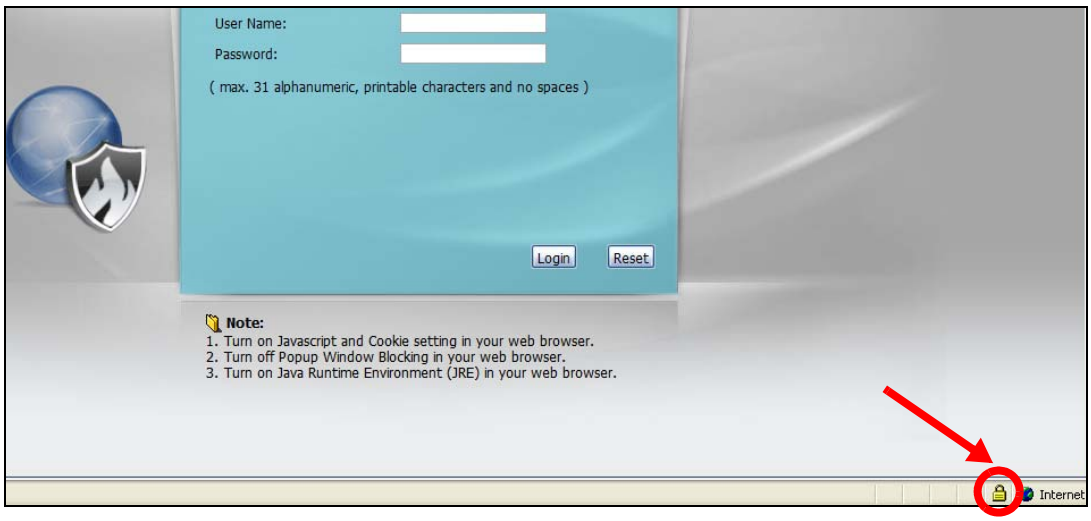
To access the NXC via HTTPS:

1 Enter 'https://NXC IP Address/ in your browser's web address field.

2 When **Authenticate Client Certificates** is selected on the NXC, the following screen asks you to select a personal certificate to send to the NXC. This screen displays even if you only have a single certificate as in the example.



3 You next see the Web Configurator login screen.



29.8 SSH

You can use SSH (Secure SHell) to securely access the NXC's command line interface. Specify which zones allow SSH access and from which IP address the access can come.

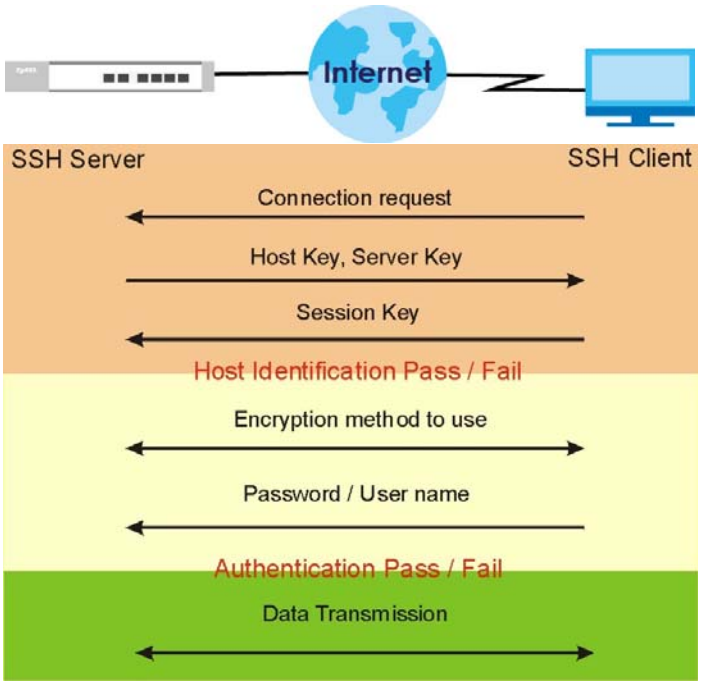
SSH is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication between two hosts over an unsecured network. In the following figure, computer **A** on the Internet uses SSH to securely connect to the WAN port of the NXC for a management session.

Figure 216 SSH Communication Over the WAN Example

29.8.1 How SSH Works

The following figure is an example of how a secure connection is established between two remote hosts using SSH v1.

Figure 217 How SSH v1 Works Example



1 Host Identification

The SSH client sends a connection request to the SSH server. The server identifies itself with a host key. The client encrypts a randomly generated session key with the host key and server key and sends the result back to the server.

The client automatically saves any new server public keys. In subsequent connections, the server public key is checked against the saved version on the client computer.

2 Encryption Method

Once the identification is verified, both the client and server must agree on the type of encryption method to use.

3 Authentication and Data Transmission

After the identification is verified and data encryption activated, a secure tunnel is established between the client and the server. The client then sends its authentication information (user name and password) to the server to log in to the server.

29.8.2 SSH Implementation on the NXC

Your NXC supports SSH versions 1 and 2 using RSA authentication and four encryption methods (AES, 3DES, Archfour, and Blowfish). The SSH server is implemented on the NXC for management using port 22 (by default).

29.8.3 Requirements for Using SSH

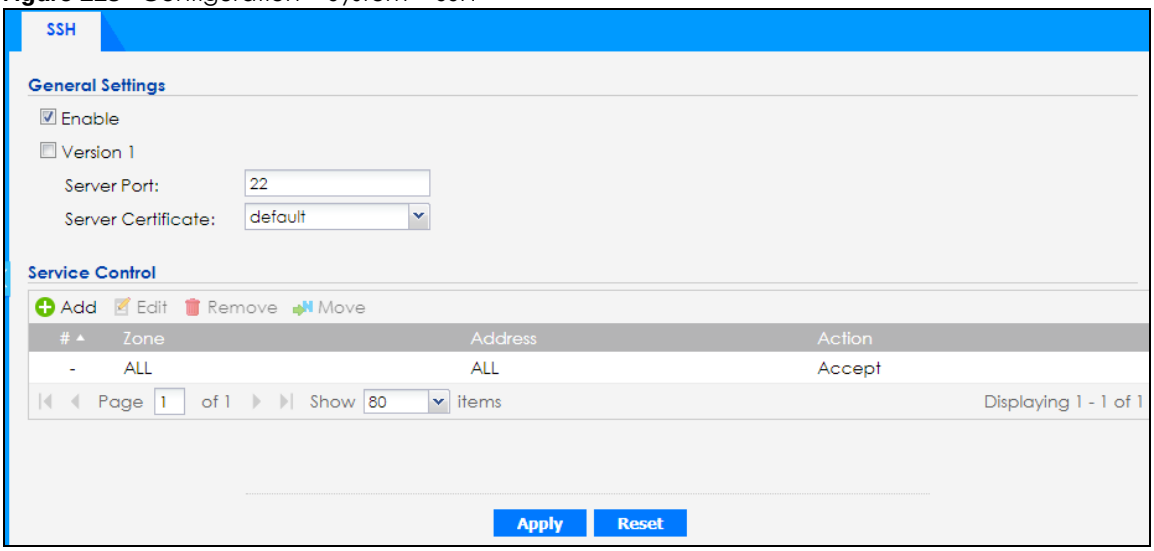
You must install an SSH client program on a client computer (Windows or Linux operating system) that is used to connect to the NXC over SSH.

29.8.4 Configuring SSH

Click **Configuration > System > SSH** to change your NXC's Secure Shell settings. Use this screen to specify from which zones SSH can be used to manage the NXC. You can also specify from which IP addresses the access can come.

Note: It is recommended that you disable Telnet and FTP when you configure SSH for secure connections.

Figure 218 Configuration > System > SSH



The following table describes the labels in this screen.

Table 175 Configuration > System > SSH

LABEL	DESCRIPTION
General Settings	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC CLI using this service.
Version 1	Select the check box to have the NXC use both SSH version 1 and version 2 protocols. If you clear the check box, the NXC uses only SSH version 2 protocol.
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Certificate	Select the certificate whose corresponding private key is to be used to identify the NXC for SSH connections. You must have certificates already configured in the **My Certificates** screen.

Table 175 Configuration > System > SSH (continued)

LABEL	DESCRIPTION
Service Control	This specifies from which computers you can access which NXC zones.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This the index number of the service control rule.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.8.5 Examples of Secure Telnet Using SSH

This section shows two examples using a command interface and a graphical interface SSH client program to remotely access the NXC. The configuration and connection steps are similar for most SSH client programs. Refer to your SSH client program user's guide.

29.8.5.1 Example 1: Microsoft Windows

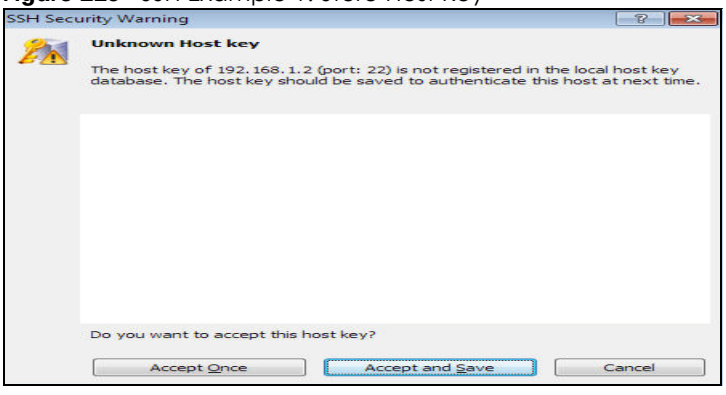
This section describes how to access the NXC using the Secure Shell Client program.

1 Launch the SSH client and specify the connection information (IP address, port number) for the NXC.

2 Configure the SSH client to accept connection using SSH version 1.

3 A window displays prompting you to store the host key in you computer. Click **Yes** to continue.

Figure 219 SSH Example 1: Store Host Key



Enter the password to log in to the NXC. The CLI screen displays next.

29.8.5.2 Example 2: Linux

This section describes how to access the NXC using the OpenSSH client program that comes with most Linux distributions.

1 Test whether the SSH service is available on the NXC.

Enter "`telnet 192.168.1.1 22`" at a terminal prompt and press [ENTER]. The computer attempts to connect to port 22 on the NXC (using the default IP address of 192.168.1.1).

A message displays indicating the SSH protocol version supported by the NXC.

Figure 220 SSH Example 2: Test

```
$ telnet 192.168.1.1 22
Trying 192.168.1.1...
Connected to 192.168.1.1.
Escape character is '^]'.
SSH-1.5-1.0.0
```

2 Enter "`ssh -1 192.168.1.1`". This command forces your computer to connect to the NXC using SSH version 1. If this is the first time you are connecting to the NXC using SSH, a message displays prompting you to save the host information of the NXC. Type "`yes`" and press [ENTER].

Then enter the password to log in to the NXC.

Figure 221 SSH Example 2: Log in

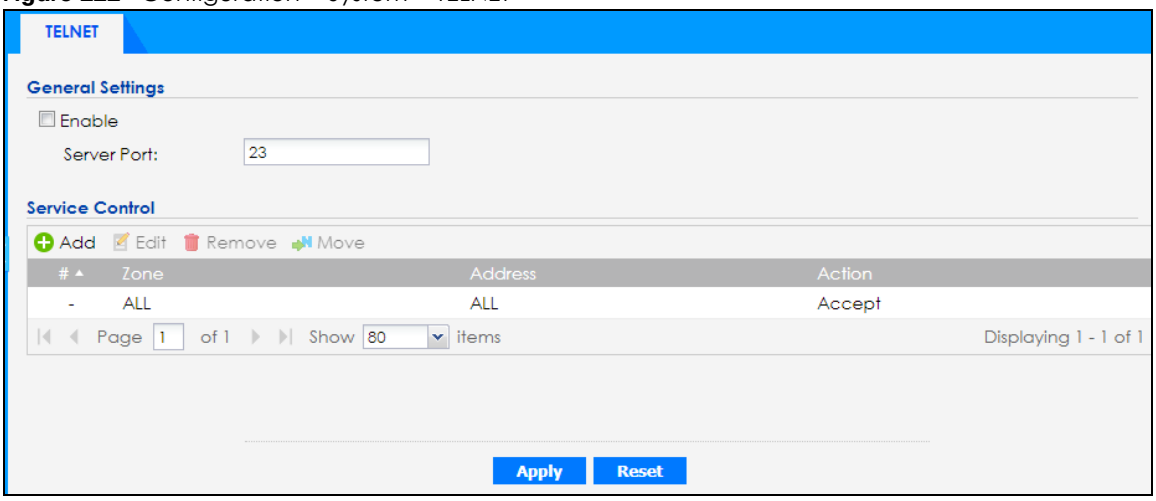
```
$ ssh -1 192.168.1.1
The authenticity of host '192.168.1.1 (192.168.1.1)' can't be established.
RSA1 key fingerprint is 21:6c:07:25:7e:f4:75:80:ec:af:bd:d4:3d:80:53:d1.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.1' (RSA1) to the list of known hosts.
Administrator@192.168.1.1's password:
```

3 The CLI screen displays next.

29.9 Telnet

You can use Telnet to access the NXC's command line interface. Specify which zones allow Telnet access and from which IP address the access can come. Click **Configuration > System > TELNET** to configure your NXC for remote Telnet access. Use this screen to specify from which zones Telnet can be used to manage the NXC. You can also specify from which IP addresses the access can come.

Figure 222 Configuration > System > TELNET



The following table describes the labels in this screen.

Table 176 Configuration > System > TELNET

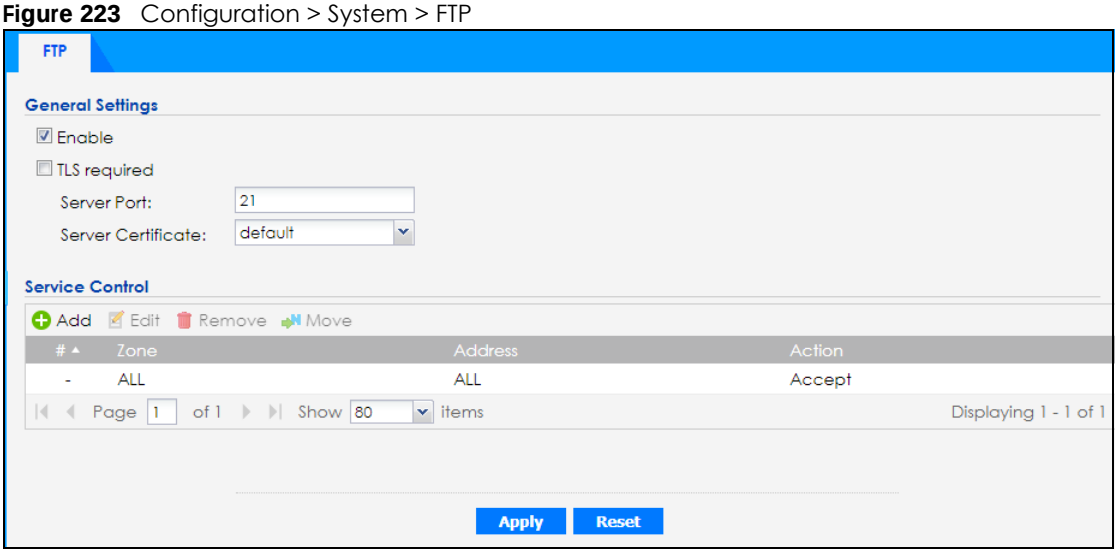
LABEL	DESCRIPTION
General Settings	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC CLI using this service.
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Service Control	This specifies from which computers you can access which NXC zones.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This the index number of the service control rule. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.10 FTP

You can upload and download the NXC's firmware and configuration files using FTP. To use this feature, your computer must have an FTP client. See Chapter 31 on page 390 for more information about firmware and configuration files.

To change your NXC's FTP settings, click **Configuration > System > FTP** tab. The screen appears as shown. Use this screen to specify from which zones FTP can be used to access the NXC. You can also specify from which IP addresses the access can come.

Figure 223 Configuration > System > FTP



The following table describes the labels in this screen.

Table 177 Configuration > System > FTP

LABEL	DESCRIPTION
General Settings	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC using this service.
TLS required	Select the check box to use FTP over TLS (Transport Layer Security) to encrypt communication. This implements TLS as a security mechanism to secure FTP clients and/or servers.
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Certificate	Select the certificate whose corresponding private key is to be used to identify the NXC for FTP connections. You must have certificates already configured in the **My Certificates** screen.
Service Control	This specifies from which computers you can access which NXC zones.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.

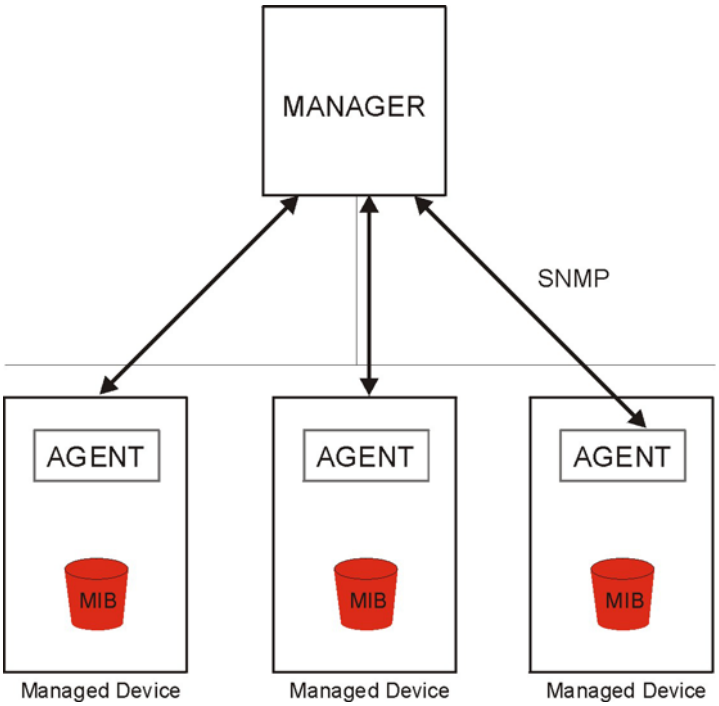
Table 177 Configuration > System > FTP (continued)

LABEL	DESCRIPTION
#	This the index number of the service control rule. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.11 SNMP

Simple Network Management Protocol is a protocol used for exchanging management information between network devices. Your NXC supports SNMP agent functionality, which allows a manager station to manage and monitor the NXC through the network. The NXC supports SNMP version one (SNMPv1), version two (SNMPv2c) and version three (SNMPv3). The next figure illustrates an SNMP management operation.

Figure 224 SNMP Management Model



An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the NXC). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

29.11.1 Supported MIBs

The NXC supports MIB II that is defined in RFC-1213 and RFC-1215. The NXC also supports private MIBs (zywall.mib and zyxel-zywall-ZLD-Common.mib) to collect information about CPU and memory usage. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance. You can download the NXC's MIBs from www.zyxel.com.

29.11.2 SNMP Traps

The NXC will send traps to the SNMP manager when any one of the following events occurs.

Table 178 SNMP Traps

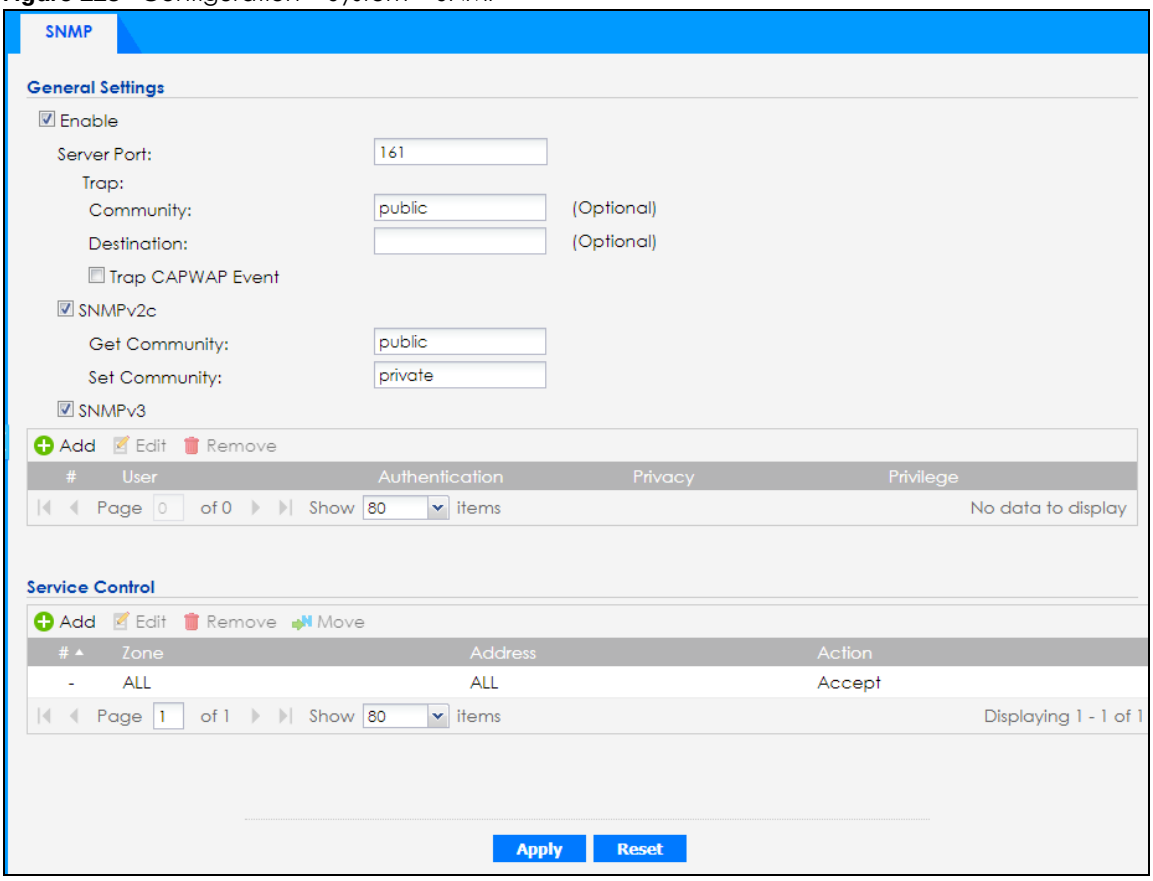
OBJECT LABEL	OBJECT ID	DESCRIPTION
Cold Start	1.3.6.1.6.3.1.1.5.1	This trap is sent when an agent reinitialized or its configuration tables have been changed.
linkDown	1.3.6.1.6.3.1.1.5.3	This trap is sent when the Ethernet link is down.
linkUp	1.3.6.1.6.3.1.1.5.4	This trap is sent when the Ethernet link is up.
authenticationFailure	1.3.6.1.6.3.1.1.5.5	This trap is sent when an SNMP request comes from non-authenticated hosts.

29.11.3 Configuring SNMP

Your NXC can act as an SNMP agent, which allows a manager station to manage and monitor the NXC through the network.

To change your NXC's SNMP settings, click **Configuration > System > SNMP** tab. The screen appears as shown. Use this screen to configure your SNMP settings, including from which zones SNMP can be used to access the NXC. You can also specify from which IP addresses the access can come and configure user profiles that define allowed SNMPv3 access.

Figure 225 Configuration > System > SNMP



The following table describes the labels in this screen.

Table 179 Configuration > System > SNMP

LABEL	DESCRIPTION
General Settings	
Enable	Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC using this service.
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Trap	
Community	Type the trap community, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.
Destination	Type the IP address of the SNMP manager to which your SNMP traps are sent.

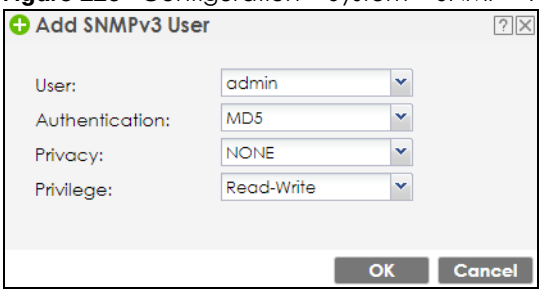
Table 179 Configuration > System > SNMP (continued)

LABEL	DESCRIPTION
Trap CAPWAP Event	Select this option to have the NXC send a trap to the SNMP manager when a managed AP is connected to or disconnected from the NXC.
SNMPv2c	Select this to allow SNMP managers using SNMPv2c to access the NXC.
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station. The default is private and allows all requests.
SNMPv3	Select this to allow SNMP managers using SNMPv3 to access the NXC.
Add	Click this to create a new entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
#	This the index number of an SNMPv3 user profile.
User	This is the name of the user for which this SNMPv3 user profile is configured.
Authentication	This field displays the type of authentication the SNMPv3 user must use to connect to the NXC using this SNMPv3 user profile.
Privacy	This field displays the type of encryption the SNMPv3 user must use to connect to the NXC using this SNMPv3 user profile.
Privilege	This field displays whether the SNMPv3 user can have read-only or read and write access to the NXC using this SNMPv3 user profile.
Service Control	This specifies from which computers you can access which NXC zones.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Move	To change an entry's position in the numbered list, select the method and click **Move** to display a field to type a number for where you want to put it and press [ENTER] to move the rule to the number that you typed.
#	This the index number of the service control rule. The entry with a hyphen (-) instead of a number is the NXC's (non-configurable) default policy. The NXC applies this to traffic that does not match any other configured rule. It is not an editable rule. To apply other behavior, configure a rule that traffic will match so the NXC will not have to use the default policy.
Zone	This is the zone on the NXC the user is allowed or denied to access.
Address	This is the object name of the IP address(es) with which the computer is allowed or denied to access.
Action	This displays whether the computer with the IP address specified above can access the NXC zone(s) configured in the **Zone** field (**Accept**) or not (**Deny**).
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.11.4 Adding or Editing an SNMPv3 User Profile

This screen allows you to add or edit an SNMPv3 user profile. To access this screen, click the **Configuration > System > SNMP** screen's **Add** button or select a SNMPv3 user profile from the list and click the **Edit** button.

Figure 226 Configuration > System > SNMP > Add



The following table describes the labels in this screen.

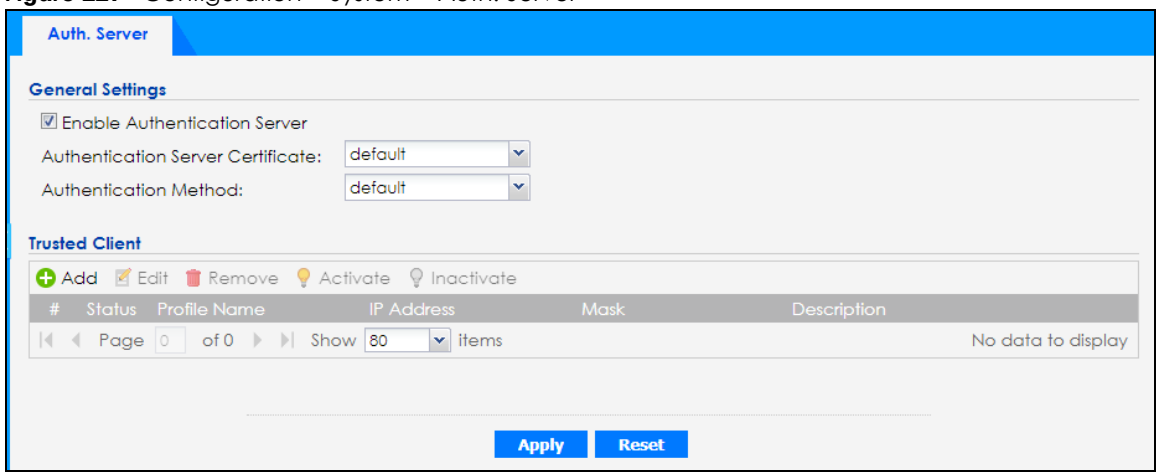
Table 180 Configuration > System > SNMP

LABEL	DESCRIPTION
User	Select the user name of the user account for which this SNMPv3 user profile is configured.
Authentication	Select the type of authentication the SNMPv3 user must use to connect to the NXC using this SNMPv3 user profile. Select **MD5** to require the SNMPv3 user's password be encrypted by MD5 for authentication. Select **SHA** to require the SNMPv3 user's password be encrypted by SHA for authentication.
Privacy	Select the type of encryption the SNMPv3 user must use to connect to the NXC using this SNMPv3 user profile. Select **NONE** to not encrypt the SNMPv3 communications. Select **DES** to use DES to encrypt the SNMPv3 communications. Select **AES** to use AES to encrypt the SNMPv3 communications.
Privilege	Select whether the SNMPv3 user can have read-only or read and write access to the NXC using this SNMPv3 user profile.
OK	Click **OK** to save your changes back to the NXC.
Cancel	Click **Cancel** to exit this screen without saving your changes.

29.12 Authentication Server

You can set the NXC to work as a RADIUS server to exchange messages with a RADIUS client, such as an AP for user authentication and authorization. Click **Configuration > System > Auth. Server** tab. The screen appears as shown. Use this screen to enable the authentication server feature of the NXC and specify the RADIUS client's IP address.

Figure 227 Configuration > System > Auth. Server



The following table describes the labels in this screen.

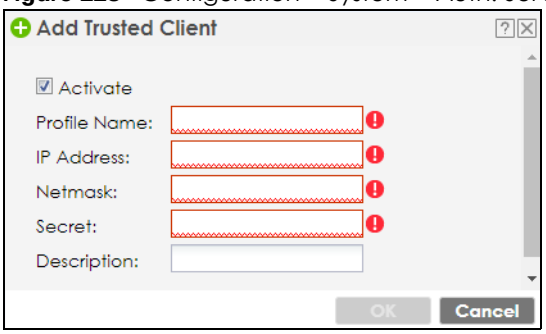
Table 181 Configuration > System > Auth. Server

LABEL	DESCRIPTION
General Settings	
Enable Authentication Server	Select the check box to have the NXC act as a RADIUS server.
Authentication Server Certificate	Select the certificate whose corresponding private key is to be used to identify the NXC to the RADIUS client. You must have certificates already configured in the **My Certificates** screen.
Authentication Method	Select an authentication method if you have created any in the **Configuration > Object > Auth. Method** screen.
Trusted Client	This specifies from which computers you can access which NXC zones.
Add	Click this to create a new entry. Select an entry and click **Add** to create a new entry after the selected entry.
Edit	Double-click an entry or select it and click **Edit** to be able to modify the entry's settings.
Remove	To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. Note that subsequent entries move up by one when you take this action.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This is the index number of the entry.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Profile Name	This field indicates the name assigned to the profile.
IP Address	This is the IP address of the RADIUS client that is allowed to exchange messages with the NXC.
Mask	This is the subnet mask of the RADIUS client.
Description	This is the description of the RADIUS client.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.12.1 Add/Edit Trusted Client

Click **Configuration > System > Auth. Server** to display the **Auth. Server** screen. Click the **Add** icon or an **Edit** icon to display the following screen. Use this screen to create a new entry or edit an existing one.

Figure 228 Configuration > System > Auth. Server > Add/Edit



The following table describes the labels in this screen.

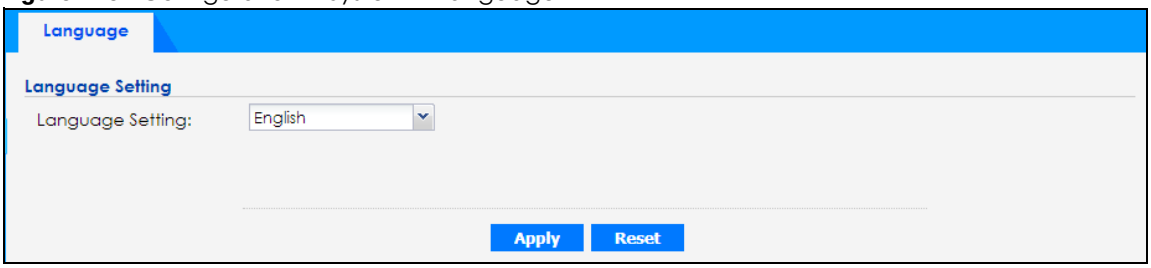
Table 182 Configuration > System > Auth. Server > Add/Edit

LABEL	DESCRIPTION
Activate	Select this check box to make this profile active.
Profile Name	Enter a descriptive name (up to 31 alphanumerical characters) for identification purposes.
IP Address	Enter the IP address of the RADIUS client that is allowed to exchange messages with the NXC.
Netmask	Enter the subnet mask of the RADIUS client.
Secret	Enter a password (up to 64 alphanumeric characters) as the key to be shared between the NXC and the RADIUS client. The key is not sent over the network. This key must be the same on the external authentication server and the NXC.
Description	Enter the description of each server, if any. You can use up to 60 printable ASCII characters.
OK	Click **OK** to save the changes.
Cancel	Click **Cancel** to discard the changes.

29.13 Language

Click **Configuration > System > Language** to open this screen. Use this screen to select a display language for the NXC's Web Configurator screens.

Figure 229 Configuration > System > Language



The following table describes the labels in this screen.

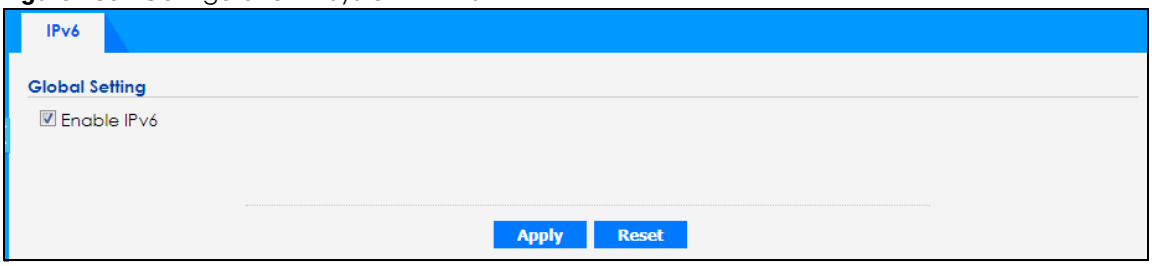
Table 183 Configuration > System > Language

LABEL	DESCRIPTION
Language Setting	Select a display language for the NXC's Web Configurator screens. You also need to open a new browser session to display the screens in the new language.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

29.14 IPv6

Click **Configuration > System > IPv6** to open the following screen. Use this screen to enable IPv6 support on the NXC.

Figure 230 Configuration > System > IPv6



The following table describes the labels in this screen.

Table 184 Configuration > System > IPv6

LABEL	DESCRIPTION
Global Setting	
Enable IPv6	Select this to have the NXC support IPv6 and make IPv6 settings be available on the screens that the functions support, such as the **Configuration > Network > Interface > Ethernet**, and **VLAN** screens. The NXC discards all IPv6 packets if you clear this check box.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

CHAPTER 30
Log and Report

30.1 Overview

Use the system screens to configure daily reporting and log settings.

30.1.1 What You Can Do In this Chapter

- The **Email Daily Report** screen (Section 30.2 on page 375) configures how and where to send daily reports and what reports to send.
- The **Log Settings** screens (Section 30.3 on page 377) specify which logs are e-mailed, where they are e-mailed, and how often they are e-mailed.

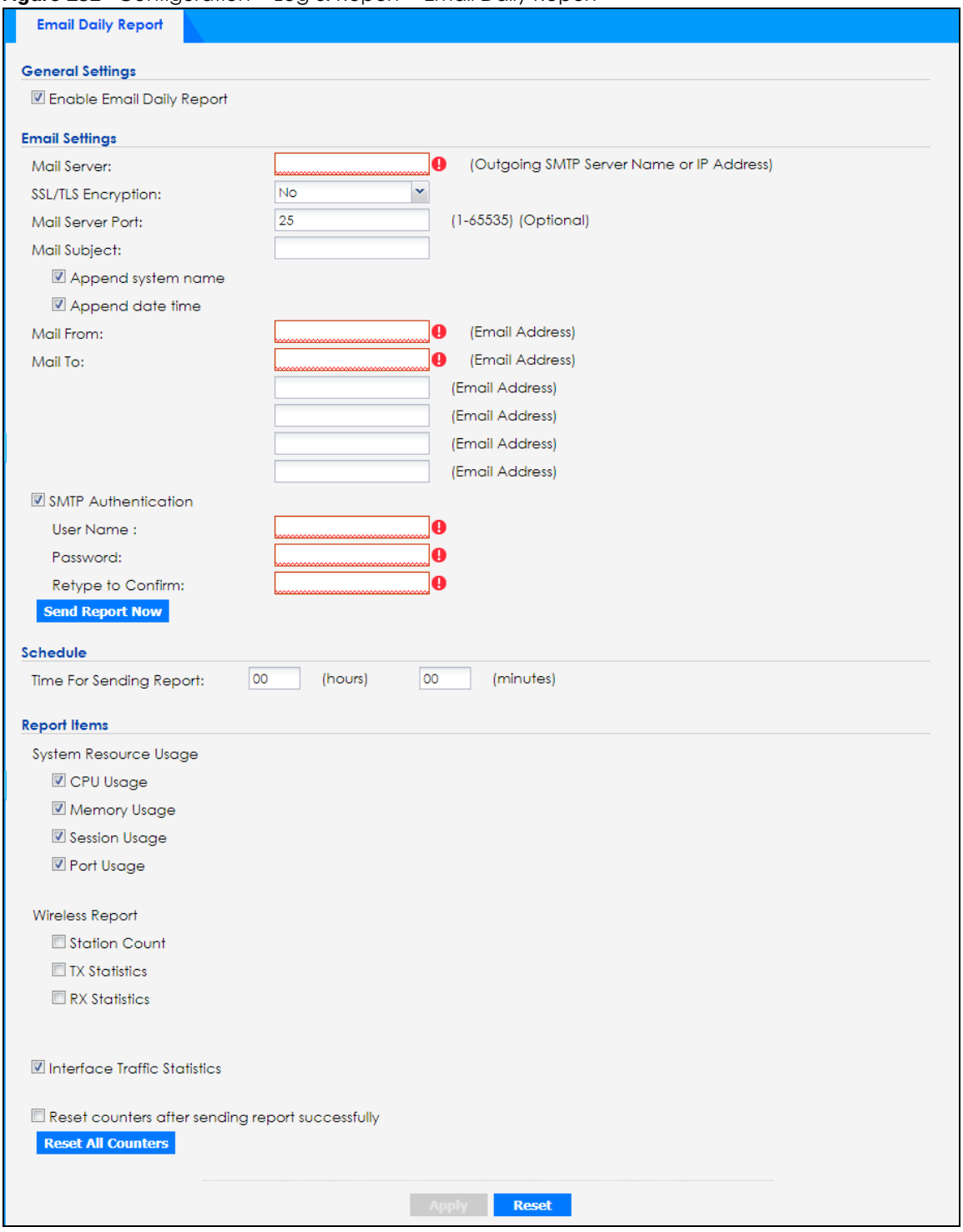
30.2 Email Daily Report

Use this screen to start or stop data collection and view various statistics about traffic passing through your NXC.

Note: Data collection may decrease the NXC's traffic throughput rate.

Click **Configuration > Log & Report > Email Daily Report** to display the following screen. Configure this screen to have the NXC e-mail you system statistics every day.

Figure 231 Configuration > Log & Report > Email Daily Report



The following table describes the labels in this screen.

Table 185 Configuration > Log & Report > Email Daily Report

LABEL	DESCRIPTION
Enable Email Daily Report	Select this to send reports by e-mail every day.
Mail Server	Type the name or IP address of the outgoing SMTP server.
SSL/TLS Encryption	Select **SSL/TLS** to use Secure Sockets Layer (SSL) or Transport Layer Security (TLS) if you want encrypted communications between the mail server and the NXC. Select **STARTTLS** to upgrade a plain text connection to a secure connection using SSL/TLS. Select **No** to not encrypt the communications.
Mail Server Port	Enter the same port number here as is on the mail server for mail traffic.
Mail Subject	Type the subject line for the outgoing e-mail. Select **Append system name** to add the NXC's system name to the subject. Select **Append date time** to add the NXC's system date and time to the subject.
Mail From	Type the e-mail address from which the outgoing e-mail is delivered. This address is used in replies.
Mail To	Type the e-mail address (or addresses) to which the outgoing e-mail is delivered.
SMTP Authentication	Select this check box if it is necessary to provide a user name and password to the SMTP server.
User Name	This box is effective when you select the **SMTP Authentication** check box. Type the user name to provide to the SMTP server when the log is e-mailed.
Password	This box is effective when you select the **SMTP Authentication** check box. Type the password to provide to the SMTP server when the log is e-mailed.
Retype to Confirm	Retype your new password for confirmation.
Send Report Now	Click this button to have the NXC send the daily e-mail report immediately.
Time for sending report	Select the time of day (hours and minutes) when the log is e-mailed. Use 24-hour notation.
Report Items	Select the information to include in the report.
Reset counters after sending report successfully	Select this if you only want to see statistics for a 24 hour period.
Reset All Counters	Click this to discard all report data and start all of the counters over at zero.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

30.3 Log Settings

These screens control log messages and alerts. A log message stores the information for viewing (for example, in the **View Log** tab) or regular e-mailing later, and an alert is e-mailed immediately. Usually, alerts are used for events that require more serious attention, such as system errors and attacks.

The NXC provides a system log and supports e-mail profiles and remote syslog servers. The system log is available on the **View Log** tab, the e-mail profiles are used to mail log messages to the specified destinations, and the other four logs are stored on specified syslog servers.

The **Log Settings** tab also controls what information is saved in each log. For the system log, you can also specify which log messages are e-mailed, where they are e-mailed, and how often they are e-mailed.

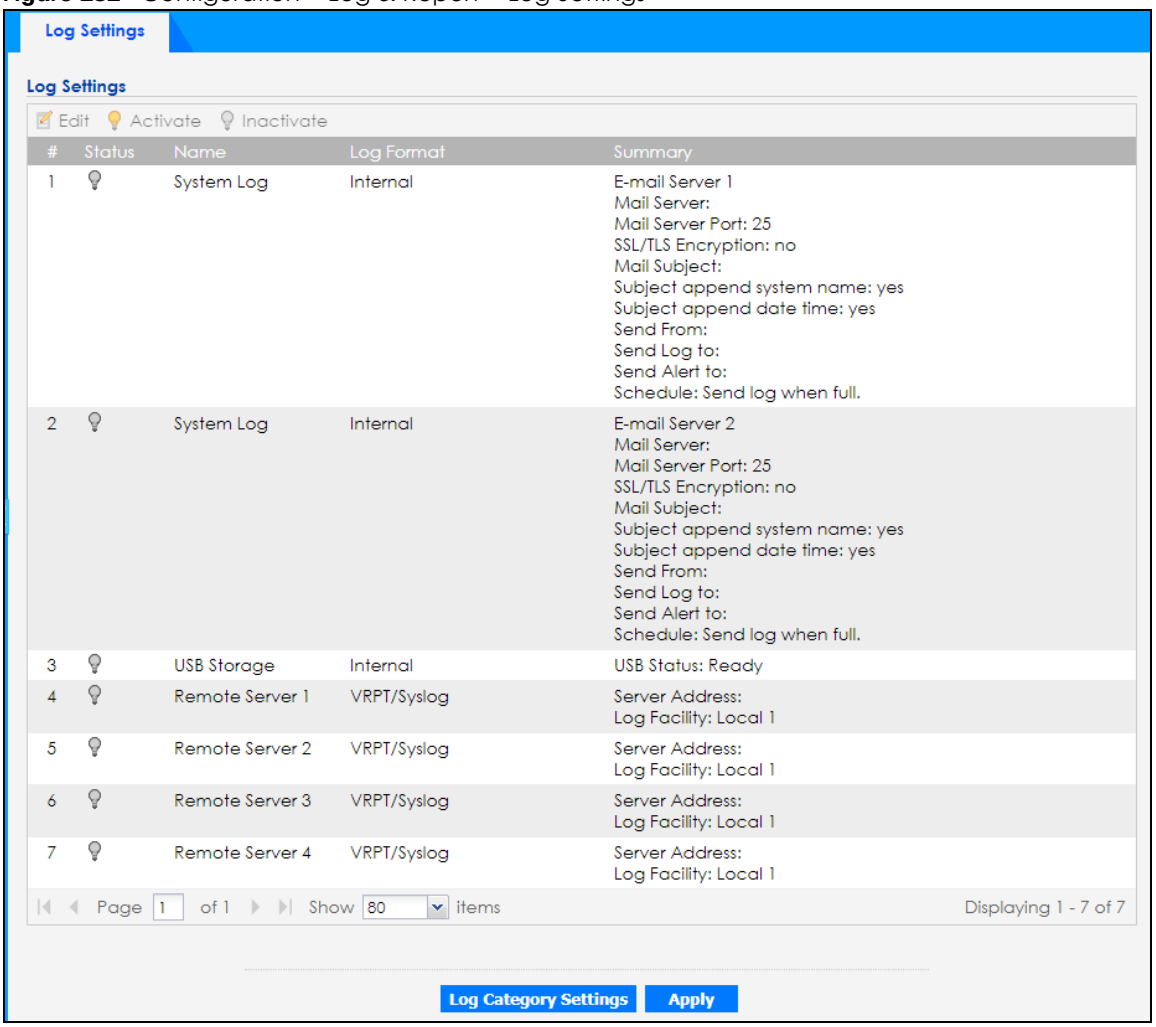
For alerts, the **Log Settings** tab controls which events generate alerts and where alerts are e-mailed.

The **Log Settings Summary** screen provides a summary of all the settings. You can use the **Log Settings Edit** screen to maintain the detailed settings (such as log categories, e-mail addresses, server names, etc.) for any log. Alternatively, if you want to edit what events is included in each log, you can also use the **Log Category Settings** screen to edit this information for all logs at the same time.

30.3.1 Log Settings Summary

To access this screen, click **Configuration > Log & Report > Log Settings**.

Figure 232 Configuration > Log & Report > Log Settings



The following table describes the labels in this screen.

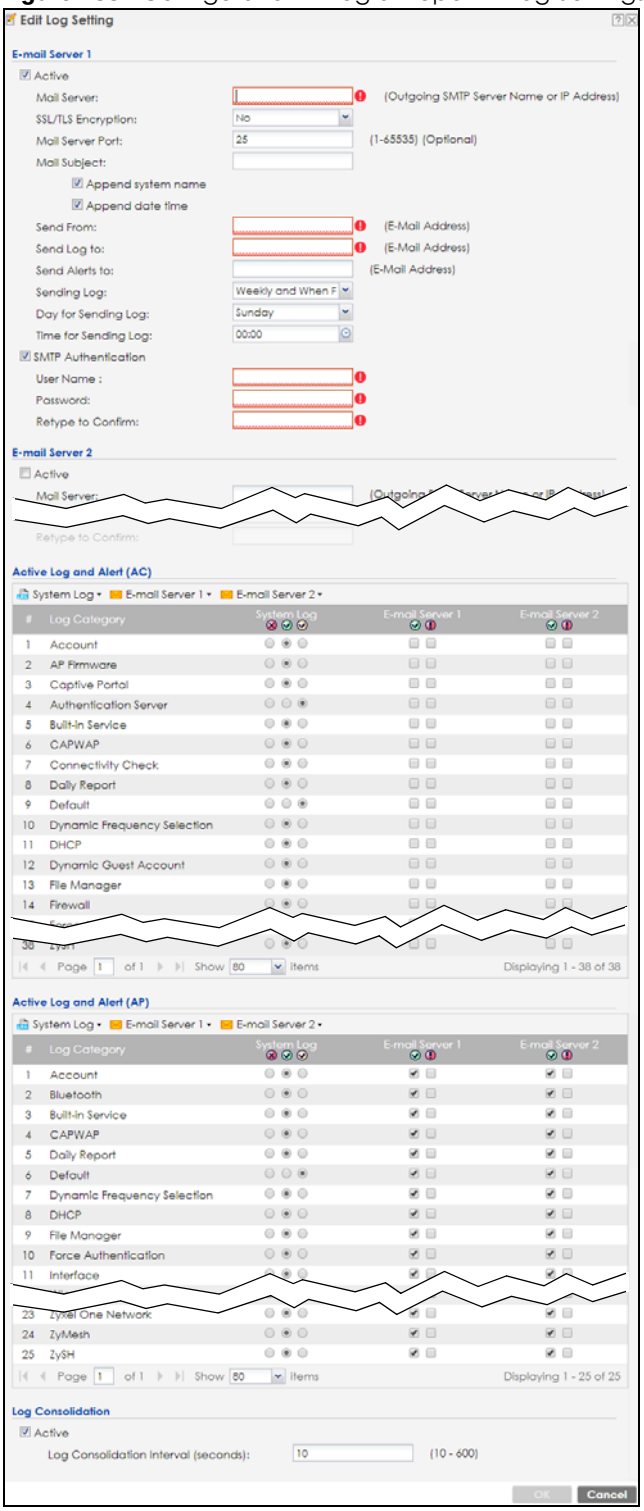
Table 186 Configuration > Log & Report > Log Settings

LABEL	DESCRIPTION
Edit	Double-click an entry or select it and click **Edit** to open a screen where you can modify the entry's settings.
Activate	To turn on an entry, select it and click **Activate**.
Inactivate	To turn off an entry, select it and click **Inactivate**.
#	This field is a sequential value, and it is not associated with a specific log.
Status	This icon is lit when the entry is active and dimmed when the entry is inactive.
Name	This field displays the name of the log (system log or one of the remote servers).
Log Format	This field displays the format of the log. **Internal** - system log; you can view the log on the **View Log** tab. **VRPT/Syslog** - Zyxel's Vantage Report, syslog-compatible format. **CEF/Syslog** - Common Event Format, syslog-compatible format.
Summary	This field is a summary of the settings for each log.
Log Category Settings	Click this button to open the **Log Category Settings** screen.
Apply	Click this button to save your changes (activate and deactivate logs) and make them take effect.

30.3.2 Editing System Log Settings

This screen controls the detailed settings for each log in the system log (which includes the e-mail profiles). Go to the **Log Settings Summary** screen and click the system log **Edit** icon.

Figure 233 Configuration > Log & Report > Log Settings > Edit (System Log)



The following table describes the labels in this screen.

Table 187 Configuration > Log & Report > Log Settings > Edit (System Log)

LABEL	DESCRIPTION
E-mail Server 1/2	
Active	Select this to send log messages and alerts according to the information in this section. You specify what kinds of log messages are included in log information and what kinds of log messages are included in alerts in the **Active Log and Alert** section.
Mail Server	Type the name or IP address of the outgoing SMTP server.
SSL/TLS Encryption	Select **SSL/TLS** to use Secure Sockets Layer (SSL) or Transport Layer Security (TLS) if you want encrypted communications between the mail server and the NXC. Select **STARTTLS** to upgrade a plain text connection to a secure connection using SSL/TLS. Select **No** to not encrypt the communications.
Mail Server Port	Enter the same port number here as is on the mail server for mail traffic.
Mail Subject	Type the subject line for the outgoing e-mail. Select **Append system name** to add the NXC's system name to the subject. Select **Append date time** to add the NXC's system date and time to the subject.
Send From	Type the e-mail address from which the outgoing e-mail is delivered. This address is used in replies.
Send Log To	Type the e-mail address to which the outgoing e-mail is delivered.
Send Alerts To	Type the e-mail address to which alerts are delivered.
Sending Log	Select how often log information is e-mailed. Choices are: **When Full**, **Hourly and When Full**, **Daily and When Full**, and **Weekly and When Full**.
Day for Sending Log	This field is available if the log is e-mailed weekly. Select the day of the week the log is e-mailed.
Time for Sending Log	This field is available if the log is e-mailed weekly or daily. Select the time of day (hours and minutes) when the log is e-mailed. Use 24-hour notation.
SMTP Authentication	Select this check box if it is necessary to provide a user name and password to the SMTP server.
User Name	This box is effective when you select the **SMTP Authentication** check box. Type the user name to provide to the SMTP server when the log is e-mailed.
Password	This box is effective when you select the **SMTP Authentication** check box. Type the password to provide to the SMTP server when the log is e-mailed.
Retype to Confirm	Retype your new password for confirmation.
Active Log and Alert	
System log	Use the **System Log** drop-down list to change the log settings for all of the log categories. **disable all logs** (red X) - do not log any information for any category for the system log or e-mail any logs to e-mail server 1 or 2. **enable normal logs** (green check mark) - create log messages and alerts for all categories for the system log. If e-mail server 1 or 2 also has normal logs enabled, the NXC will e-mail logs to them. **enable normal logs and debug logs** (yellow check mark) - create log messages, alerts, and debugging information for all categories. The NXC does not e-mail debugging information, even if this setting is selected.

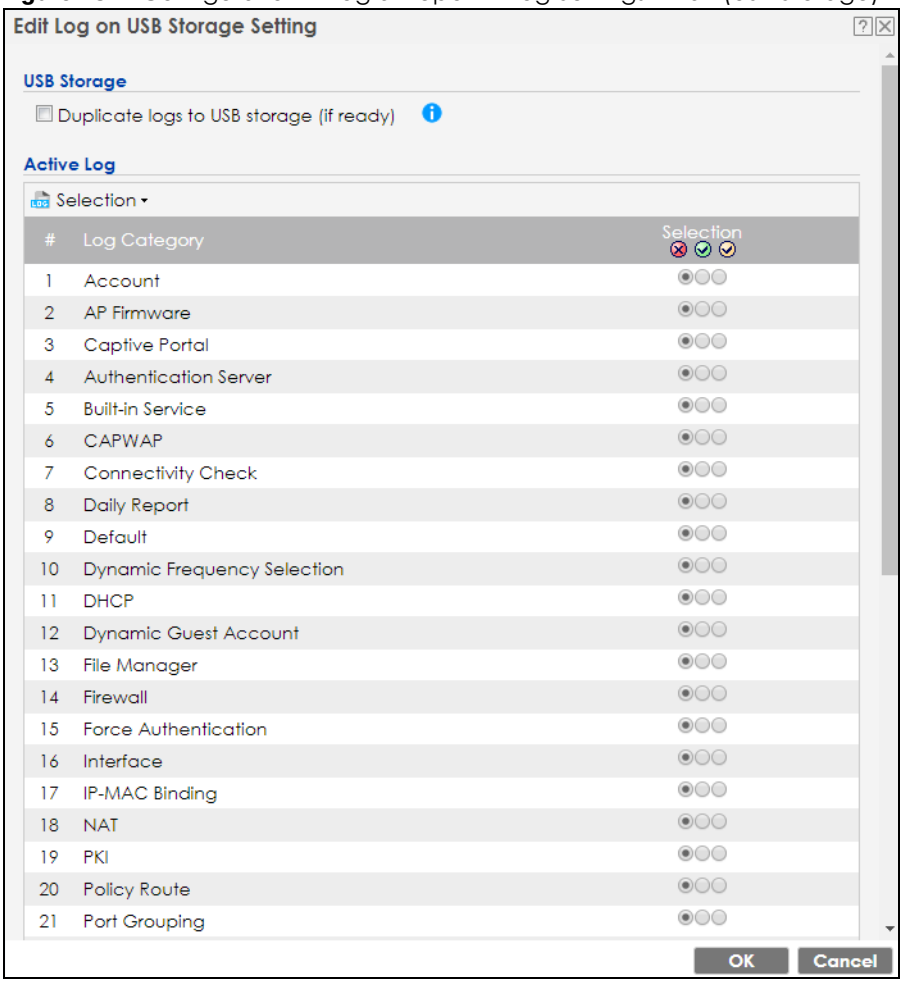
Table 187 Configuration > Log & Report > Log Settings > Edit (System Log) (continued)

LABEL	DESCRIPTION
E-mail Server 1	Use the **E-Mail Server 1** drop-down list to change the settings for e-mailing logs to e-mail server 1 for all log categories. Using the **System Log** drop-down list to disable all logs overrides your e-mail server 1 settings. **enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 1. **enable alert logs** (red exclamation point) - e-mail alerts for all categories to e-mail server 1.
E-mail Server 2	Use the **E-Mail Server 2** drop-down list to change the settings for e-mailing logs to e-mail server 2 for all log categories. Using the **System Log** drop-down list to disable all logs overrides your e-mail server 2 settings. **enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 2. **enable alert logs** (red exclamation point) - e-mail alerts for all categories to e-mail server 2.
#	This field is a sequential value, and it is not associated with a specific address.
Log Category	This field displays each category of messages. It is the same value used in the **Display** and **Category** fields in the **View Log** tab. The **Default** category includes debugging messages generated by open source software.
System log	Select which events you want to log by **Log Category**. There are three choices: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - create log messages and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - create log messages, alerts, and debugging information from this category; the NXC does not e-mail debugging information, however, even if this setting is selected.
E-mail Server 1	Select whether each category of events should be included in the log messages when it is e-mailed (green check mark) and/or in alerts (red exclamation point) for the e-mail settings specified in **E-Mail Server 1**. The NXC does not e-mail debugging information, even if it is recorded in the **System log**.
E-mail Server 2	Select whether each category of events should be included in log messages when it is e-mailed (green check mark) and/or in alerts (red exclamation point) for the e-mail settings specified in **E-Mail Server 2**. The NXC does not e-mail debugging information, even if it is recorded in the **System log**.
Log Consolidation	
Active	Select this to activate log consolidation. Log consolidation aggregates multiple log messages that arrive within the specified **Log Consolidation Interval**. In the **View Log** tab, the text "[count=*x*]", where *x* is the number of original log messages, is appended at the end of the **Message** field, when multiple log messages were aggregated.
Log Consolidation Interval	Type how often, in seconds, to consolidate log information. If the same log message appears multiple times, it is aggregated into one log message with the text "[count=*x*]", where *x* is the number of original log messages, appended at the end of the **Message** field.
OK	Click this to save your changes and return to the previous screen.
Cancel	Click this to return to the previous screen without saving your changes.

30.3.3 Editing USB Storage Log Settings

The **Edit Log on USB Storage Setting** screen controls the detailed settings for saving logs to a connected USB storage device. Go to the **Log Settings Summary** screen, and click the USB storage **Edit** icon.

Figure 234 Configuration > Log & Report > Log Settings > Edit (USB Storage)



The following table describes the labels in this screen.

Table 188 Configuration > Log & Report > Log Settings > Edit (USB Storage)

LABEL	DESCRIPTION
Duplicate logs to USB storage (if ready)	Select this to have the NXC save a copy of its system logs to a connected USB storage device. Use the **Active Log** section to specify what kinds of messages to include.
Active Log	
Selection	Use the **Selection** drop-down list to change the log settings for all of the log categories. **disable all logs** (red X) - do not send the remote server logs for any log category. **enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories. **enable normal logs and debug logs** (yellow check mark) - send the remote server log messages, alerts, and debugging information for all log categories.
#	This field is a sequential value, and it is not associated with a specific entry.

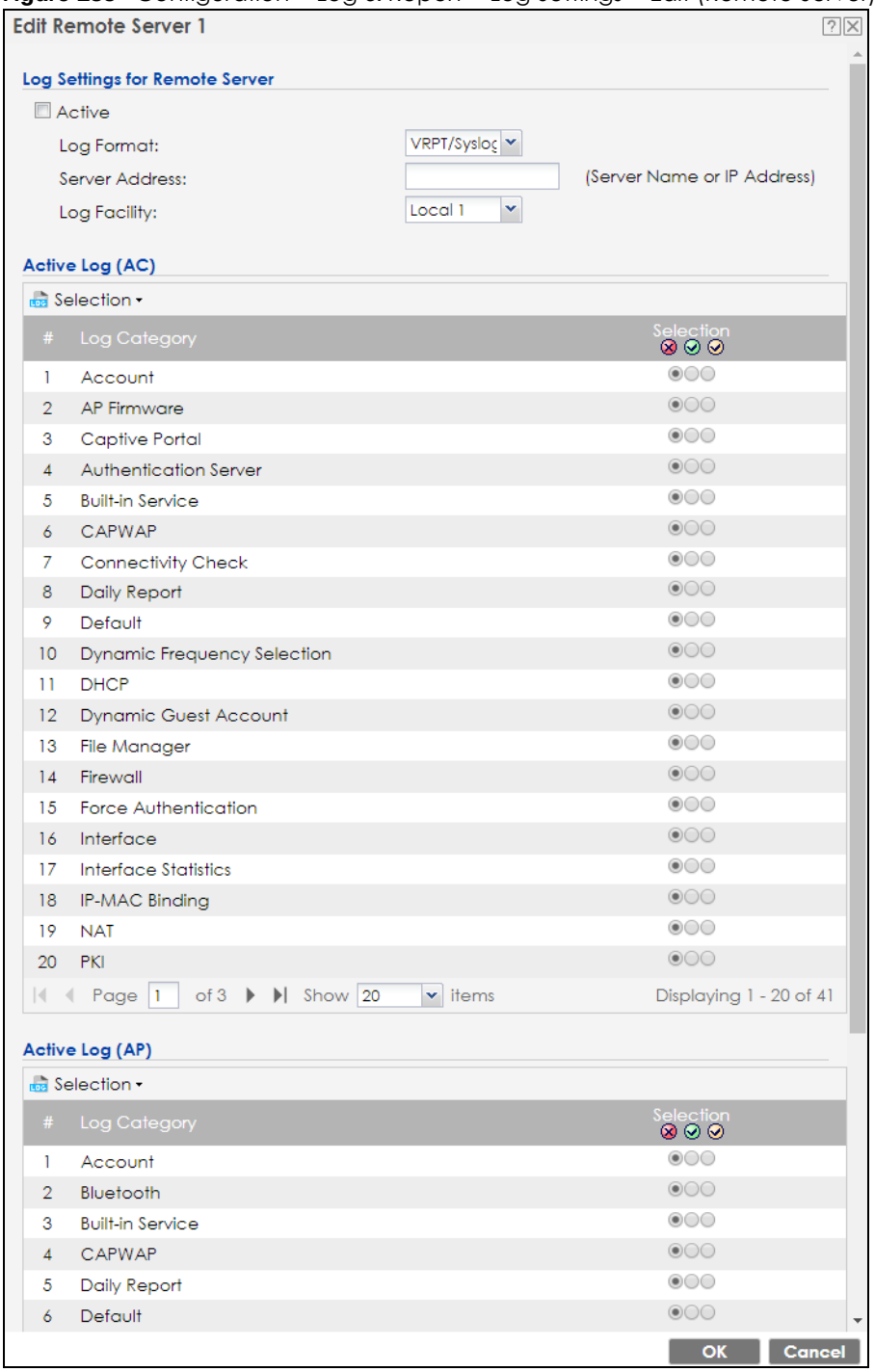
Table 188 Configuration > Log & Report > Log Settings > Edit (USB Storage) (continued)

LABEL	DESCRIPTION
Log Category	This field displays each category of messages. The **Default** category includes debugging messages generated by open source software.
Selection	Select what information you want to log from each **Log Category** (except **All Logs**; see below). Choices are: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - log regular information and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - log regular information, alerts, and debugging information from this category.
OK	Click this to save your changes and return to the previous screen.
Cancel	Click this to return to the previous screen without saving your changes.

30.3.4 Editing Remote Server Log Settings

This screen controls the settings for each log in the remote server (syslog). Go to the **Log Settings Summary** screen and click a remote server **Edit** icon.

Figure 235 Configuration > Log & Report > Log Settings > Edit (Remote Server)



The following table describes the labels in this screen.

Table 189 Configuration > Log & Report > Log Settings > Edit (Remote Server)

LABEL	DESCRIPTION
Log Settings for Remote Server	
Active	Select this check box to send log information according to the information in this section. You specify what kinds of messages are included in log information in the **Active Log** section.

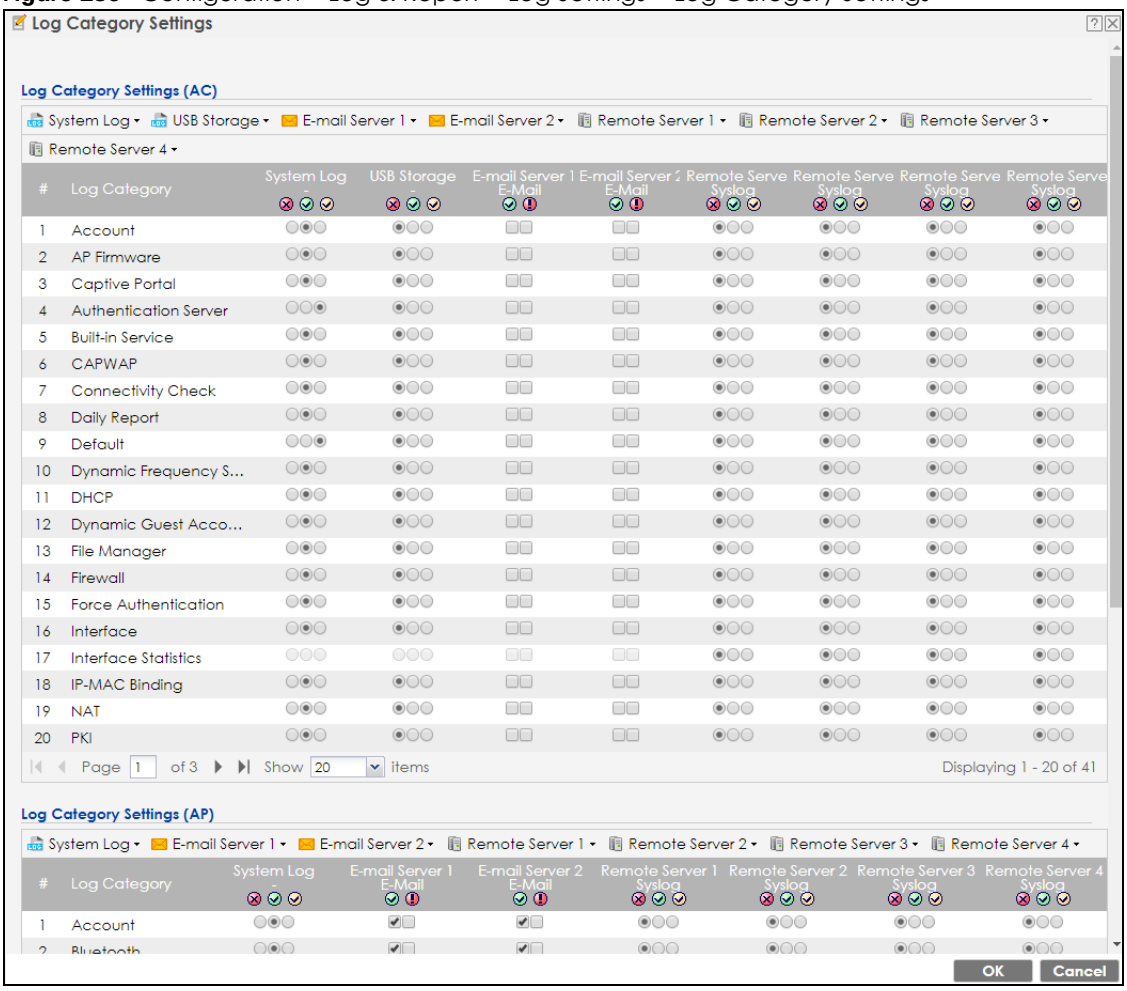
Table 189 Configuration > Log & Report > Log Settings > Edit (Remote Server) (continued)

LABEL	DESCRIPTION
Log Format	This field displays the format of the log information. It is read-only. **VRPT/Syslog** - Zyxel's Vantage Report, syslog-compatible format. **CEF/Syslog** - Common Event Format, syslog-compatible format.
Server Address	Type the server name or the IP address of the syslog server to which to send log information.
Log Facility	Select a log facility. The log facility allows you to log the messages to different files in the syslog server. Please see the documentation for your syslog program for more information.
Active Log	
Selection	Use the **Selection** drop-down list to change the log settings for all of the log categories. **disable all logs** (red X) - do not send the remote server logs for any log category. **enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories. **enable normal logs and debug logs** (yellow check mark) - send the remote server log messages, alerts, and debugging information for all log categories.
#	This field is a sequential value, and it is not associated with a specific address.
Log Category	This field displays each category of messages. It is the same value used in the **Display** and **Category** fields in the **View Log** tab. The **Default** category includes debugging messages generated by open source software.
Selection	Select what information you want to log from each **Log Category** (except **All Logs**; see below). Choices are: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - log regular information and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - log regular information, alerts, and debugging information from this category.
OK	Click this to save your changes and return to the previous screen.
Cancel	Click this to return to the previous screen without saving your changes.

30.3.5 Log Category Settings

This screen allows you to view and to edit what information is included in the system log, USB storage, e-mail profiles, and remote servers at the same time. It does not let you change other log settings (for example, where and how often log information is e-mailed or remote server names). To access this screen, go to the **Log Settings Summary** screen, and click the **Log Category Settings** button.

Figure 236 Configuration > Log & Report > Log Settings > Log Category Settings



This screen provides a different view and a different way of indicating which messages are included in each log and each alert. (The **Default** category includes debugging messages generated by open source software.)

The following table describes the fields in this screen.

Table 190 Configuration > Log & Report > Log Settings > Log Category Settings

LABEL	DESCRIPTION
System log	Use the **System Log** drop-down list to change the log settings for all of the log categories. **disable all logs** (red X) - do not log any information for any category for the system log or e-mail any logs to e-mail server 1 or 2. **enable normal logs** (green check mark) - create log messages and alerts for all categories for the system log. If e-mail server 1 or 2 also has normal logs enabled, the NXC will e-mail logs to them. **enable normal logs and debug logs** (yellow check mark) - create log messages, alerts, and debugging information for all categories. The NXC does not e-mail debugging information, even if this setting is selected.
USB Storage	Use the **USB Storage** drop-down list to change the log settings for saving logs to a connected USB storage device. **disable all logs** (red X) - do not log any information for any category to a connected USB storage device. **enable normal logs** (green check mark) - create log messages and alerts for all categories and save them to a connected USB storage device. **enable normal logs and debug logs** (yellow check mark) - create log messages, alerts, and debugging information for all categories and save them to a connected USB storage device.
E-mail Server 1	Use the **E-Mail Server 1** drop-down list to change the settings for e-mailing logs to e-mail server 1 for all log categories. Using the **System Log** drop-down list to disable all logs overrides your e-mail server 1 settings. **enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 1. **enable alert logs** (red exclamation point) - e-mail alerts for all categories to e-mail server 1.
E-mail Server 2	Use the **E-Mail Server 2** drop-down list to change the settings for e-mailing logs to e-mail server 2 for all log categories. Using the **System Log** drop-down list to disable all logs overrides your e-mail server 2 settings. **enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 2. **enable alert logs** (red exclamation point) - e-mail alerts for all categories to e-mail server 2.
Remote Server 1~4	For each remote server, use the **Selection** drop-down list to change the log settings for all of the log categories. **disable all logs** (red X) - do not send the remote server logs for any log category. **enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories. **enable normal logs and debug logs** (yellow check mark) - send the remote server log messages, alerts, and debugging information for all log categories.
#	This field is a sequential value, and it is not associated with a specific address.
Log Category	This field displays each category of messages. It is the same value used in the **Display** and **Category** fields in the **View Log** tab. The **Default** category includes debugging messages generated by open source software.

Table 190 Configuration > Log & Report > Log Settings > Log Category Settings (continued)

LABEL	DESCRIPTION
System log	Select which events you want to log by **Log Category**. There are three choices: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - create log messages and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - create log messages, alerts, and debugging information from this category; the NXC does not e-mail debugging information, however, even if this setting is selected.
USB Storage	Select which event log categories to save to a connected USB storage device. There are three choices: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - save log messages and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - save log messages, alerts, and debugging information from this category.
E-mail Server 1 E-mail	Select whether each category of events should be included in the log messages when it is e-mailed (green check mark) and/or in alerts (red exclamation point) for the e-mail settings specified in **E-Mail Server 1**. The NXC does not e-mail debugging information, even if it is recorded in the **System log**.
E-mail Server 2 E-mail	Select whether each category of events should be included in log messages when it is e-mailed (green check mark) and/or in alerts (red exclamation point) for the e-mail settings specified in **E-Mail Server 2**. The NXC does not e-mail debugging information, even if it is recorded in the **System log**.
Remote Server 1~4	For each remote server, select what information you want to log from each **Log Category** (except **All Logs**; see below). Choices are: **disable all logs** (red X) - do not log any information from this category. **enable normal logs** (green check mark) - log regular information and alerts from this category. **enable normal logs and debug logs** (yellow check mark) - log regular information, alerts, and debugging information from this category.
OK	Click this to save your changes and return to the previous screen.
Cancel	Click this to return to the previous screen without saving your changes.

CHAPTER 31
File Manager

31.1 Overview

Configuration files define the NXC's settings. Shell scripts are files of commands that you can store on the NXC and run when you need them. You can apply a configuration file or run a shell script without the NXC restarting. You can store multiple configuration files and shell script files on the NXC. You can edit configuration files or shell scripts in a text editor and upload them to the NXC. Configuration files use a .conf extension and shell scripts use a .zysh extension.

31.1.1 What You Can Do in this Chapter

- The **Configuration File** screen (Section 31.2 on page 392) stores and names configuration files. You can also download and upload configuration files.
- The **Firmware Package** screen (Section 31.3 on page 396) checks your current firmware version and uploads firmware to the NXC.
- The **Shell Script** screen (Section 31.4 on page 398) stores, names, downloads, uploads and runs shell script files.

31.1.2 What you Need to Know

The following terms and concepts may help as you read this chapter.

Configuration Files and Shell Scripts

When you apply a configuration file, the NXC uses the factory default settings for any features that the configuration file does not include. When you run a shell script, the NXC only applies the commands that it contains. Other settings do not change.

These files have the same syntax, which is also identical to the way you run CLI commands manually. An example is shown below.

Figure 237 Configuration File / Shell Script: Example

```
# enter configuration mode
configure terminal
# change administrator password
username admin password 4321 user-type admin
# configure ge3
interface ge3
ip address 172.16.37.240 255.255.255.0
ip gateway 172.16.37.254 metric 1
exit
# create address objects for remote management
# use the address group in case we want to open up remote management later
address-object TW_SUBNET 172.16.37.0/24
object-group address TW_TEAM
address-object TW_SUBNET
exit
# enable Telnet access (not enabled by default, unlike other services)
ip telnet server
# open WLAN-to-NXC firewall for TW_TEAM for remote management
firewall WLAN NXC insert 4
sourceip TW_TEAM
service TELNET
action allow
exit
write
```

While configuration files and shell scripts have the same syntax, the NXC applies configuration files differently than it runs shell scripts. This is explained below.

Table 191 Configuration Files and Shell Scripts in the NXC

Configuration Files (.conf)	Shell Scripts (.zysh)
• Resets to default configuration. • Goes into CLI **Configuration** mode. • Runs the commands in the configuration file.	• Goes into CLI **Privilege** mode. • Runs the commands in the shell script.

You have to run the aforementioned example as a shell script because the first command is run in **Privilege** mode. If you remove the first command, you have to run the example as a configuration file because the rest of the commands are executed in **Configuration** mode.

Comments in Configuration Files or Shell Scripts

In a configuration file or shell script, use "#" or "!" as the first character of a command line to have the NXC treat the line as a comment.

Your configuration files or shell scripts can use "exit" or a command line consisting of a single "!" to have the NXC exit sub command mode.

Note: "exit" or "!"' must follow sub commands if it is to make the NXC exit sub command mode.

Line 3 in the following example exits sub command mode.

```
interface ge1
ip address dhcp
!
```

Lines 1 and 3 in the following example are comments and line 4 exits sub command mode.

```
!
interface ge1
# this interface is a DHCP client
!
```

Lines 1 and 2 are comments. Line 5 exits sub command mode.

```
! this is from Joe
# on 2008/04/05
interface ge1
ip address dhcp
!
```

Errors in Configuration Files or Shell Scripts

When you apply a configuration file or run a shell script, the NXC processes the file line-by-line. The NXC checks the first line and applies the line if no errors are detected. Then it continues with the next line. If the NXC finds an error, it stops applying the configuration file or shell script and generates a log.

You can change the way a configuration file or shell script is applied. Include `setenv stop-on-error off` in the configuration file or shell script. The NXC ignores any errors in the configuration file or shell script and applies all of the valid commands. The NXC still generates a log for any errors.

31.2 Configuration File

Click **Maintenance > File Manager > Configuration File** to open this screen. Use the **Configuration File** screen to store, run, and name configuration files. You can also download configuration files from the NXC to your computer and upload configuration files from your computer to the NXC.

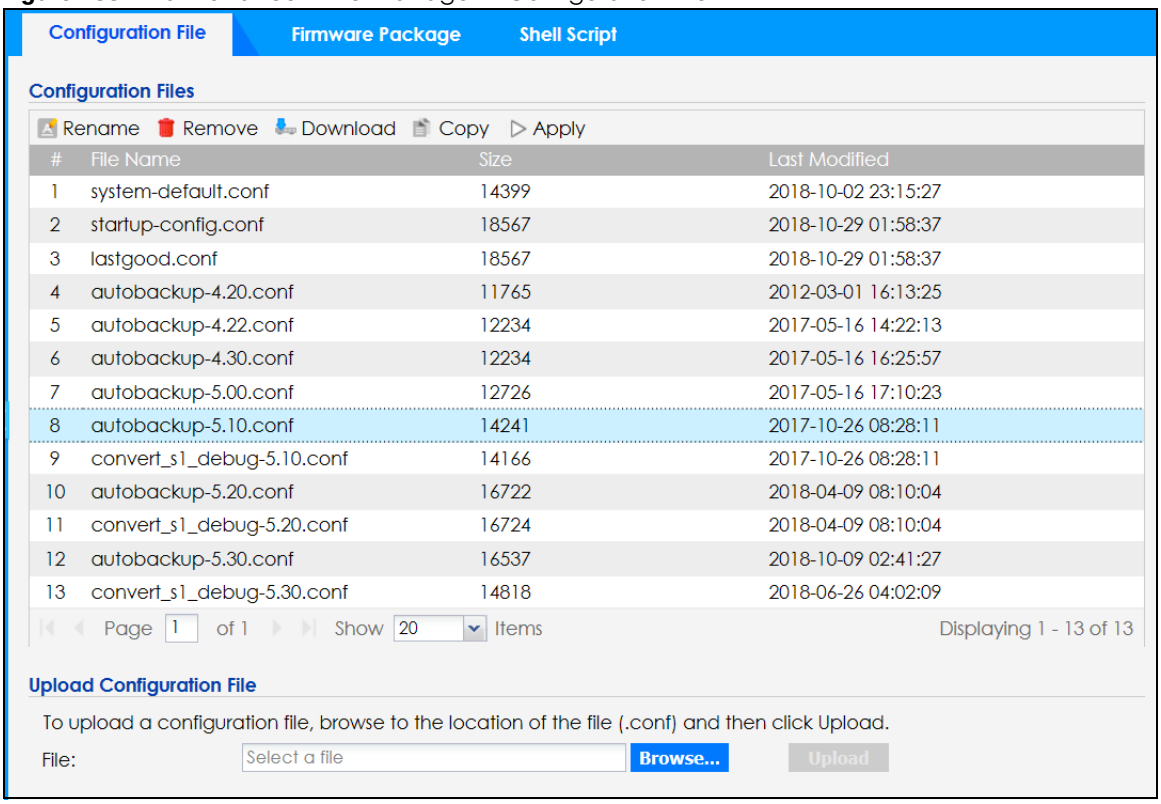
Once your NXC is configured and functioning properly, it is highly recommended that you back up your configuration file before making further configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Configuration File Flow at Restart

- If there is not a **startup-config.conf** when you restart the NXC (whether through a management interface or by physically turning the power off and back on), the NXC uses the **system-default.conf** configuration file with the NXC's default settings.

- If there is a **startup-config.conf**, the NXC checks it for errors and applies it. If there are no errors, the NXC uses it and copies it to the **lastgood.conf** configuration file as a back up file. If there is an error, the NXC generates a log and copies the **startup-config.conf** configuration file to the **startup-config-bad.conf** configuration file and tries the existing **lastgood.conf** configuration file. If there isn't a **lastgood.conf** configuration file or it also has an error, the NXC applies the **system-default.conf** configuration file.
- You can change the way the **startup-config.conf** file is applied. Include the `setenv-startup stop-on-error off` command. The NXC ignores any errors in the **startup-config.conf** file and applies all of the valid commands. The NXC still generates a log for any errors.

Figure 238 Maintenance > File Manager > Configuration File



Do not turn off the NXC while configuration file upload is in progress.

The following table describes the labels in this screen.

Table 192 Maintenance > File Manager > Configuration File

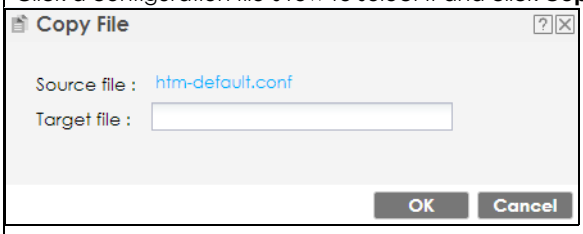
LABEL	DESCRIPTION
Rename	Use this button to change the label of a configuration file on the NXC. You can only rename manually saved configuration files. You cannot rename the **lastgood.conf**, **system-default.conf** and **startup-config.conf** files. You cannot rename a configuration file to the name of another configuration file in the NXC. Click a configuration file's row to select it and click **Rename** to open the **Rename File** screen.  Specify the new name for the configuration file. Use up to 25 characters (including a-z, A-Z, 0-9;'~!@#$%^&()_+[]{}',.=-). Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file.
Remove	Click a configuration file's row to select it and click **Remove** to delete it from the NXC. You can only delete manually saved configuration files. You cannot delete the **system-default.conf**, **startup-config.conf** and **lastgood.conf** files. A pop-up window asks you to confirm that you want to delete the configuration file. Click **OK** to delete the configuration file or click **Cancel** to close the screen without deleting the configuration file.
Download	Click a configuration file's row to select it and click **Download** to save the configuration to your computer.
Copy	Use this button to save a duplicate of a configuration file on the NXC. Click a configuration file's row to select it and click **Copy** to open the **Copy File** screen.  Specify a name for the duplicate configuration file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-). Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file.

Table 192 Maintenance > File Manager > Configuration File (continued)

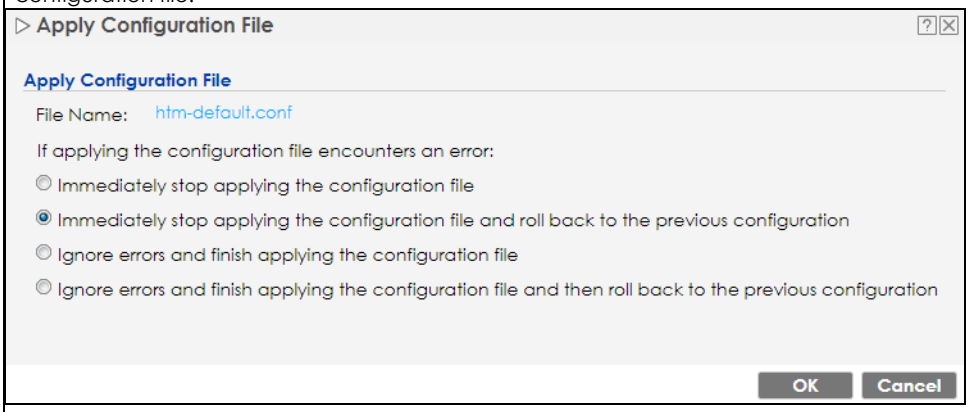
LABEL	DESCRIPTION
Apply	Use this button to have the NXC use a specific configuration file. Click a configuration file's row to select it and click **Apply** to have the NXC use that configuration file. The NXC does not have to restart in order to use a different configuration file, although you will need to wait for a few minutes while the system reconfigures. The following screen gives you options for what the NXC is to do if it encounters an error in the configuration file.  **Immediately stop applying the configuration file** - this is not recommended because it would leave the rest of the configuration blank. If the interfaces were not configured before the first error, the console port may be the only way to access the device. **Immediately stop applying the configuration file and roll back to the previous configuration** - this gets the NXC started with a fully valid configuration file as quickly as possible. **Ignore errors and finish applying the configuration file** - this applies the valid parts of the configuration file and generates error logs for all of the configuration file's errors. This lets the NXC apply most of your configuration and you can refer to the logs for what to fix. **Ignore errors and finish applying the configuration file and then roll back to the previous configuration** - this applies the valid parts of the configuration file, generates error logs for all of the configuration file's errors, and starts the NXC with a fully valid configuration file. Click **OK** to have the NXC start applying the configuration file or click **Cancel** to close the screen.
#	This column displays the number for each configuration file entry. This field is a sequential value, and it is not associated with a specific address. The total number of configuration files that you can save depends on the sizes of the configuration files and the available flash storage space.
File Name	This column displays the label that identifies a configuration file. You cannot delete the following configuration files or change their file names. The system-default.conf file contains the NXC's default settings. Select this file and click Apply to reset all of the NXC settings to the factory defaults. This configuration file is included when you upload a firmware package. The startup-config.conf file is the configuration file that the NXC is currently using. If you make and save changes during your management session, the changes are applied to this configuration file. The NXC applies configuration changes made in the Web Configurator to the configuration file when you click **Apply** or **OK**. It applies configuration changes made via commands when you use the `write` command. The **lastgood.conf** is the most recently used (valid) configuration file that was saved when the device last restarted. If you upload and apply a configuration file with an error, you can apply lastgood.conf to return to a valid configuration.
Size	This column displays the size (in KB) of a configuration file.

Table 192 Maintenance > File Manager > Configuration File (continued)

LABEL	DESCRIPTION
Last Modified	This column displays the date and time that the individual configuration files were last changed or saved.
Upload Configuration File	The bottom part of the screen allows you to upload a new or previously saved configuration file from your computer to your NXC. You cannot upload a configuration file named **system-default.conf** or **lastgood.conf**. If you upload **startup-config.conf**, it will replace the current configuration and immediately apply the new settings.
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.
Browse...	Click **Browse...** to find the .conf file you want to upload. The configuration file must use a ".conf" filename extension. You will receive an error message if you try to upload a fie of a different format. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.

31.3 Firmware Package

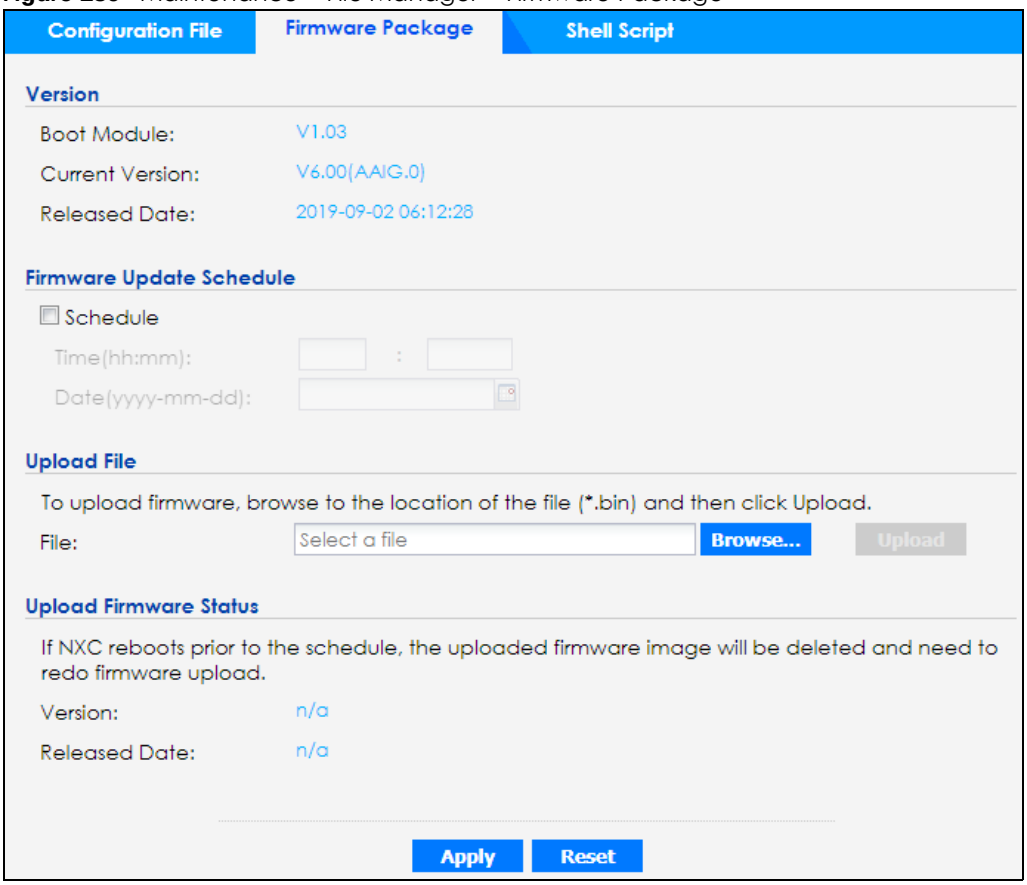
Click **Maintenance > File Manager > Firmware Package** to open this screen. Use the **Firmware Package** screen to check your current firmware version and upload firmware to the NXC.

Note: The Web Configurator is the recommended method for uploading firmware. You only need to use the command line interface if you need to recover the firmware. See the CLI Reference Guide for how to determine if you need to recover the firmware and how to recover it.

Find the firmware package at www.zyxel.com in a file that (usually) uses the system model name with a .bin extension, for example, "nxc.bin".

The firmware update can take up to five minutes. Do not turn off or reset the NXC while the firmware update is in progress!

Figure 239 Maintenance > File Manager > Firmware Package



The following table describes the labels in this screen.

Table 193 Maintenance > File Manager > Firmware Package

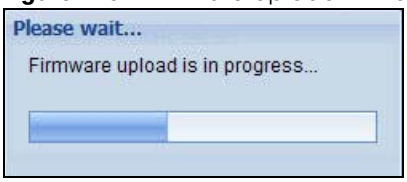
LABEL	DESCRIPTION
Version	
Boot Module	This is the version of the boot module that is currently on the NXC.
Current Version	This is the version of the firmware that is currently installed on the NXC. The firmware version consists of the trunk version number, model code, and release number. For example, V4.20(AAOS.1) means V4.20 is the trunk number, AAOS represents NXC5500, and 1 means the first release.
Released Date	This is the date that the firmware was created.
Firmware Update Schedule	The NXC can be scheduled to install the firmware you uploaded at the specified date and time.
Schedule	Select this option to turn on the firmware update scheduling feature. Note: To enable scheduling, you have to select this option and click **Apply** before you upload a firmware package. Otherwise, the NXC installs the uploaded firmware package immediately.
Time (hh:mm)	Enter the time of the day in 24-hour format (for example 23:00 equals 11:00 pm) to install the firmware.
Date (yyyy-mm-dd)	Select or specify the day in year-month-date format to install the firmware.
Upload File	
File	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.

Table 193 Maintenance > File Manager > Firmware Package (continued)

LABEL	DESCRIPTION
Browse...	Click **Browse...** to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.
Upload Firmware Status	
Version	This is the version of the firmware that you uploaded.
Released Date	This is the date that the firmware was created.
Apply	Click **Apply** to save your changes back to the NXC.
Reset	Click **Reset** to return the screen to its last-saved settings.

After you see the **Firmware Upload in Process** screen, wait two minutes before logging into the NXC again.

Figure 240 Firmware Upload In Process



Note: The NXC automatically reboots after a successful firmware update.

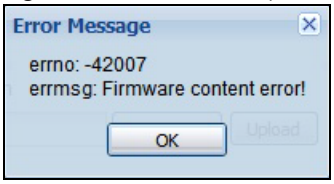
The NXC automatically restarts causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 241 Network Temporarily Disconnected

After five minutes, log in again and check your new firmware version in the **Dashboard** screen.

If the firmware update was not successful, the following message appears in the screen.

Figure 242 Firmware Upload Error



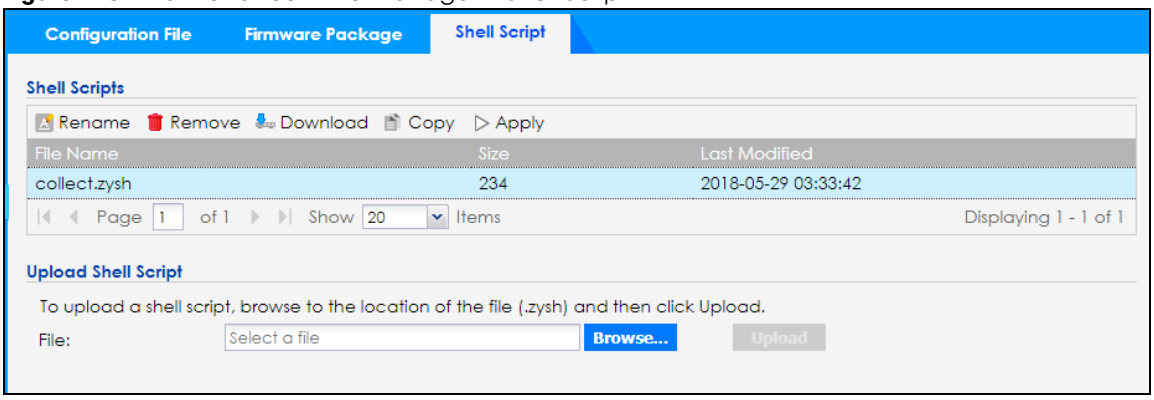
31.4 Shell Script

Use shell script files to have the NXC use commands that you specify. Use a text editor to create the shell script files. They must use a "*.zysh*" filename extension.

Click **Maintenance > File Manager > Shell Script** to open this screen. Use the **Shell Script** screen to store, name, download, upload and run shell script files. You can store multiple shell script files on the NXC at the same time.

Note: You should include `write` commands in your scripts. If you do not use the `write` command, the changes will be lost when the NXC restarts. You could use multiple `write` commands in a long script.

Figure 243 Maintenance > File Manager > Shell Script



Each field is described in the following table.

Table 194 Maintenance > File Manager > Shell Script

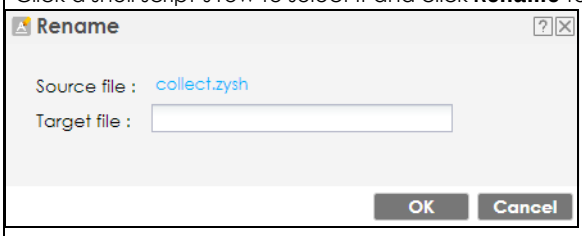
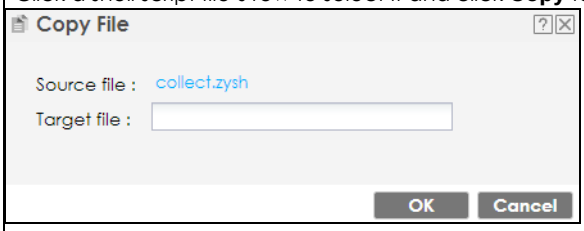
LABEL	DESCRIPTION
Rename	Use this button to change the label of a shell script file on the NXC. You cannot rename a shell script to the name of another shell script in the NXC. Click a shell script's row to select it and click **Rename** to open the **Rename File** screen.  Specify the new name for the shell script file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-). Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file.
Remove	Click a shell script file's row to select it and click **Delete** to delete the shell script file from the NXC. A pop-up window asks you to confirm that you want to delete the shell script file. Click **OK** to delete the shell script file or click **Cancel** to close the screen without deleting the shell script file.
Download	Click a shell script file's row to select it and click **Download** to save the configuration to your computer.

Table 194 Maintenance > File Manager > Shell Script (continued)

LABEL	DESCRIPTION
Copy	Use this button to save a duplicate of a shell script file on the NXC. Click a shell script file's row to select it and click **Copy** to open the **Copy File** screen.  Specify a name for the duplicate file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-). Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file.
Apply	Use this button to have the NXC use a specific shell script file. Click a shell script file's row to select it and click **Apply** to have the NXC use that shell script file. You may need to wait awhile for the NXC to finish applying the commands.
#	This column displays the number for each shell script file entry.
File Name	This column displays the label that identifies a shell script file.
Size	This column displays the size (in KB) of a shell script file.
Last Modified	This column displays the date and time that the individual shell script files were last changed or saved.
Upload Shell Script	The bottom part of the screen allows you to upload a new or previously saved shell script file from your computer to your NXC.
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.
Browse...	Click **Browse...** to find the .zysh file you want to upload.
Upload	Click **Upload** to begin the upload process. This process may take up to several minutes.

CHAPTER 32
Diagnostics

32.1 Overview

Use the diagnostics screens for troubleshooting.

32.1.1 What You Can Do in this Chapter

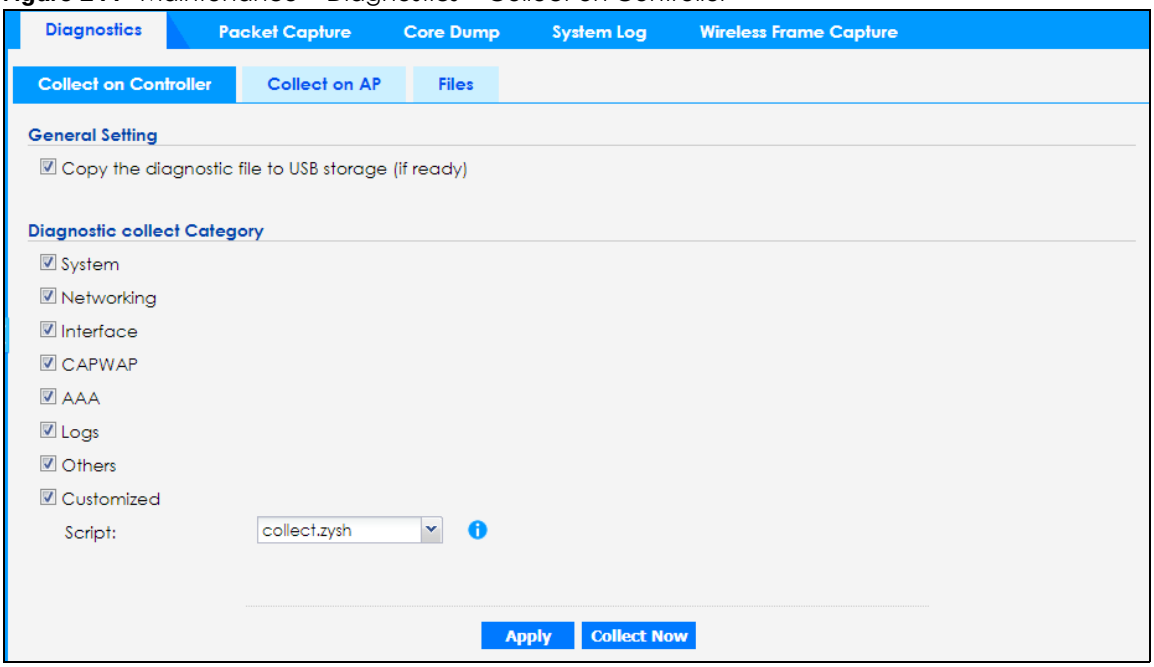
- The **Diagnostics** screen (Section 32.2 on page 401) generates a file containing the NXC's configuration and diagnostic information if you need to provide it to customer support during troubleshooting.
- The **Packet Capture** screen (Section 32.3 on page 405) captures data packets going through the NXC.
- The **Core Dump** screens (Section 32.4 on page 413) save a process's core dump to an attached USB storage device if the process terminates abnormally (crashes) so you can send the file to customer support for troubleshooting.
- The **System Log** screens (Section 32.5 on page 414) download files of system logs from a connected USB storage device to your computer.
- The **Wireless Frame Capture** screens (Section 32.6 on page 415) capture network traffic going through the AP interfaces connected to your NXC.

32.2 Diagnostics

This screen provides an easy way for you to generate a file containing the NXC's configuration and diagnostic information. You may need to generate this file and send it to customer support during troubleshooting.

Click **Maintenance > Diagnostics** to open the **Collect on Controller** screen.

Figure 244 Maintenance > Diagnostics > Collect on Controller



The following table describes the labels in this screen.

Table 195 Maintenance > Diagnostics > Collect on Controller

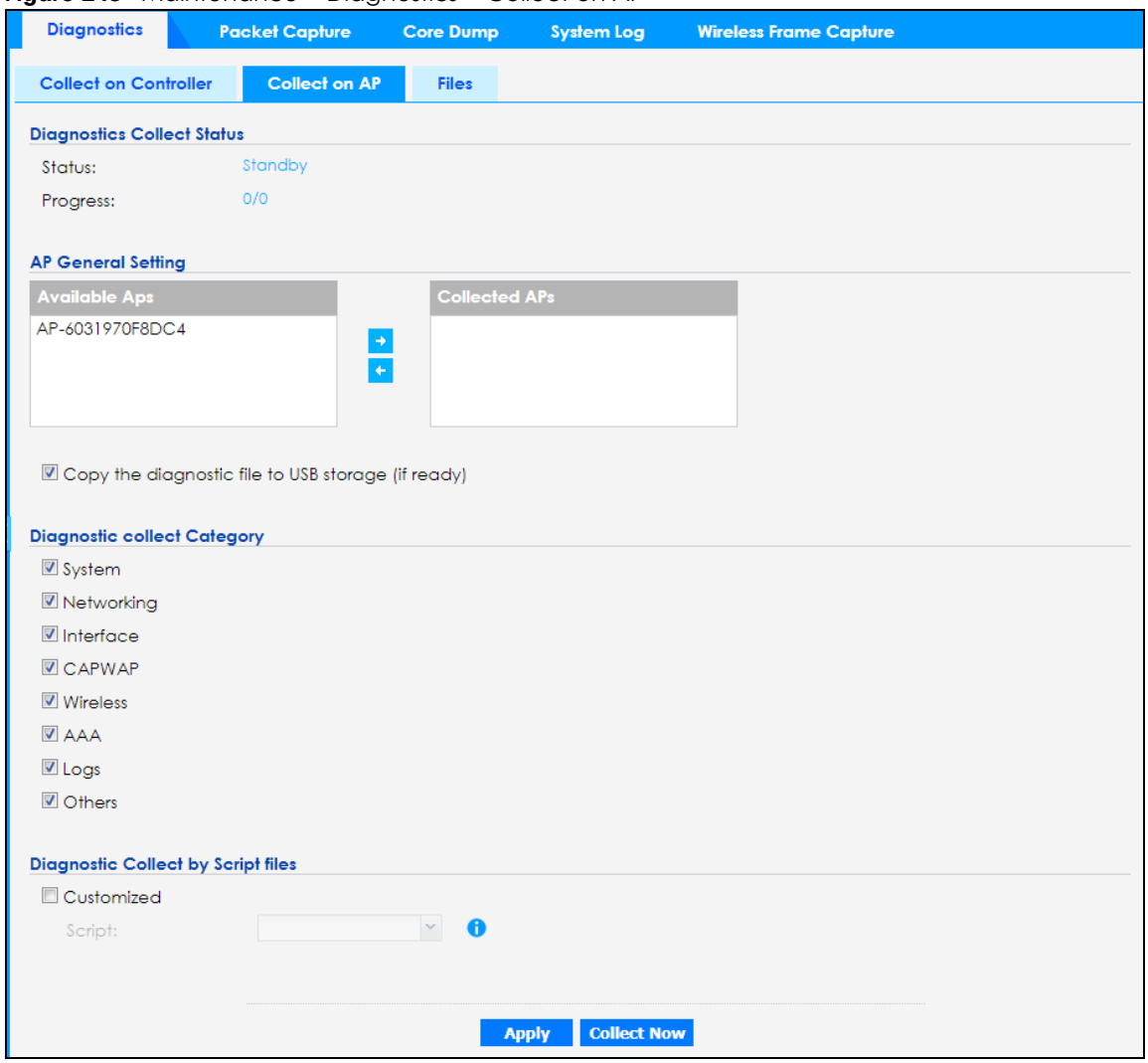
LABEL	DESCRIPTION
General Setting	
Copy the diagnostic file to USB storage (if ready)	Select this to have the NXC create an extra copy of the diagnostic file to a connected USB storage device.
Diagnostic Collect Category	This field displays each category of settings. Select which categories you want the NXC to include in the diagnostic file.
Customized	Select this option to obtain the diagnostic information for configuration which is not included in a pre-defined category.
Script	If you select the **Customized** option, select a shell script file from the drop-down list. You can upload a new shell script file using the **Maintenance > File Manager > Shell Script** screen.
Apply	Click **Apply** to save your changes.
Collect Now	Click this to have the NXC create a new diagnostic file. Note: This button works only when it shows **Standby** in the **Status** field of the **Diagnostics > Collect on AP** screen,

32.2.1 Diagnostics - AP Configuration

This screen provides an easy way for you to generate a file containing the selected managed AP's configuration and diagnostic information. You may need to generate this file and send it to customer support during troubleshooting.

Click **Maintenance > Diagnostics** > **Collect on AP** to open the **Diagnostic** screen.

Figure 245 Maintenance > Diagnostics > Collect on AP



The following table describes the labels in this screen.

Table 196 Maintenance > Diagnostics > Collect on AP

LABEL	DESCRIPTION
Diagnostics Collect Status	
Status	This shows **Standby** when the NXC is ready to or have finished generating a diagnostic file. This shows **Busy on AP** when the NXC is generating a diagnostic file for the selected managed AP(s). This shows **Busy on Controller** when the NXC is generating a diagnostic file containing its own configuration and diagnostic information.
Progress	This shows the number of managed APs whose configuration has been contained in the file and the number of managed APs you selected to generate a diagnostic file.
AP General Setting	
Available APs	This text box lists the managed APs that are connected and available. Select the managed APs that you want the NXC to generate a diagnostic file containing their configuration, and click the right arrow button to add them.

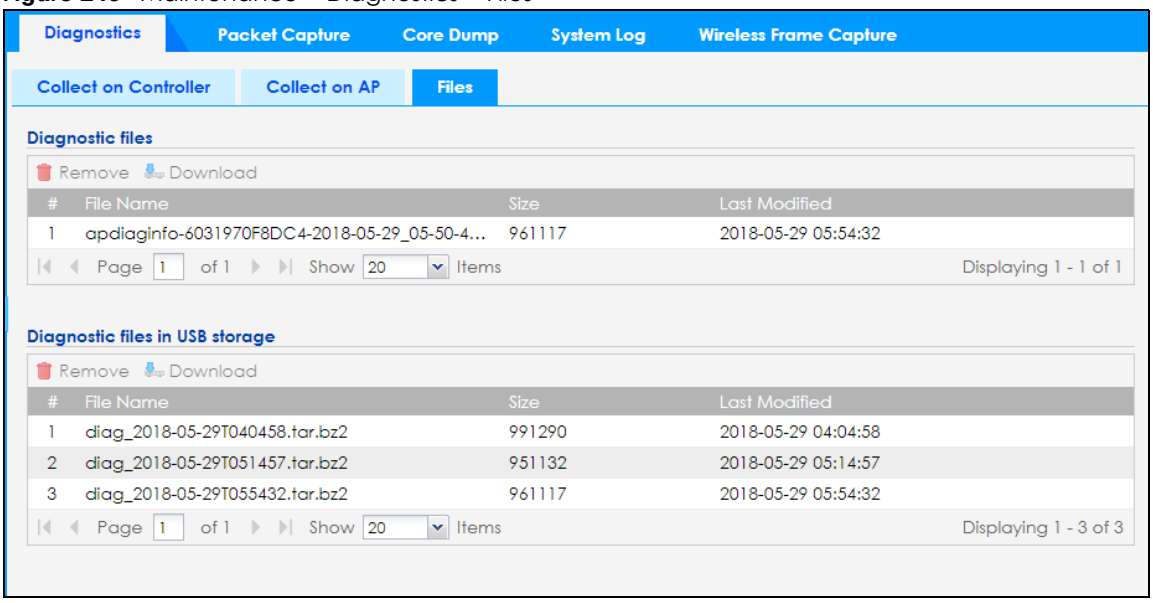
Table 196 Maintenance > Diagnostics > Collect on AP

LABEL	DESCRIPTION
Collected APs	This text box lists the managed APs that you allow the NXC to generate a diagnostic file containing their configuration. Select any managed APs that you want to prevent the NXC from generating a diagnostic file for them, and click the left arrow button to remove them.
Copy the diagnostic file to USB storage (if ready)	Select this to have the NXC create an extra copy of the diagnostic file to a connected USB storage device.
Diagnostic Collect Category	This field displays each category of settings. Select which categories you want the NXC to include in the diagnostic file.
Diagnostic Collect by Script files	
Customized	Select this option to obtain the diagnostic information for configuration which is not included in a pre-defined category.
Script	If you select the **Customized** option, select a shell script file from the drop-down list. You can upload a new shell script file using the **Maintenance > File Manager > Shell Script** screen.
Apply	Click **Apply** to save your changes.
Collect Now	Click this to have the NXC create a new diagnostic file. Note: This button works only when it shows **Standby** in the **Status** field of the **Diagnostics > Collect on AP** screen.

32.2.2 Diagnostics Files

Click **Maintenance > Diagnostics > Files** to open the diagnostic files screen. This screen lists the files of diagnostic information the NXC has collected and stored on the NXC or a connected USB storage device. You may need to send these files to customer support for troubleshooting.

Figure 246 Maintenance > Diagnostics > Files



The following table describes the labels in this screen.

Table 197 Maintenance > Diagnostics > Files

LABEL	DESCRIPTION
Diagnostic files / Diagnostic files in USB storage	
Remove	Select files and click **Remove** to delete them from the NXC or the connected USB storage device. Use the [Shift] and/or [Ctrl] key to select multiple files. A pop-up window asks you to confirm that you want to delete.
Download	Click a file to select it and click **Download** to save it to your computer.
#	This column displays the number for each file entry. The total number of files that you can save depends on the file sizes and the available storage space.
File Name	This column displays the label that identifies the file.
Size	This column displays the size (in bytes) of a file.
Last Modified	This column displays the date and time that the individual files were saved.

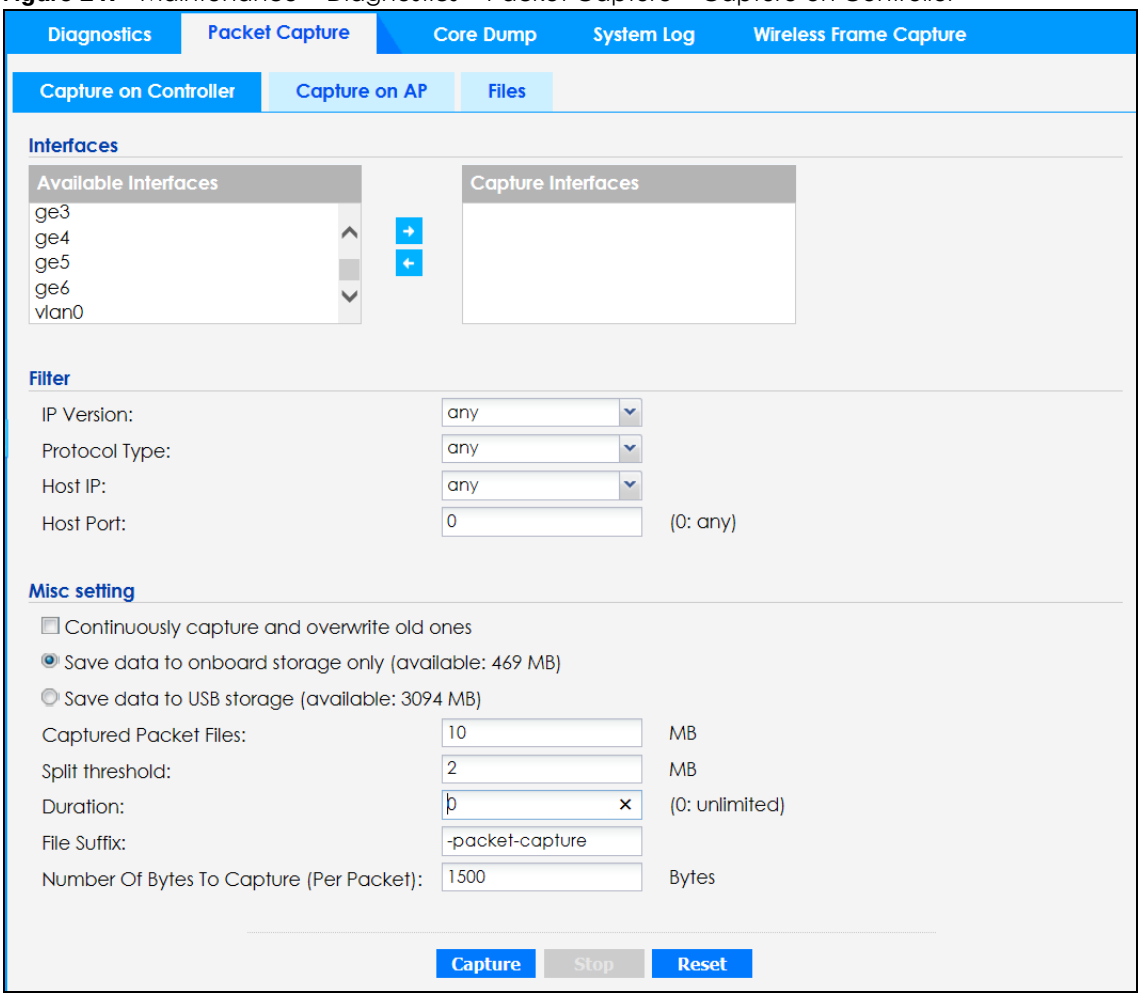
32.3 Packet Capture

Use this screen to capture network traffic going through the NXC's interfaces. Studying these packet captures may help you identify network problems.

Click **Maintenance > Diagnostics > Packet Capture** to open the **Capture on Controller** screen.

Note: New capture files overwrite existing files of the same name. Change the **File Suffix** field's setting to avoid this.

Figure 247 Maintenance > Diagnostics > Packet Capture > Capture on Controller



The following table describes the labels in this screen.

Table 198 Maintenance > Diagnostics > Packet Capture > Capture on Controller

LABEL	DESCRIPTION
Interfaces	Enabled interfaces appear under **Available Interfaces**. Select interfaces for which to capture packets and click the right arrow button to move them to the **Capture Interfaces** list. Use the [Shift] and/or [Ctrl] key to select multiple objects.
Filter	
IP Version	Select the version of the Internet Protocol (IP) by which traffic is routed across the networks and Internet. Select **any** to capture packets for traffic sent by either IP version.
Protocol Type	Select the protocol type of traffic for which to capture packets. Select **any** to capture packets for all types of traffic.
Host IP	Select a host IP address object for which to capture packets. Select **any** to capture packets for all hosts. Select **User Defined** to be able to enter an IP address.
Host Port	This field is configurable when you set the **Protocol Type** to **any**, **tcp**, or **udp**. Specify the port number of traffic to capture.
Misc setting	
Continuously capture and overwrite old ones	Select this to have the NXC keep capturing traffic and overwriting old packet capture entries when the available storage space runs out.

Table 198 Maintenance > Diagnostics > Packet Capture > Capture on Controller (continued)

LABEL	DESCRIPTION
Save data to onboard storage only	Select this to have the NXC only store packet capture entries on the NXC. The available storage size is displayed as well. Note: The NXC reserves some onboard storage space as a buffer.
Save data to USB storage	Select this to have the NXC store packet capture entries only on a USB storage device connected to the NXC. Status: **Unused** - the connected USB storage device was manually unmounted by using the **Remove Now** button or for some reason the NXC cannot mount it. **none** - no USB storage device is connected. **available** - you can have the NXC use the USB storage device. The available storage capacity also displays. **service deactivated** - the USB storage feature is disabled and the NXC cannot use a connected USB device to store the system log and other diagnostic information. Note: The NXC reserves some USB storage space as a buffer.
Captured Packet Files	When saving packet captures only to the NXC's onboard storage, specify a maximum limit in megabytes for the total combined size of all the capture files on the NXC. When saving packet captures to a connected USB storage device, specify a maximum limit in megabytes for each capture file. Note: If you have existing capture files and have not selected the **Continuously capture and overwrite old ones** option, you may need to set this size larger or delete existing capture files. The valid range depends on the available onboard/USB storage size. The NXC stops the capture and generates the capture file when either the file reaches this size or the time period specified in the **Duration** field expires.
Split threshold	Specify a maximum size limit in megabytes for individual packet capture files. After a packet capture file reaches this size, the NXC starts another packet capture file.
Duration	Set a time limit in seconds for the capture. The NXC stops the capture and generates the capture file when either this period of time has passed or the file reaches the size specified in the **Captured Packet Files** field. **0** means there is no time limit.
File Suffix	Specify text to add to the end of the file name (before the dot and filename extension) to help you identify the packet capture files. Modifying the file suffix also avoids making new capture files that overwrite existing files of the same name. The file name format is "interface name-file suffix.cap", for example "vlan2-packet-capture.cap".
Number Of Bytes To Capture (Per Packet)	Specify the maximum number of bytes to capture per packet. The NXC automatically truncates packets that exceed this size. As a result, when you view the packet capture files in a packet analyzer, the actual size of the packets may be larger than the size of captured packets.

Table 198 Maintenance > Diagnostics > Packet Capture > Capture on Controller (continued)

LABEL	DESCRIPTION
Capture	Click this button to have the NXC capture packets according to the settings configured in this screen. You can configure the NXC while a packet capture is in progress although you cannot modify the packet capture settings. The NXC's throughput or performance may be affected while a packet capture is in progress. After the NXC finishes the capture it saves a separate capture file for each selected interface. The total number of packet capture files that you can save depends on the file sizes and the available flash storage space. Once the flash storage space is full, adding more packet captures will fail.
Stop	Click this button to stop a currently running packet capture and generate a separate capture file for each selected interface.
Reset	Click this button to return the screen to its last-saved settings.

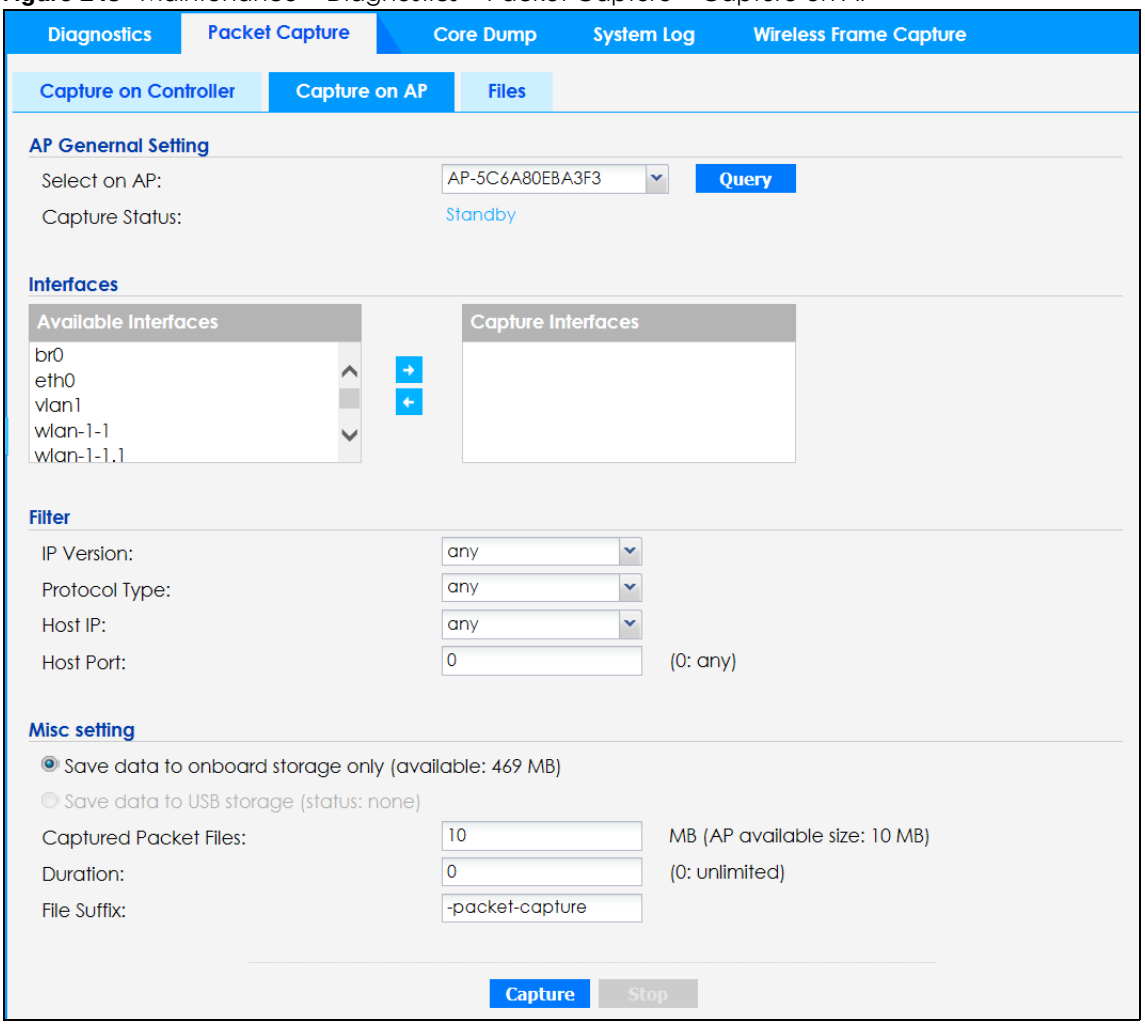
32.3.1 Packet Capture on AP

Use this screen to capture network traffic going through the connected AP's interfaces. Studying these packet captures may help you identify network problems.

Click **Maintenance > Diagnostics > Packet Capture > Capture on AP** to open the packet capture screen.

Note: New capture files overwrite existing files of the same name. Change the **File Suffix** field's setting to avoid this.

Figure 248 Maintenance > Diagnostics > Packet Capture > Capture on AP



The following table describes the labels in this screen.

Table 199 Maintenance > Diagnostics > Packet Capture > Capture on AP

LABEL	DESCRIPTION
AP General Setting	
Select on AP	This lists the managed APs that are connected and available. Select the managed AP that you want the NXC to capture network traffic going through it.
Query	After you select an AP, click this button to update and display the interfaces, filter configuration and storage size available for the selected AP in the screen. Note: You need to use the **Query** button before packet capturing on an AP if the AP has rebooted or the applied AP profile settings have been changed.

Table 199 Maintenance > Diagnostics > Packet Capture > Capture on AP (continued)

LABEL	DESCRIPTION
Capture Status	This shows **Standby** when the NXC is ready to or have finished capturing network traffic going through the selected AP's interface(s). This shows **Preparing** when the NXC is sending the capture command to the AP's interface(s). This shows **Capturing** when the AP is capturing network traffic going through the selected AP's interface(s). This shows **File Receiving** when the NXC starts to receive capture files from the AP's interface(s) after you press the **Stop** button.
Interfaces	Enabled interfaces appear under **Available Interfaces**. Select interfaces for which to capture packets and click the right arrow button to move them to the **Capture Interfaces** list. Use the [Shift] and/or [Ctrl] key to select multiple objects.
Filter	
IP Version	Select the version of the Internet Protocol (IP) by which traffic is routed across the networks and Internet. Select **any** to capture packets for traffic sent by either IP version.
Protocol Type	Select the protocol type of traffic for which to capture packets. Select **any** to capture packets for all types of traffic.
Host IP	Select a host IP address object for which to capture packets. Select **any** to capture packets for all hosts. Select **User Defined** to be able to enter an IP address.
Host Port	This field is configurable when you set the **Protocol Type** to **any**, **tcp**, or **udp**. Specify the port number of traffic to capture.
Misc setting	
Save data to onboard storage only	Select this to have the NXC only store packet capture entries on the NXC. The available storage size is displayed as well. Note: The NXC reserves some onboard storage space as a buffer.
Save data to USB storage	Select this to have the NXC store packet capture entries only on a USB storage device connected to the NXC. Status: **Unused** - the connected USB storage device was manually unmounted by using the **Remove Now** button or for some reason the NXC cannot mount it. **none** - no USB storage device is connected. **available** - you can have the NXC use the USB storage device. The available storage capacity also displays. **service deactivated** - the USB storage feature is disabled and the NXC cannot use a connected USB device to store the system log and other diagnostic information. Note: The NXC reserves some USB storage space as a buffer.
Captured Packet Files	When saving packet captures only to the NXC's onboard storage, specify a maximum limit in megabytes for the total combined size of all the capture files on the NXC. When saving packet captures to a connected USB storage device, specify a maximum limit in megabytes for each capture file. The valid range depends on the AP's available storage size. The NXC stops the capture and generates the capture file when either the file reaches this size or the time period specified in the **Duration** field expires.
Duration	Set a time limit in seconds for the capture. The NXC has the AP stop the capture and generate the capture file when either this period of time has passed or the file reaches the size specified in the **Captured Packet Files** field. **0** means there is no time limit.

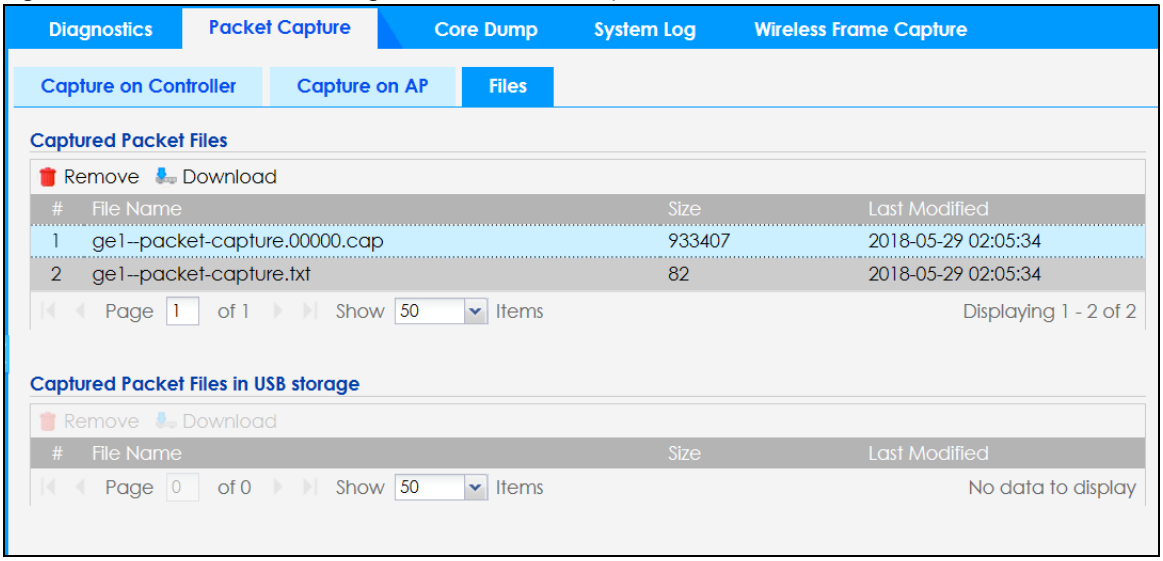
Table 199 Maintenance > Diagnostics > Packet Capture > Capture on AP (continued)

LABEL	DESCRIPTION
File Suffix	Specify text to add to the end of the file name (before the dot and filename extension) to help you identify the packet capture files. Modifying the file suffix also avoids making new capture files that overwrite existing files of the same name. The file name format is "interface name-file suffix.cap", for example "vlan2-packet-capture.cap".
Capture	Click this button to have the connected AP capture packets according to the settings configured in this screen. You can configure the NXC while a packet capture is in progress although you cannot modify the packet capture settings. The NXC's throughput or performance may be affected while a packet capture is in progress. After the AP finishes the capture it saves a separate capture file for each selected interface. The total number of packet capture files that you can save depends on the file sizes and the available flash storage space. Once the flash storage space is full, adding more packet captures will fail.
Stop	Click this button to stop a currently running packet capture and generate a separate capture file for each selected interface.

32.3.2 Packet Capture Files

Click **Maintenance > Diagnostics > Packet Capture > Files** to open the packet capture files screen. This screen lists the files of packet captures stored on the NXC or a connected USB storage device. You can download the files to your computer where you can study them using a packet analyzer (also known as a network or protocol analyzer) such as Wireshark.

Figure 249 Maintenance > Diagnostics > Packet Capture > Files



The following table describes the labels in this screen.

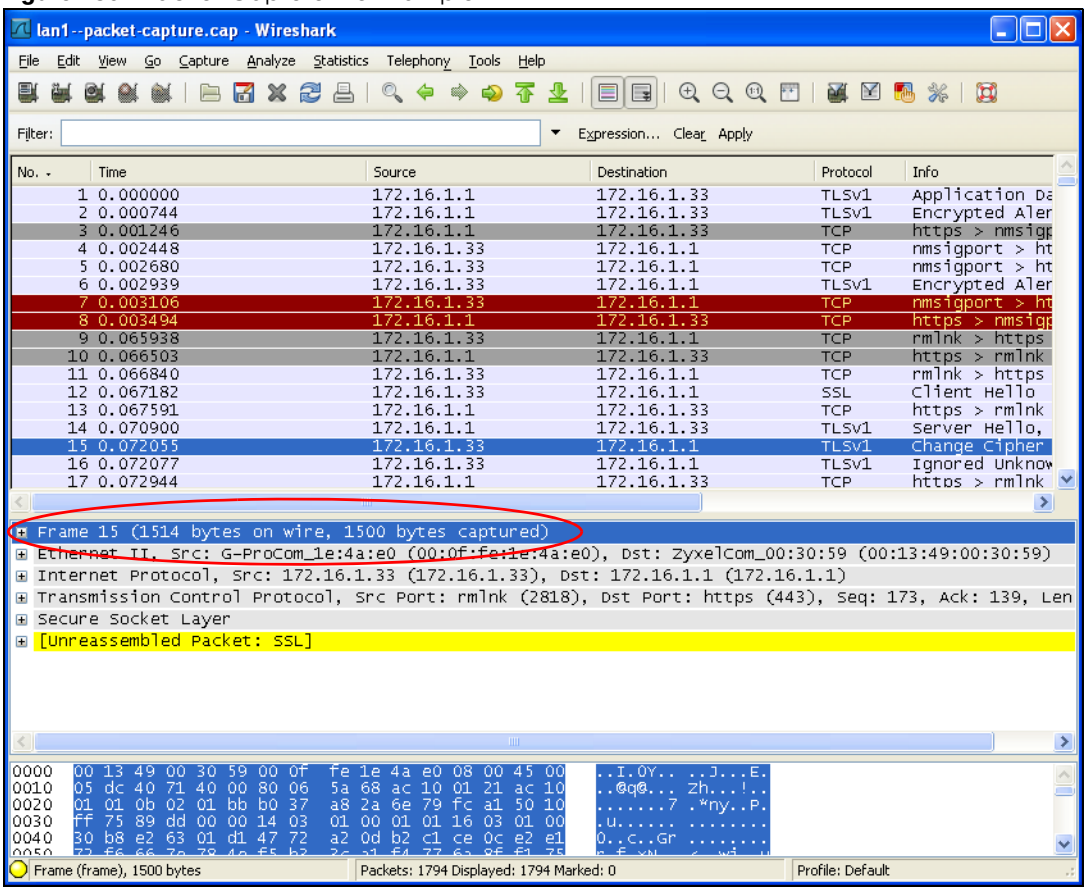
Table 200 Maintenance > Diagnostics > Packet Capture > Files

LABEL	DESCRIPTION
Remove	Select files and click **Remove** to delete them from the NXC or the connected USB storage device. Use the [Shift] and/or [Ctrl] key to select multiple files. A pop-up window asks you to confirm that you want to delete.
Download	Click a file to select it and click **Download** to save it to your computer.
#	This column displays the number for each packet capture file entry. The total number of packet capture files that you can save depends on the file sizes and the available flash storage space.
File Name	This column displays the label that identifies the file. The file name format is interface name-file suffix.cap.
Size	This column displays the size (in bytes) of a configuration file.
Last Modified	This column displays the date and time that the individual files were saved.

32.3.3 Example of Viewing a Packet Capture File

Here is an example of a packet capture file viewed in the Wireshark packet analyzer. Notice that the size of frame 15 on the wire is 1514 bytes while the captured size is only 1500 bytes. The NXC truncated the frame because the capture screen's **Number Of Bytes To Capture (Per Packet)** field was set to 1500 bytes.

Figure 250 Packet Capture File Example

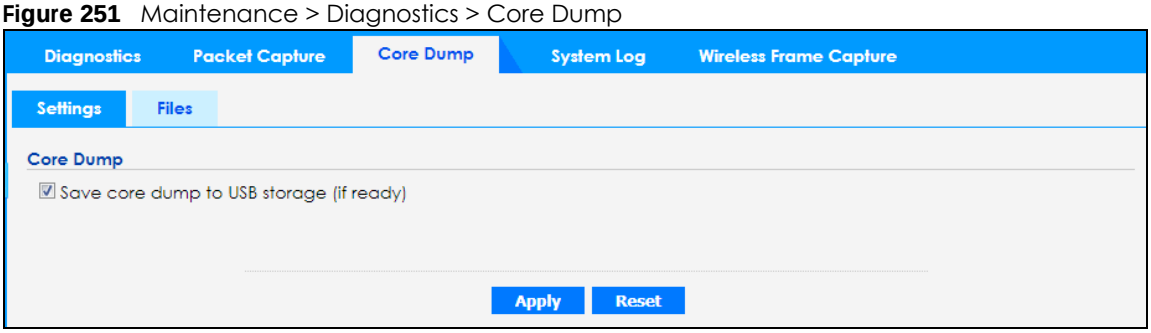


32.4 Core Dump

Use the **Core Dump** screen to have the NXC save a process's core dump to an attached USB storage device if the process terminates abnormally (crashes). You may need to send this file to customer support for troubleshooting.

Click **Maintenance > Diagnostics > Core Dump** to open the following screen.

Figure 251 Maintenance > Diagnostics > Core Dump



The following table describes the labels in this screen.

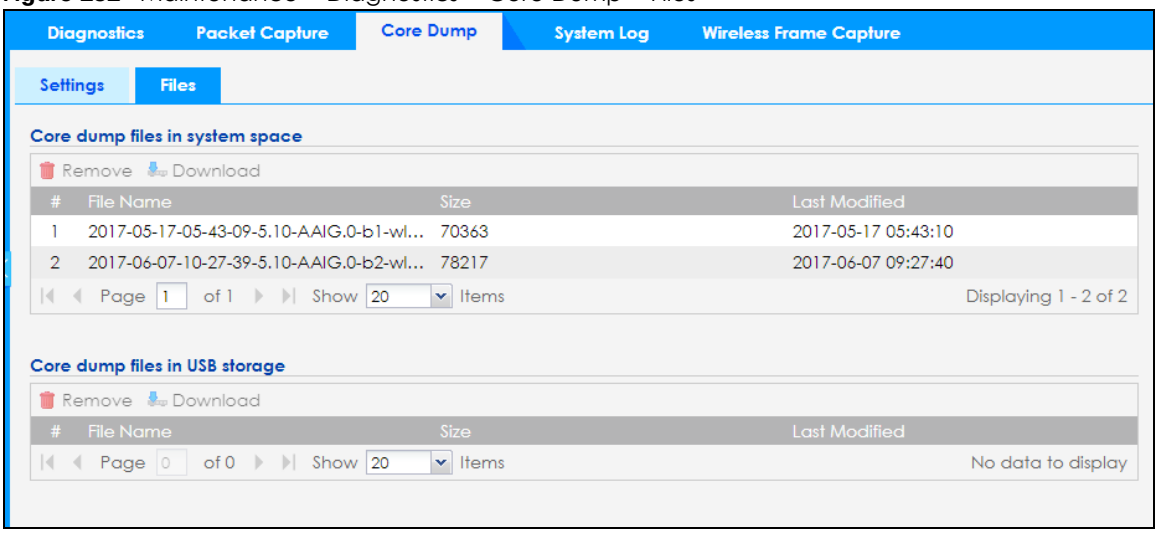
Table 201 Maintenance > Diagnostics > Core Dump

LABEL	DESCRIPTION
Save core dump to USB storage (if ready)	Select this to have the NXC save a process's core dump to an attached USB storage device if the process terminates abnormally (crashes). If you clear this option the NXC only saves to flash memory. Once the flash is full, the NXC stops generating the core dump file.
Apply	Click **Apply** to save the changes.
Reset	Click **Reset** to return the screen to its last-saved settings.

32.4.1 Core Dump Files

Click **Maintenance > Diagnostics > Core Dump > Files** to open the core dump files screen. This screen lists the core dump files stored on the NXC or a connected USB storage device. You may need to send these files to customer support for troubleshooting.

Figure 252 Maintenance > Diagnostics > Core Dump > Files



The following table describes the labels in this screen.

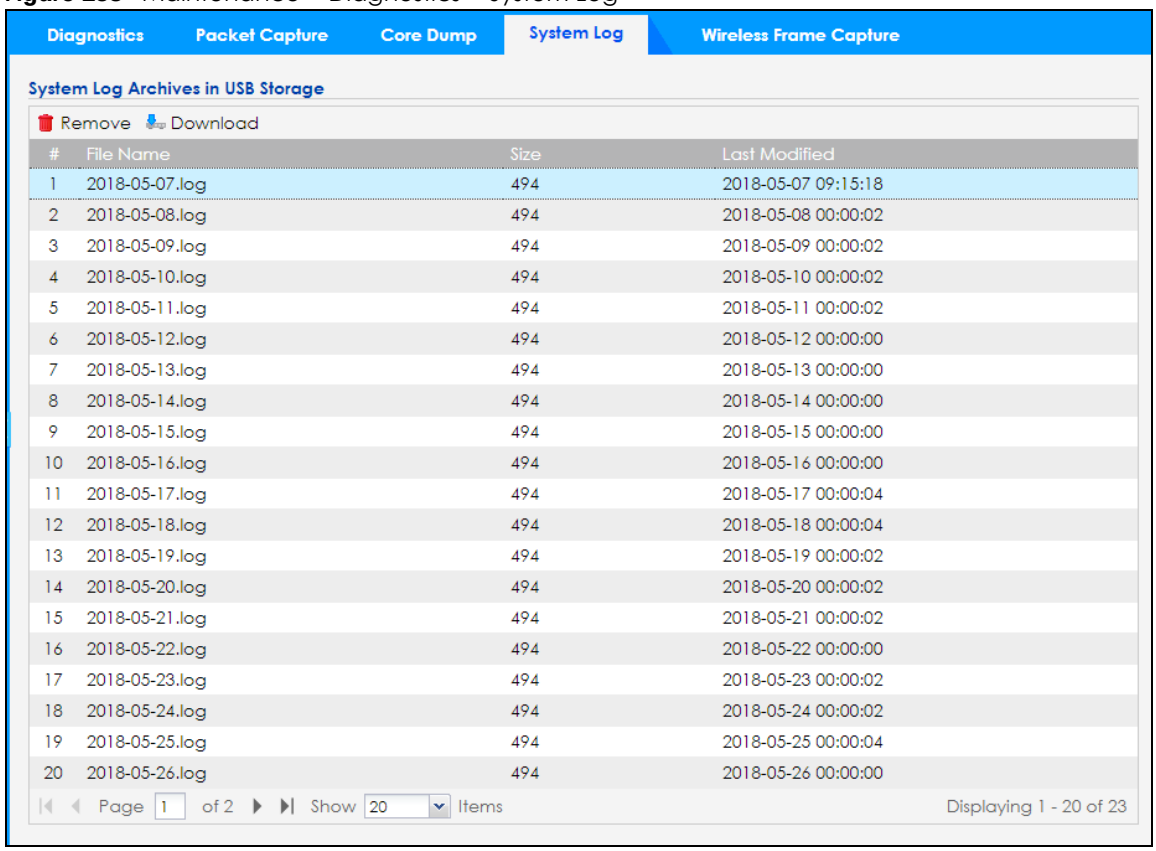
Table 202 Maintenance > Diagnostics > Core Dump > Files

LABEL	DESCRIPTION
Remove	Select files and click **Remove** to delete them from the NXC or the connected USB storage device. Use the [Shift] and/or [Ctrl] key to select multiple files. A pop-up window asks you to confirm that you want to delete.
Download	Click a file to select it and click **Download** to save it to your computer.
#	This column displays the number for each core dump file entry. The total number of core dump files that you can save depends on the file sizes and the available flash storage space.
File Name	This column displays the label that identifies the file.
Size	This column displays the size (in bytes) of a file.
Last Modified	This column displays the date and time that the individual files were saved.

32.5 System Log

Click **Maintenance > Diagnostics > System Log** to open the system log files screen. This screen lists the files of system logs stored on a connected USB storage device. The files are in comma separated value (csv) format. You can download them to your computer and open them in a tool like Microsoft's Excel.

Figure 253 Maintenance > Diagnostics > System Log



The following table describes the labels in this screen.

Table 203 Maintenance > Diagnostics > System Log

LABEL	DESCRIPTION
Remove	Select files and click **Remove** to delete them from the connected USB storage device. Use the [Shift] and/or [Ctrl] key to select multiple files. A pop-up window asks you to confirm that you want to delete.
Download	Click a file to select it and click **Download** to save it to your computer.
#	This column displays the number for each file entry. The total number of files that you can save depends on the file sizes and the available storage space.
File Name	This column displays the label that identifies the file.
Size	This column displays the size (in bytes) of a file.
Last Modified	This column displays the date and time that the individual files were saved.

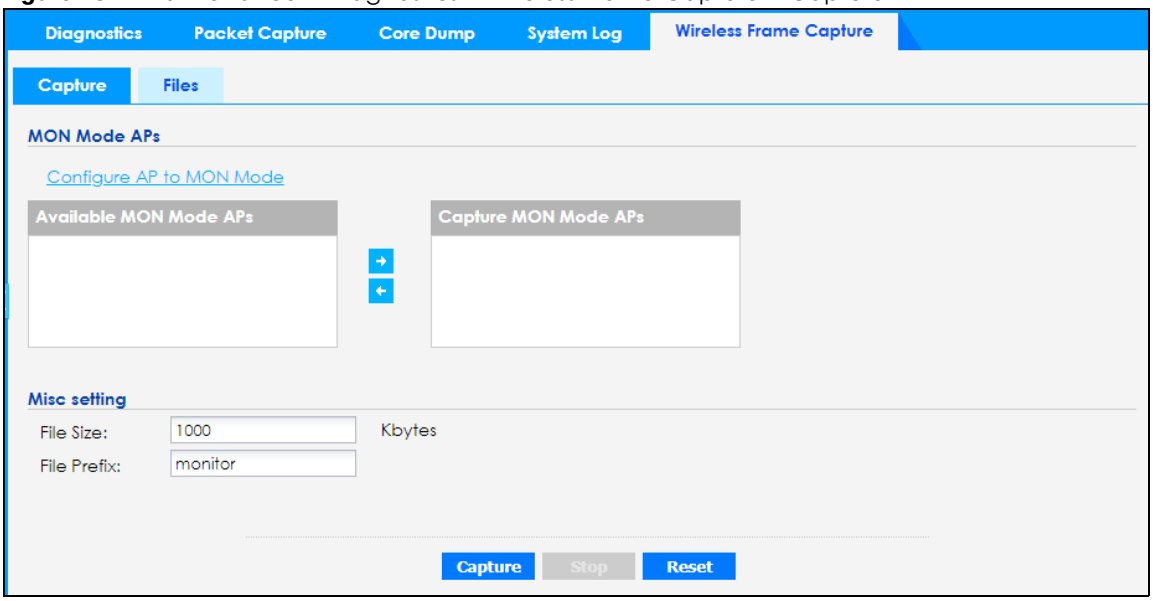
32.6 Wireless Frame Capture

Use this screen to capture wireless network traffic going through the AP interfaces connected to your NXC. Studying these frame captures may help you identify network problems.

Click **Maintenance > Diagnostics > Wireless Frame Capture** to display this screen.

Note: New capture files overwrite existing files of the same name. Change the **File Prefix** field's setting to avoid this.

Figure 254 Maintenance > Diagnostics > Wireless Frame Capture > Capture



The following table describes the labels in this screen.

Table 204 Maintenance > Diagnostics > Wireless Frame Capture > Capture

LABEL	DESCRIPTION
MON Mode APs	
Configure AP to MON Mode	Click this to go the **Configuration > Wireless > AP Management** screen, where you can set one or more APs to monitor mode.
Available MON Mode APs	This column displays which APs on your wireless network are currently configured for monitor mode. Use the arrow buttons to move APs off this list and onto the **Captured MON Mode APs** list.
Capture MON Mode APs	This column displays the monitor-mode configured APs selected to for wireless frame capture.
Misc Setting	
File Size	Specify a maximum size limit in kilobytes for the total combined size of all the capture files on the NXC, including any existing capture files and any new capture files you generate. Note: If you have existing capture files you may need to set this size larger or delete existing capture files. The valid range is 1 to 50000. The NXC stops the capture and generates the capture file when either the file reaches this size.
File Prefix	Specify text to add to the front of the file name in order to help you identify frame capture files. You can modify the prefix to also create new frame capture files each time you perform a frame capture operation. Doing this does no overwrite existing frame capture files. The file format is: [file prefix].cap. For example, "monitor.cap".

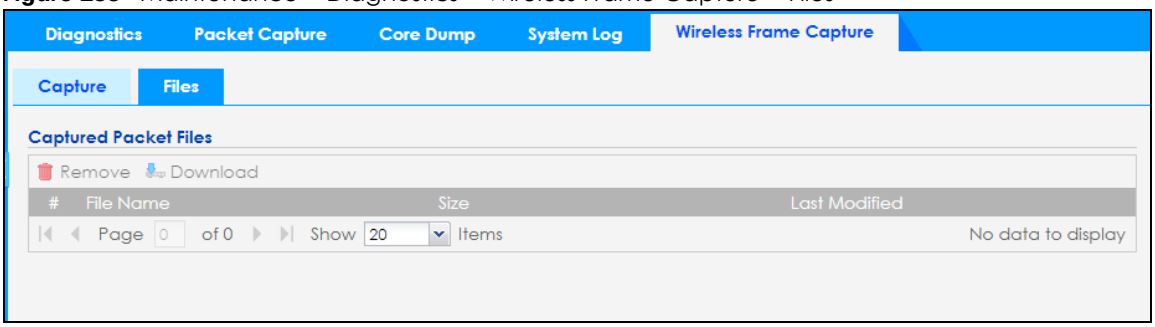
Table 204 Maintenance > Diagnostics > Wireless Frame Capture > Capture (continued)

LABEL	DESCRIPTION
Capture	Click this button to have the NXC capture frames according to the settings configured in this screen. You can configure the NXC while a frame capture is in progress although you cannot modify the frame capture settings. The NXC's throughput or performance may be affected while a frame capture is in progress. After the NXC finishes the capture it saves a combined capture file for all APs. The total number of frame capture files that you can save depends on the file sizes and the available flash storage space. Once the flash storage space is full, adding more frame captures will fail.
Stop	Click this button to stop a currently running frame capture and generate a combined capture file for all APs.
Reset	Click this button to return the screen to its last-saved settings.

32.6.1 Wireless Frame Capture Files

Click **Maintenance > Diagnostics > Wireless Frame Capture > Files** to open this screen. This screen lists the files of wireless frame captures the NXC has performed. You can download the files to your computer where you can study them using a packet analyzer (also known as a network or protocol analyzer) such as Wireshark.

Figure 255 Maintenance > Diagnostics > Wireless Frame Capture > Files



The following table describes the labels in this screen.

Table 205 Maintenance > Diagnostics > Wireless Frame Capture > Files

LABEL	DESCRIPTION
Remove	Select files and click **Remove** to delete them from the NXC. Use the [Shift] and/or [Ctrl] key to select multiple files. A pop-up window asks you to confirm that you want to delete.
Download	Click a file to select it and click **Download** to save it to your computer.
#	This column displays the number for each packet capture file entry. The total number of packet capture files that you can save depends on the file sizes and the available flash storage space.
File Name	This column displays the label that identifies the file. The file name format is interface name-file suffix.cap.
Size	This column displays the size (in bytes) of a configuration file.
Last Modified	This column displays the date and time that the individual files were saved.

CHAPTER 33
Packet Flow Explore

33.1 Overview

Use this to get a clear picture on how the NXC determines where to forward a packet and how to change the source IP address of the packet according to your current settings. This function provides you a summary of all your routing and SNAT settings and helps troubleshoot any related problems.

33.1.1 What You Can Do in this Chapter

- The **Routing Status** screen (Section 33.2 on page 418) displays the overall routing flow and each routing function's settings.
- The **SNAT Status** screen (Section 33.3 on page 421) displays the overall source IP address conversion (SNAT) flow and each SNAT function's settings.

33.2 The Routing Status Screen

The **Routing Status** screen allows you to view the current routing flow and quickly link to specific routing settings. Click a function box in the **Routing Flow** section, the related routes (activated) will display in the **Routing Table** section. To access this screen, click **Maintenance** > **Packet Flow Explore**.

The order of the routing flow may vary depending on whether you:

- select **use policy route to override direct route** in the **CONFIGURATION > Network > Routing > Policy Route** screen.
- use policy routes to control 1-1 NAT by using the `policy control-virtual-server-rules activate` command.

Note: Once a packet matches the criteria of a routing rule, the NXC takes the corresponding action and does not perform any further flow checking.

Figure 256 Maintenance > Packet Flow Explore > Routing Status (Direct Route)

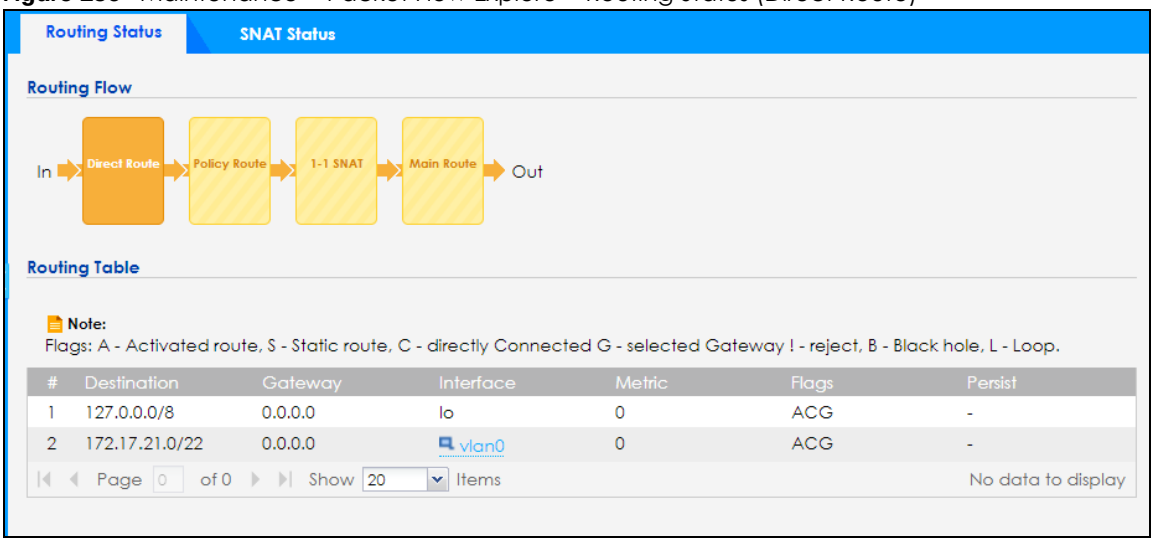


Figure 257 Maintenance > Packet Flow Explore > Routing Status (Policy Route)

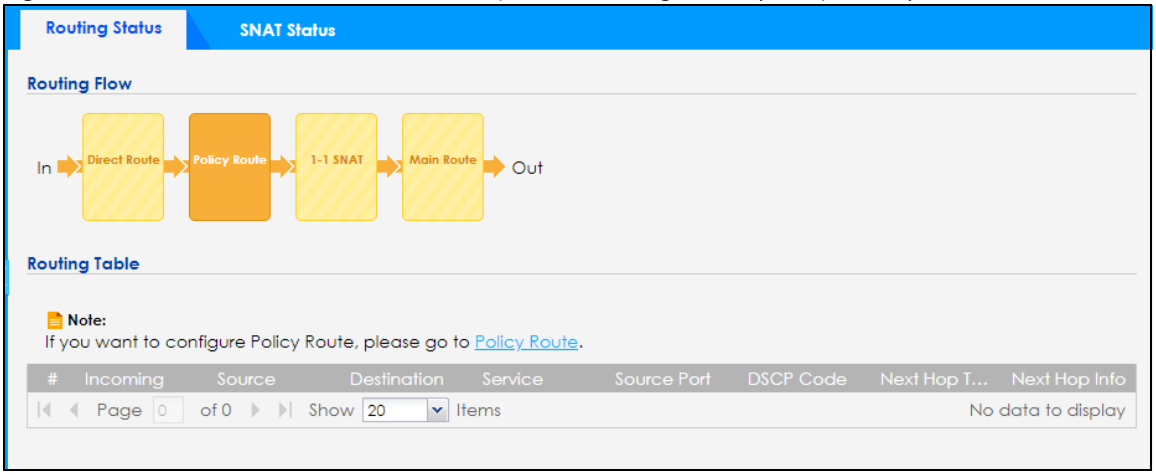


Figure 258 Maintenance > Packet Flow Explore > Routing Status (1-1 SNAT)

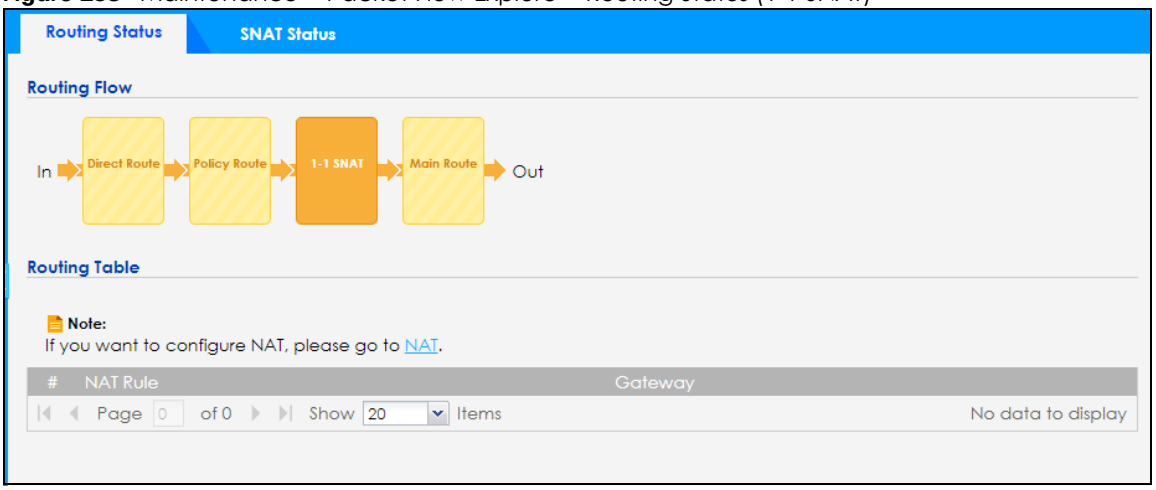
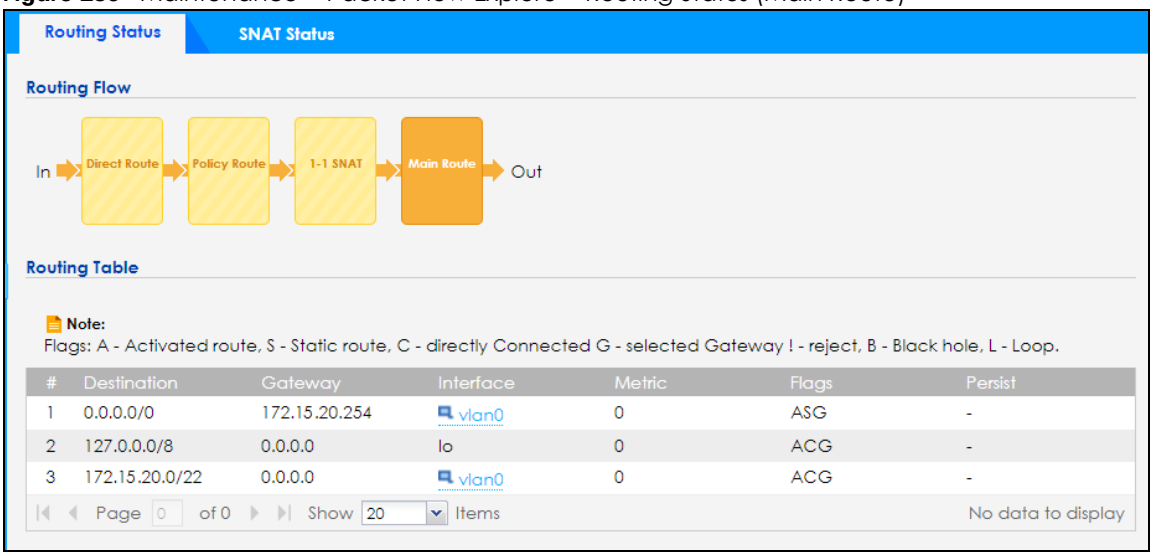


Figure 259 Maintenance > Packet Flow Explore > Routing Status (Main Route)



The following table describes the labels in this screen.

Table 206 Maintenance > Packet Flow Explore > Routing Status

LABEL	DESCRIPTION
Routing Flow	This section shows you the flow of how the NXC determines where to route a packet. Click a function box to display the related settings in the **Routing Table** section.
Routing Table	This section shows the corresponding settings according to the function box you click in the **Routing Flow** section.
The following fields are available if you click **Direct Route** or **Main Route** in the **Routing Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
Destination	This is the destination IP address of a route.
Gateway	This is the IP address of the next-hop gateway or the interface through which the traffic is routed.
Interface	This is the name of an interface associated with the route.
Metric	This is the route's priority among the displayed routes.
Flags	This indicates additional information for the route. The possible flags are: • **A** - this route is currently activated. • **S** - this is a static route. • **C** - this is a direct connected route. • **O** - this is a dynamic route learned through OSPF. • **R** - this is a dynamic route learned through RIP. • **G** - the route is to a gateway (router) in the same network. • **!** - this is a route which forces a route lookup to fail. • **B** - this is a route which discards packets. • **L** - this is a recursive route.
Persist	This is the remaining time of a dynamically learned route. The NXC removes the route after this time period is counted down to zero.
The following fields are available if you click **Policy Route** in the **Routing Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
PR #	This is the number of an activated policy route. If you have configured a schedule for the route, this screen only displays the route at the scheduled time.
Incoming	This is the interface on which the packets are received.
Source	This is the source IP address(es) from which the packets are sent.

Table 206 Maintenance > Packet Flow Explore > Routing Status (continued)

LABEL	DESCRIPTION
Destination	This is the destination IP address(es) to which the packets are transmitted.
Service	This is the name of the service object. **any** means all services.
Source Port	This is the name of a service object. The NXC applies the policy route to the packets sent from the corresponding service port. **any** means all service ports.
DSCP Code	This is the DSCP value of incoming packets to which this policy route applies.
Next Hop Type	This is the type of the next hop to which packets are directed.
Next Hop Info	• This is the main route if the next hop type is **Auto**. • This is the interface name and gateway IP address if the next hop type is **Interface /GW**.
The following fields are available if you click **1-1 SNAT** in the **Routing Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
NAT Rule	This is the name of an activated 1:1 or Many 1:1 NAT rule in the NAT table.
Source	This is the original source IP address(es). **any** means any IP address.
Destination	This is the original destination IP address(es). **any** means any IP address.
Outgoing	This is the name of an interface which transmits packets out of the NXC.
Gateway	This is the IP address of the gateway in the same network of the outgoing interface.

33.3 The SNAT Status Screen

The **SNAT Status** screen allows you to view and quickly link to specific source NAT (SNAT) settings. Click a function box in the **SNAT Flow** section, the related SNAT rules (activated) will display in the **SNAT Table** section. To access this screen, click **Maintenance** > **Packet Flow Explore** > **SNAT Status**.

The order of the SNAT flow may vary depending on whether you:

- use policy routes to control 1-1 NAT by using the `policy control-virtual-server-rules activate` command.

Note: Once a packet matches the criteria of an SNAT rule, the NXC takes the corresponding action and does not perform any further flow checking.

Figure 260 Maintenance > Packet Flow Explore > SNAT Status (Policy Route SNAT)

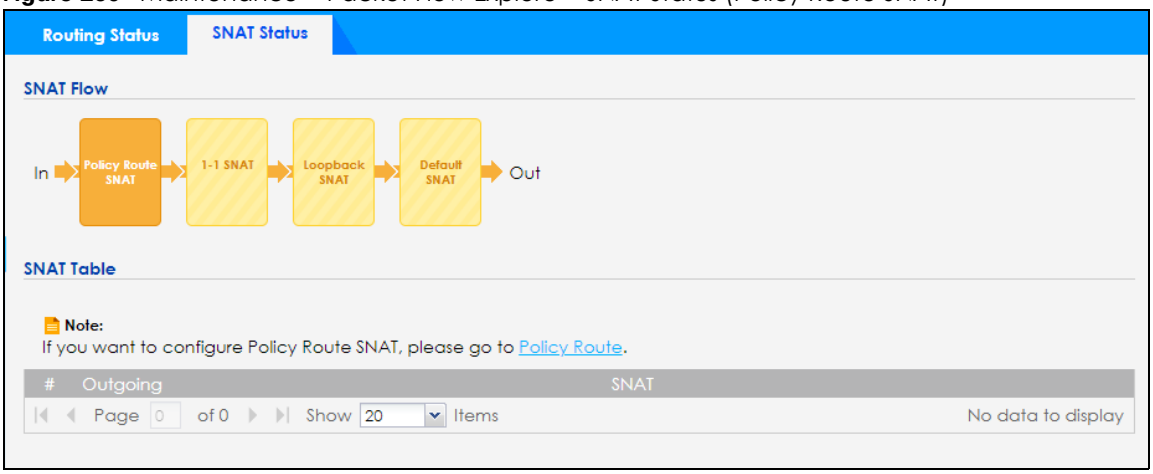


Figure 261 Maintenance > Packet Flow Explore > SNAT Status (1-1 SNAT)

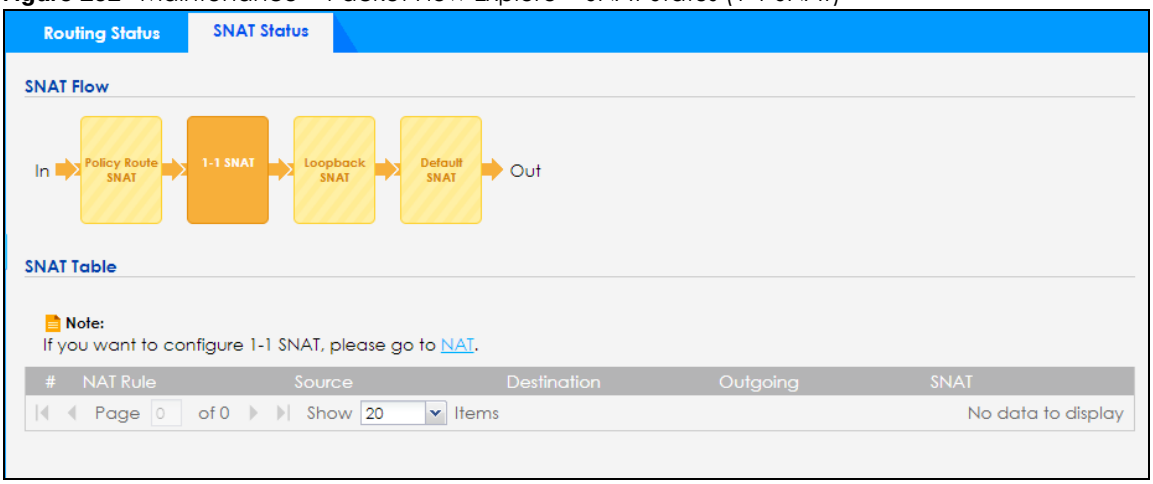


Figure 262 Maintenance > Packet Flow Explore > SNAT Status (Loopback SNAT)

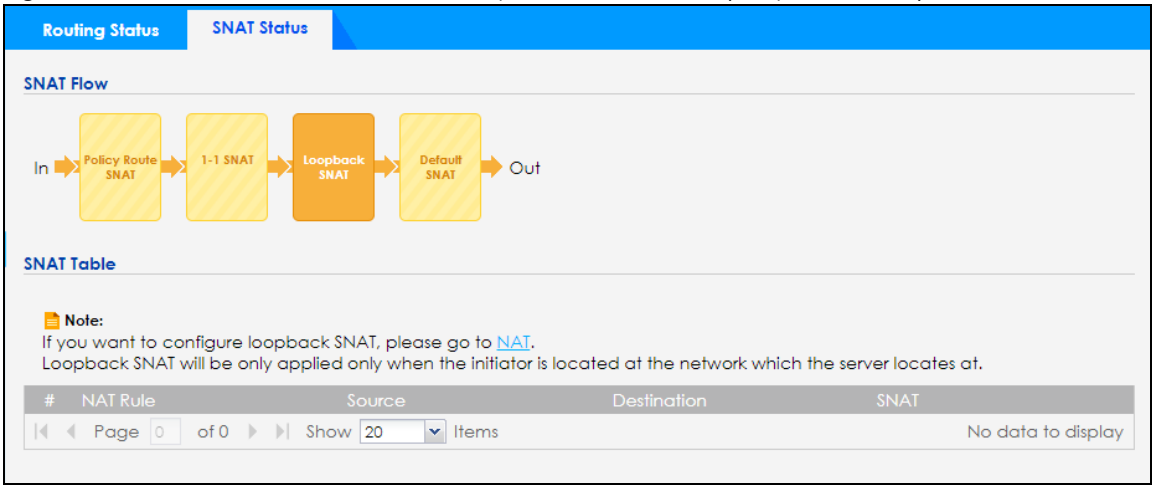
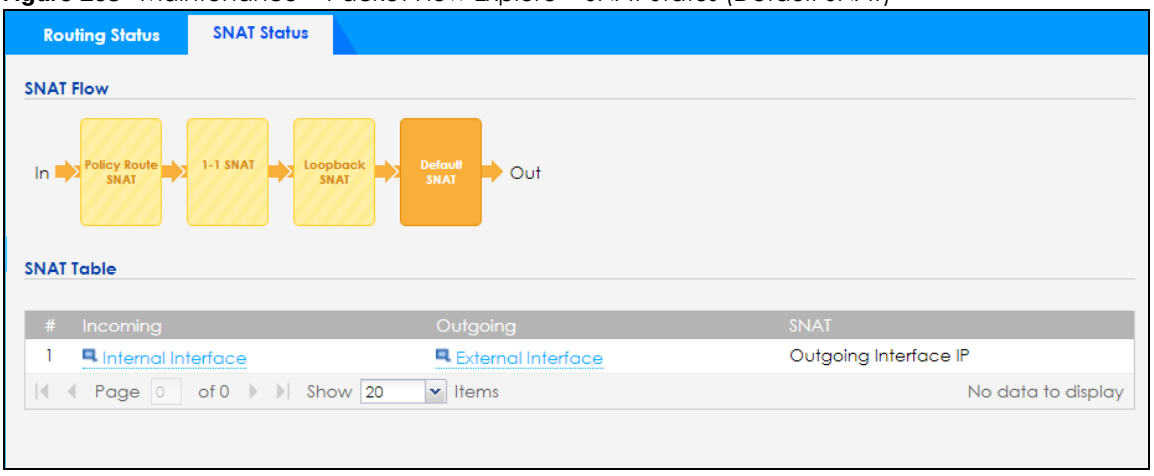


Figure 263 Maintenance > Packet Flow Explore > SNAT Status (Default SNAT)



The following table describes the labels in this screen.

Table 207 Maintenance > Packet Flow Explore > SNAT Status

LABEL	DESCRIPTION
SNAT Flow	This section shows you the flow of how the NXC changes the source IP address for a packet according to the rules you have configured in the NXC. Click a function box to display the related settings in the **SNAT Table** section.
SNAT Table	The table fields in this section vary depending on the function box you select in the **SNAT Flow** section.
The following fields are available if you click **Policy Route SNAT** in the **SNAT Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
PR #	This is the number of an activated policy route which uses SNAT.
Outgoing	This is the outgoing interface that the route uses to transmit packets.
SNAT	This is the source IP address(es) that the SNAT rule uses finally.
The following fields are available if you click **1-1 SNAT** in the **SNAT Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
NAT Rule	This is the name of an activated NAT rule which uses SNAT.
Source	This is the original source IP address(es).
Destination	This is the original destination IP address(es).
Outgoing	This is the outgoing interface that the SNAT rule uses to transmit packets.
SNAT	This is the source IP address(es) that the SNAT rule uses finally.
The following fields are available if you click **Loopback SNAT** in the **SNAT Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
NAT Rule	This is the name of an activated NAT rule which uses SNAT and enables NAT loopback.
Source	This is the original source IP address(es). **any** means any IP address.
Destination	This is the original destination IP address(es). **any** means any IP address.
SNAT	This indicates which source IP address the SNAT rule uses finally. For example, **Outgoing Interface IP** means that the NXC uses the IP address of the outgoing interface as the source IP address for the matched packets it sends out through this rule.
The following fields are available if you click **Default SNAT** in the **SNAT Flow** section.	
#	This field is a sequential value, and it is not associated with any entry.
Incoming	This indicates internal interface(s) on which the packets are received.
Outgoing	This indicates external interface(s) from which the packets are transmitted.
SNAT	This indicates which source IP address the SNAT rule uses finally. For example, **Outgoing Interface IP** means that the NXC uses the IP address of the outgoing interface as the source IP address for the matched packets it sends out through this rule.

CHAPTER 34
Reboot

34.1 Overview

Use this screen to restart the device.

34.1.1 What You Need To Know

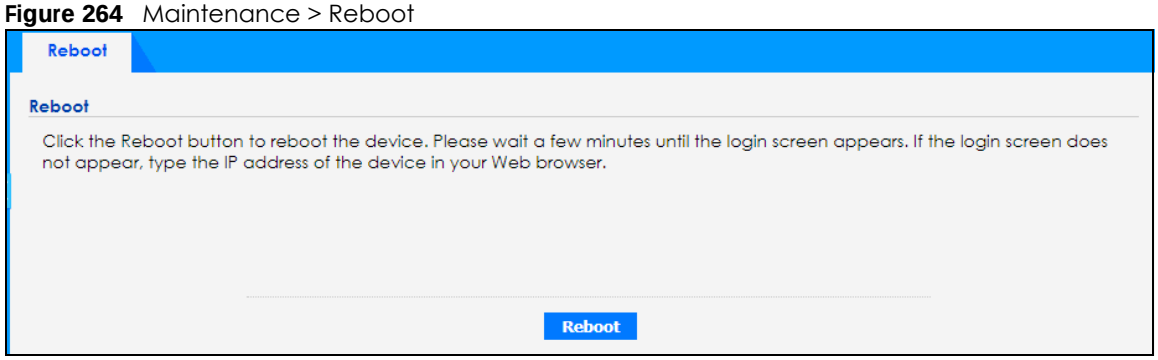
If you applied changes in the Web configurator, these were saved automatically and do not change when you reboot. If you made changes in the CLI, however, you have to use the `write` command to save the configuration before you reboot. Otherwise, the changes are lost when you reboot.

Reboot is different to reset; reset returns the device to its default configuration.

34.2 Reboot

This screen allows remote users to restart the device. To access this screen, click **Maintenance** > **Reboot**.

Figure 264 Maintenance > Reboot



Click the **Reboot** button to restart the NXC. Wait a few minutes until the login screen appears. If the login screen does not appear, type the IP address of the device in your Web browser.

You can also use the CLI command `reboot` to restart the NXC.

CHAPTER 35
Shutdown

35.1 Overview

Use this screen to shut down the device.

Always use Maintenance > Shutdown > Shutdown or the `shutdown` command before you turn off the NXC or remove the power. Not doing so can cause the firmware to become corrupt.

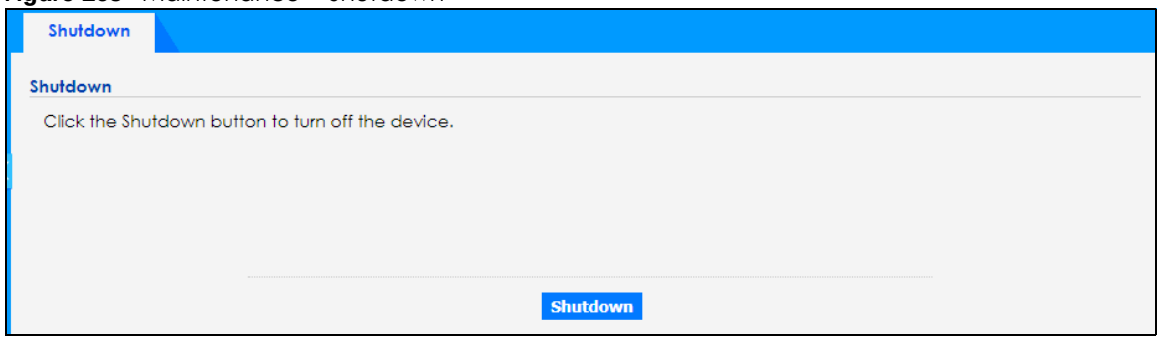
35.1.1 What You Need To Know

Shutdown writes all cached data to the local storage and stops the system processes. Shutdown is different to reset; reset returns the device to its default configuration.

35.2 Shutdown

To access this screen, click **Maintenance** > **Shutdown**.

Figure 265 Maintenance > Shutdown



Click the **Shutdown** button to shut down the NXC. Wait for the device to shut down before you manually turn off or remove the power. It does not turn off the power.

You can also use the CLI command `shutdown` to shut down the NXC.

PART III
Appendices and Troubleshooting

CHAPTER 36
Troubleshooting

36.1 Overview

This chapter offers some suggestions to solve problems you might encounter.

36.1.1 General

This section provides a broad range of troubleshooting tips for your device.

None of the LEDs turn on.

Make sure that you have the power cord connected to the NXC and plugged in to an appropriate power source. Make sure that you have both power cords connected to the NXC and plugged into appropriate power sources. Make sure you have both of the NXC's power switches turned on. Make sure you have the NXC turned on. Check all cable connections.

If the LEDs still do not turn on, you may have a hardware problem. In this case, you should contact your local vendor.

Cannot access the NXC from the LAN.

- Check the cable connection between the NXC and your computer or switch.
- Ping the NXC from a LAN computer. Make sure your computer's Ethernet card is installed and functioning properly. Also make sure that its IP address is in the same subnet as the NXC's.
- In the computer, click **Start** > **Programs** > **Accessories** and then **Command Prompt**. In the **Command Prompt** window, type "ping" followed by the NXC's LAN IP address (192.168.1.1 is the default) and then press [ENTER]. The NXC should reply.
- If you've forgotten the NXC's password, use the **RESET** button. Press the button in for about 5 seconds (or until the **PWR** LED starts to blink), then release it. It returns the NXC to the factory defaults (password is 1234, LAN IP address 192.168.1.1 etc.; see your User's Guide for details).
- If you've forgotten the NXC's IP address, you can use the commands through the console port to check it. Connect your computer to the **CONSOLE** port using a console cable. Your computer should have a terminal emulation communications program (such as HyperTerminal) set to VT100 terminal emulation, no parity, 8 data bits, 1 stop bit, no flow control and 115200 bps port speed.
- Check if your computer is connecting to the correct port after you change the default settings of the management VLAN. Go to the **Configuration > Interface > VLAN** screen to check the members of the management VLAN.

I cannot access the Internet.

- Check the NXC's connection to the Ethernet jack with Internet access. Make sure the Internet gateway device (such as a DSL modem) is working properly.
- If the NXC is operating in its default bridge mode, ensure that the DHCP server to which the NXC is connected is properly configured to assign IP addresses.
- Check the NXC's security settings and/or interface and VLAN settings to ensure you have not inadvertently excluded your client device from accessing the network or the Internet.

The NXC is not applying the custom policy route I configured.

The NXC checks the policy routes in the order that they are listed. So make sure that your custom policy route comes before any other routes that the traffic would also match.

I can't enter the interface name I want.

The format of interface names other than the Ethernet interface names is very strict. Each name consists of 2-4 letters (interface type), followed by a number (x, limited by the maximum number of each type of interface). For example, VLAN interfaces are vlan0, vlan1, vlan2, ...; and so on.

My rules and settings that apply to a particular interface no longer work.

The interface's IP address may have changed. To avoid this create an IP address object based on the interface. This way the NXC automatically updates every rule or setting that uses the object whenever the interface's IP address settings change. For example, if you change ge1's IP address, the NXC automatically updates the corresponding interface-based, ge1 subnet address object.

Hackers have accessed my WEP-encrypted wireless LAN.

WEP is extremely insecure. Its encryption can be broken by an attacker, using widely-available software. It is strongly recommended that you use a more effective security mechanism. Use the strongest security mechanism that all the wireless devices in your network support. WPA2 or WPA2-PSK is recommended.

The wireless security is not following the re-authentication timer setting I specified.

If a RADIUS server authenticates wireless stations, the re-authentication timer on the RADIUS server has priority. Change the RADIUS server's configuration if you need to use a different re-authentication timer setting.

The NXC is not applying an interface's configured ingress bandwidth limit.

At the time of writing, the NXC does not support ingress bandwidth management.

The NXC routes and applies SNAT for traffic from some interfaces but not from others.

The NXC automatically uses SNAT for traffic it routes from internal interfaces to external interfaces. For example LAN to WAN traffic. You must manually configure a policy route to add routing and SNAT settings for an interface with the **Interface Type** set to **General**. You can also configure a policy route to override the default routing and SNAT behavior for an interface with the **Interface Type** set to **Internal** or **External**.

The NXC keeps resetting the connection.

If an alternate gateway on the LAN has an IP address in the same subnet as the NXC's LAN IP address, return traffic may not go through the NXC. This is called an asymmetrical or "triangle" route. This causes the NXC to reset the connection, as the connection has not been acknowledged.

I changed the LAN IP address and can no longer access the Internet.

The NXC automatically updates address objects based on an interface's IP address, subnet, or gateway if the interface's IP address settings change. However, you need to manually edit any address objects for your LAN that are not based on the interface.

I cannot get the RADIUS server to authenticate the NXC's default admin account.

The default **admin** account is always authenticated locally, regardless of the authentication method setting.

The NXC fails to authenticate the ext-user user accounts I configured.

An external server such as AD, LDAP or RADIUS must authenticate the ext-user accounts. If the NXC tries to use the local database to authenticate an **ext-user**, the authentication attempt will always fail.

I cannot add the admin users to a user group with access users.

You cannot put access users and admin users in the same user group.

I cannot add the default admin account to a user group.

You cannot put the default **admin** account into any user group.

The schedule I configured is not being applied at the configured times.

Make sure the NXC's current date and time are correct.

I cannot get a certificate to import into the NXC.

1. For **My Certificates**, you can import a certificate that matches a corresponding certification request that was generated by the NXC. You can also import a certificate in PKCS#12 format, including the certificate's public and private keys.
2. You must remove any spaces from the certificate's filename before you can import the certificate.
3. Any certificate that you want to import has to be in one of these file formats:
   - Binary X.509: This is an ITU-T recommendation that defines the formats for X.509 certificates.
   - PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses lowercase letters, uppercase letters and numerals to convert a binary X.509 certificate into a printable form.
   - Binary PKCS#7: This is a standard that defines the general syntax for data (including digital signatures) that may be encrypted. A PKCS #7 file is used to transfer a public key certificate. The private key is not included. The NXC currently allows the importation of a PKS#7 file that contains a single certificate.
   - PEM (Base-64) encoded PKCS#7: This Privacy Enhanced Mail (PEM) format uses lowercase letters, uppercase letters and numerals to convert a binary PKCS#7 certificate into a printable form.
   - Binary PKCS#12: This is a format for transferring public key and private key certificates.The private key in a PKCS #12 file is within a password-encrypted envelope. The file's password is not connected to your certificate's public or private passwords. Exporting a PKCS #12 file creates this and you must provide it to decrypt the contents when you import the file into the NXC.

   Note: Be careful not to convert a binary file to text during the transfer process. It is easy for this to occur since many programs use text files by default.

I cannot access the NXC from a computer connected to the Internet.

Check the service control rules.

I uploaded a logo to display on the upper left corner of the Web Configurator login screen and access page but it does not display properly.

Make sure the logo file is a GIF, JPG, or PNG of 100 kilobytes or less.

I uploaded a logo to use as the screen or window background but it does not display properly.

Make sure the logo file is a GIF, JPG, or PNG of 100 kilobytes or less.

The NXC's traffic throughput rate decreased after I started collecting traffic statistics.

Data collection may decrease the NXC's traffic throughput rate.

I can only see newer logs. Older logs are missing.

When a log reaches the maximum number of log messages, new log messages automatically overwrite existing log messages, starting with the oldest existing log message first.

The commands in my configuration file or shell script are not working properly.

- In a configuration file or shell script, use "#" or "!" as the first character of a command line to have the NXC treat the line as a comment.
- Your configuration files or shell scripts can use "exit" or a command line consisting of a single "!" to have the NXC exit sub command mode.
- Include `write` commands in your scripts. Otherwise the changes will be lost when the NXC restarts. You could use multiple `write` commands in a long script.

Note: "exit" or "!'" must follow sub commands if it is to make the NXC exit sub command mode.

I cannot get the firmware uploaded using the commands.

The Web Configurator is the recommended method for uploading firmware. You only need to use the command line interface if you need to recover the firmware. See the CLI Reference Guide for how to determine if you need to recover the firmware and how to recover it.

My packet capture captured less than I wanted or failed.

The packet capture screen's **File Size** sets a maximum size limit for the total combined size of all the capture files on the NXC, including any existing capture files and any new capture files you generate. If you have existing capture files you may need to set this size larger or delete existing capture files.

The NXC stops the capture and generates the capture file when either the capture files reach the **File Size** or the time period specified in the **Duration** field expires.

My earlier packet capture files are missing.

New capture files overwrite existing files of the same name. Change the **File Suffix** field's setting to avoid this.

The screens of the NXC Web Configurator are not displaying properly.

Clear cache and cookies from your web browser, and try to access the Web Configurator again.

36.1.2 Wireless

This section provides troubleshooting for wireless devices connected to the NXC.

APs cannot be managed by the NXC.

- There may be a configuration mismatch between the AP and the NXC. This could be the result of a number of things, such as incorrect VLAN topology, incorrect AP profiles, incorrect security settings between the AP, and the NXC.

  See Section 6.11 on page 86 for how to check if the AP's runtime management VLAN ID setting matches the NXC's management VLAN ID setting for the AP.

  See Section 6.11.1 on page 90 for how to check if the AP's configuration is in conflict with the NXC's settings for the AP.
- The wireless client's MAC address may be on the MAC filtering list. See Section 19.3.3 on page 275 for details on managing the NXC MAC Filter.
- Your AP needs to support CAPWAP managed AP mode in order to be managed by the NXC. See the NWA/WAC Series User's Guide.

- The wireless client may not be able to get an IP:

  If the NXC is operating in bridge mode, check the settings on the DHCP server associated with the network.

  Check the wireless client's own network configuration settings to ensure that it is set up to receive its IP address automatically.

  If the NXC or a connected Internet access device are managing the network with static IPs, make sure that the server settings for issuing those IPs are properly configured.

  Check the wireless client's own network settings to ensure it is already set up with its static IP address.
- Authentication of the wireless client with the authentication server may have failed. Ensure the AP profile assigned to the AP uses a security profile that is properly configured and which matches the security settings in use by the NXC. For example, if the security mode on the AP is set to WPA/WPA2 then make sure the authentication server is running and able to complete the 802.1x authentication sequence. See Chapter 19 on page 257 and Chapter 8 on page 119 for more.

  If the AP profile uses an SSID security profile that has the AP use an external server to authenticate wireless clients by MAC address, check the SSID security profile's MAC authentication settings (see Section 19.3.2.1 on page 271).
- Enable the AP **Wireless LAN** logs (see Section 30.3.2 on page 380).
- Check the AP log **Wireless LAN** logs (Section 6.18 on page 113) for WTP logs. WTP stands for Wireless Terminal Point and is equivalent to an AP.
- If you cannot solve the problem on your own, before contacting Customer Support use the built-in wireless frame capture tools (Chapter 32 on page 401) to capture data that can be used for more granular troubleshooting procedures. To use the built-in wireless frame capture tool, first set up a second AP nearby to act as a Monitor AP (Chapter 8 on page 119).

The AP status is registered as offline even though it is on.

- Check the network connections between the NXC and the AP to ensure they are still intact.
- The AP may be suffering from instability. Disconnect it to turn its power off, wait some time, then reconnect it and see if that resolves the issue.
- The CAPWAP daemon may be down. You can use the NXC's built-in diagnostic tools and CLI console to get CAPWAP debug messages which can later be sent to customer service for analysis. See Chapter 3 on page 33 for more information.

A wireless client cannot be authenticated through the Captive Portal.

If the Captive Portal redirects a wireless client to a failed login page or an internal server error page, then the authentication server may not be reachable. Make sure that the NXC can reach it if is external to the LAN by opening the Console Window and pinging the server's IP address.

If Captive Portal is using the external web portal:

- Make sure the Captive Portal configuration pointing to it is correct. You must configure the **Login URL** field.
- Check that the external Web server is configured properly.
- It is recommended to have the external web server on the same subnet as the login users.

The NXC sends wireless clients the default logout page instead of a login page.

Make sure you have configured the Captive Portal external web portal's **Login URL** field correctly.

Wireless clients are not being load balanced among my APs.

- Make sure that all the APs used by the wireless clients in question share the same SSID, security, and radio settings.
- Make sure that the APs belong to the same load balancing group.
- Make sure that all the APs are in the same broadcast domain.
- Make sure that the wireless clients are in range of the other APs; if they are only in range of a single AP, then load balancing may not be as effective.

In the **Monitor > Wireless > AP Info > AP List** screen, there is no load balancing indicator associated with any APs assigned to the load balancing task.

- Check to be sure that the AP profile which contains the load balancing settings is correctly assigned to the APs in question.
- The load balancing task may have been terminated because further load balancing on the APs in question is no longer required.

36.2 Resetting the NXC

If you cannot access the NXC by any method, try restarting it by turning the power off and then on again. If you still cannot access the NXC by any method or you forget the administrator password(s), you can reset the NXC to its factory-default settings. Any configuration file or shell script that you saved on the NXC should still be available afterwards.

Use the following procedure to reset the NXC to its factory-default settings. This overwrites the settings in the startup-config.conf file with the settings in the system-default.conf file.

Note: This procedure removes the current configuration.

1. Make sure the **SYS** LED is on and not blinking.
2. Press the **RESET** button and hold it until the **SYS** LED begins to blink. (This usually takes about five seconds.)
3. Release the **RESET** button, and wait for the NXC to restart.

   You should be able to access the NXC using the default settings.

36.3 Getting More Troubleshooting Help

Search for support information for your model at www.zyxel.com for more troubleshooting suggestions.

APPENDIX A
Log Descriptions

This appendix provides descriptions of example log messages.

The ZySH logs deal with internal system errors.

Table 208 ZySH Logs

LOG MESSAGE	DESCRIPTION
Invalid message queue. Maybe someone starts another zysh daemon.	
ZySH daemon is instructed to reset by %d	1st:pid num
System integrity error!	
Group OPS	
cannot close property group	
cannot close group	
%s: cannot get size of group	1st:zysh group name
%s: cannot specify properties for entry %s	1st:zysh group name, 2st:zysh entry name
%s: cannot join group %s, loop detected	1st:zysh group name, 2st:zysh group name
cannot create, too many groups (>%d)	1st:max group num
%s: cannot find entry %s	1st:zysh group name, 2st:zysh entry name
%s: cannot remove entry %s	1st:zysh group name, 2st:zysh entry name
List OPS	
can't alloc entry: %s!	1st:zysh entry name
can't retrieve entry: %s!	1st:zysh entry name
can't get entry: %s!	1st:zysh entry name
can't print entry: %s!	1st:zysh entry name
%s: cannot retrieve entries from list!	1st:zysh list name
can't get name for entry %d!	1st:zysh entry index
can't get reference count: %s!	1st:zysh list name

Table 208 ZySH Logs (continued)

LOG MESSAGE	DESCRIPTION
can't print entry name: %s!	1st:zysh entry name
Can't append entry: %s!	1st:zysh entry name
Can't set entry: %s!	1st:zysh entry name
Can't define entry: %s!	1st:zysh entry name
%s: list is full!	1st:zysh list name
Can't undefine %s	1st:zysh list name
Can't remove %s	1st:zysh list name
Table OPS	
%s: cannot retrieve entries from table!	1st:zysh table name
%s: index is out of range!	1st:zysh table name
%s: cannot set entry #%d	1st:zysh table name,2st: zysh entry num
%s: table is full!	1st:zysh table name
%s: invalid old/new index!	1st:zysh table name
Unable to move entry #%d!	1st:zysh entry num
%s: invalid index!	1st:zysh table name
Unable to delete entry #%d!	1st:zysh entry num
Unable to change entry #%d!	1st:zysh entry num
%s: cannot retrieve entries from table!	1st:zysh table name
%s: invalid old/new index!	1st:zysh table name
Unable to move entry #%d!	1st:zysh entry num
%s: apply failed at initial stage!	1st:zysh table name
%s: apply failed at main stage!	1st:zysh table name
%s: apply failed at closing stage!	1st:zysh table name

Table 209 User Logs

LOG MESSAGE	DESCRIPTION
%s %s from %s has logged in EnterpriseWLAN	A user logged into the NXC. 1st %s: The type of user account. 2nd %s: The user's user name. 3rd %s: The name of the service the user is using (HTTP, HTTPS, FTP, Telnet, SSH, or console).
%s %s from %s has logged out EnterpriseWLAN	A user logged out of the NXC. 1st %s: The type of user account. 2nd %s: The user's user name. 3rd %s: The name of the service the user is using (HTTP, HTTPS, FTP, Telnet, SSH, or console).
%s %s from %s has been logged out EnterpriseWLAN (re-auth timeout)	The NXC is signing the specified user out due to a re-authentication timeout. 1st %s: The type of user account. 2nd %s: The user's user name. 3rd %s: The name of the service the user is using (HTTP, HTTPS, FTP, Telnet, SSH, or console).
%s %s from %s has been logged out EnterpriseWLAN (lease timeout)	The NXC is signing the specified user out due to a lease timeout. 1st %s: The type of user account. 2nd %s: The user's user name. 3rd %s: The name of the service the user is using (HTTP, HTTPS, FTP, Telnet, SSH, or console).
%s %s from %s has been logged out EnterpriseWLAN (idle timeout)	The NXC is signing the specified user out due to an idle timeout. 1st %s: The type of user account. 2nd %s: The user's user name. 3rd %s: The name of the service the user is using (HTTP, HTTPS, FTP, Telnet, SSH, or console).
Console has been put into lockout state	Too many failed login attempts were made on the console port so the NXC is blocking login attempts on the console port.
Address %u.%u.%u.%u has been put into lockout state	Too many failed login attempts were made from an IP address so the NXC is blocking login attempts from that IP address. %u.%u.%u.%u: the source address of the user's login attempt
Failed login attempt to EnterpriseWLAN from %s (login on a lockout address)	A login attempt came from an IP address that the NXC has locked out. %u.%u.%u.%u: the source address of the user's login attempt
Failed login attempt to EnterpriseWLAN from %s (reach the max. number of user)	The NXC blocked a login because the maximum login capacity for the particular service has already been reached. %s: service name
Failed login attempt to EnterpriseWLAN from %s (reach the max. number of simultaneous logon)	The NXC blocked a login because the maximum simultaneous login capacity for the administrator or access account has already been reached. %s: service name

Table 209 User Logs (continued)

LOG MESSAGE	DESCRIPTION
User %s has been denied access from %s	The NXC blocked a login according to the access control configuration. %s: service name
User %s has been denied access from %s	The NXC blocked a login attempt by the specified user name because of an invalid user name or password. 2nd %s: service name
LDAP/AD: Wrong IP or Port. IP:%s, Port: %d	LDAP/AD: Wrong IP or Port.Please check the AAA server setting.
Domain-auth fail	Domain-auth fail. Please check the domain-auth related setting.
Failed to join domain: Access denied	Failed to join domain: Access denied. Please check the AD server.

Table 210 Registration Logs

LOG MESSAGE	DESCRIPTION
Send registration message to MyZyxel.com server has failed.	The device was not able to send a registration message to myZyxel.com.
Get server response has failed.	The device sent packets to the myZyxel.com server, but did not receive a response. The root cause may be that the connection is abnormal.
Timeout for get server response.	zysh need to catch myZyxel.com agent's return code, this log will be shown when timeout.
User has existed.	The user name already exists in myZyxel.com's database. So the user can't use it for device registration and needs to specify another one.
User does not exist.	The user name does not yet exist in myZyxel.com's database. So the user can use it for device registration.
Internal server error.	myZyxel.com's database had an error when checking the user name.
Device registration has failed:%s.	Device registration failed, an error message returned by the myZyxel.com server will be appended to this log. %s: error message returned by the myZyxel.com server
Device registration has succeeded.	The device registered successfully with the myZyxel.com server.
Registration has failed. Because of lack must fields.	The device received an incomplete response from the myZyxel.com server and it caused a parsing error for the device.
%s:Trial service activation has failed:%s.	Trail service activation failed for the specified service, an error message returned by the myZyxel.com server will be appended to this log. 1st %s: service name 2nd %s: error message returned by the myZyxel.com server
%s:Trial service activation has succeeded.	Trail service was activated successfully for the specified service. %s: service name
Trial service activation has failed. Because of lack must fields.	The device received an incomplete response from the myZyxel.com server and it caused a parsing error for the device.

Table 210 Registration Logs (continued)

LOG MESSAGE	DESCRIPTION
Standard service activation has failed:%s.	Standard service activation failed, this log will append an error message returned by the myZyxel.com server. %s: error message returned by the myZyxel.com server
Standard service activation has succeeded.	Standard service activation has succeeded.
Standard service activation has failed. Because of lack must fields.	The device received an incomplete response from the myZyxel.com server and it caused a parsing error for the device.
Service expiration check has failed:%s.	The service expiration day check failed, this log will append an error message returned by the myZyxel.com server. %s: error message returned by myZyxel.com server
Service expiration check has succeeded.	The service expiration day check was successful.
Service expiration check has failed. Because of lack must fields.	The device received an incomplete response from the myZyxel.com server and it caused a parsing error for the device.
Server setting error.	The device could not retrieve the myZyxel.com server's IP address or FQDN from local.
Resolve server IP has failed.	The device could not resolve the myZyxel.com server's FQDN to an IP address through gethostbyname().
Verify server's certificate has failed.	The device could not process an HTTPS connection because it could not verify the myZyxel.com server's certificate.
Connect to MyZyxel.com server has failed.	The device could not connect to the myZyxel.com server.
Do account check.	The device started to check whether or not the user name in myZyxel.com's database.
Do device register.	The device started device registration.
Do trial service activation.	The device started trail service activation.
Do standard service activation.	The device started standard service activation.
Do expiration check.	The device started the service expiration day check.
Build query message has failed.	Some information was missing in the packets that the device sent to the myZyxel.com server.
Parse receive message has failed.	The device cannot parse the response returned by the myZyxel.com server. Maybe some required fields are missing.
Resolve server IP has failed. Update stop.	The update has stopped because the device couldn't resolve the myZyxel.com server's FQDN to an IP address through gethostbyname().
Verify server's certificate has failed. Update stop.	The device could not process an HTTPS connection because it could not verify the myZyxel.com server's certificate. The update has stopped.

Table 210 Registration Logs (continued)

LOG MESSAGE	DESCRIPTION
Send download request to update server has failed.	The device's attempt to send a download message to the update server failed.
Get server response has failed.	The device sent packets to the myZyxel.com server, but did not receive a response. The root cause may be that the connection is abnormal.
Timeout for get server response.	zysh need to catch myZyxel.com agent's return code, this log will be shown when timeout.
Send update request to update server has failed.	The device could not send an update message to the update server.
Update has failed. Because of lack must fields.	The device received an incomplete response from the update server and it caused a parsing error for the device.
Update server is busy now. File download after %d seconds.	The update server was busy so the device will wait for the specified number of seconds and send the download request to the update server again.
Device has latest file. No need to update.	The device already has the latest version of the file so no update is needed.
Device has latest signature file; no need to update	The device already has the latest version of the signature file so no update is needed.
Connect to update server has failed.	The device cannot connect to the update server.
Wrong format for packets received.	The device cannot parse the response returned by the server. Maybe some required fields are missing.
Server setting error. Update stop.	The device could not resolve the update server's FQDN to an IP address through gethostbyname(). The update process stopped.
Build query message failed.	Some information was missing in the packets that the device sent to the server.
System protect signature download has succeeded.	The device successfully downloaded the system protect signature file.
System protect signature update has succeeded.	The device successfully downloaded and applied a system protect signature file.
System protect signature download has failed.	The device still cannot download the system protect signature file after 3 retries.
Resolve server IP has failed.	The device could not resolve the myZyxel.com server's FQDN to an IP address through gethostbyname().
Connect to MyZyxel.com server has failed.	The device could not connect to the myZyxel.com server.
Build query message has failed.	Some information was missing in the packets that the device sent to the server.

Table 210 Registration Logs (continued)

LOG MESSAGE	DESCRIPTION
Verify server's certificate has failed.	The device could not process an HTTPS connection because it could not verify the server's certificate.
Get server response has failed.	The device sent packets to the server, but did not receive a response. The root cause may be that the connection is abnormal.
Expiration daily-check has failed:%s.	The daily check for service expiration failed, an error message returned by the myZyxel.com server will be appended to this log. %s: error message returned by myZyxel.com server
Do expiration daily-check has failed. Because of lack must fields.	The device received an incomplete response to the daily service expiration check and the packets caused a parsing error for the device.
Server setting error.	The device could not retrieve the server's IP address or FQDN from local.
Do expiration daily-check has failed.	The daily check for service expiration failed.
Do expiration daily-check has succeeded.	The daily check for service expiration was successful.
System bootup. Do expiration daily-check.	The device processes a service expiration day check immediately after it starts up.
After register. Do expiration daily-check immediately.	The device processes a service expiration day check immediately after device registration.
Time is up. Do expiration daily-check.	The processes a service expiration day check every 24 hrs.
Read MyZyxel.com storage has failed.	Read data from EEPROM has failed.
Open /proc/MRD has failed.	This error message is shown when getting MAC address.
Unknown TLS/SSL version: %d.	The device only supports SSLv3 protocol. %d: SSL version assigned by client.
Load trusted root certificates has failed.	The device needs to load the trusted root certificate before the device can verify a server's certificate. This log displays if the device failed to load it.
Certificate has expired.	Verification of a server's certificate failed because it has expired.
Self signed certificate.	Verification of a server's certificate failed because it is self-signed.
Self signed certificate in certificate chain.	Verification of a server's certificate failed because there is a self-signed certificate in the server's certificate chain.
Verify peer certificates has succeeded.	The device verified a server's certificate while processing an HTTPS connection.

Table 210 Registration Logs (continued)

LOG MESSAGE	DESCRIPTION
Certification verification failed: Depth: %d, Error Number(%d):%s.	Verification of a server's certificate failed while processing an HTTPS connection. This log identifies the reason for the failure. 1st %d: certificate chain level 2nd %d: error number %s: error message
Certificate issuer name:%s.	Verification of the specified certificate failed because the device could not get the certificate's issuer name. %s is the certificate name.
The wrong format for HTTP header.	The header format of a packet returned by a server is wrong.
Timeout for get server response.	After the device sent packets to a server, the device did not receive any response from the server. The root cause may be a network delay issue.
Download file size is wrong.	The file size downloaded for AS is not identical with content-length
Parse HTTP header has failed.	Device can't parse the HTTP header in a response returned by a server. Maybe some HTTP headers are missing.

Table 211 Sessions Limit Logs

LOG MESSAGE	DESCRIPTION
Maximum sessions per host (%d) was exceeded.	%d is maximum sessions per host.

Table 212 Policy Route Logs

LOG MESSAGE	DESCRIPTION
Can't open bwm_entries	Policy routing can't activate BWM feature.
Can't open link_down	Policy routing can't detect link up/down status.
Cannot get handle from UAM, user-aware PR is disabled	User-aware policy routing is disabled due to some reason.
mblock: allocate memory failed!	Allocating policy routing rule fails: insufficient memory.
pt: allocate memory failed!	Allocating policy routing rule fails: insufficient memory.
To send message to policy route daemon failed!	Failed to send control message to policy routing manager.
The policy route %d allocates memory fail!	Allocating policy routing rule fails: insufficient memory. %d: the policy route rule number
The policy route %d uses empty user group!	Use an empty object group. %d: the policy route rule number

Table 212 Policy Route Logs (continued)

LOG MESSAGE	DESCRIPTION
The policy route %d uses empty source address group!	Use an empty object group. %d: the policy route rule number
The policy route %d uses empty destination address group!	Use an empty object group. %d: the policy route rule number
The policy route %d uses empty service group	Use an empty object group. %d: the policy route rule number
Policy-route rule %d was inserted.	Rules is inserted into system. %d: the policy route rule number
Policy-route rule %d was appended.	Rules is appended into system. %d: the policy route rule number
Policy-route rule %d was modified.	Rule is modified. %d: the policy route rule number
Policy-route rule %d was moved to %d.	Rule is moved. 1st %d: the original policy route rule number 2nd %d: the new policy route rule number
Policy-route rule %d was deleted.	Rule is deleted. %d: the policy route rule number
Policy-route rules were flushed.	Policy routing rules are cleared.
BWM has been activated.	The global setting for bandwidth management on the NXC has been turned on.
BWM has been deactivated.	The global setting for bandwidth management on the NXC has been turned off.

Table 213 Built-in Services Logs

LOG MESSAGE	DESCRIPTION
User on %u.%u.%u.%u has been denied access from %s	HTTP/HTTPS/TELNET/SSH/FTP/SNMP access to the device was denied. %u.%u.%u.%u is IP address %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET
HTTPS certificate:%s does not exist. HTTPS service will not work.	An administrator assigned a nonexistent certificate to HTTPS. %s is certificate name assigned by user
HTTPS port has been changed to port %s.	An administrator changed the port number for HTTPS. %s is port number
HTTPS port has been changed to default port.	An administrator changed the port number for HTTPS back to the default (443).
HTTP port has changed to port %s.	An administrator changed the port number for HTTP. %s is port number assigned by user

Table 213 Built-in Services Logs (continued)

LOG MESSAGE	DESCRIPTION
HTTP port has changed to default port.	An administrator changed the port number for HTTP back to the default (80).
SSH port has been changed to port %s.	An administrator changed the port number for SSH. %s is port number assigned by user
SSH port has been changed to default port.	An administrator changed the port number for SSH back to the default (22).
SSH certificate:%s does not exist. SSH service will not work.	An administrator assigned a nonexistent certificate to SSH. %s is certificate name assigned by user
SSH certificate:%s format is wrong. SSH service will not work.	After an administrator assigns a certificate for SSH, the device needs to convert it to a key used for SSH. %s is certificate name assigned by user
TELNET port has been changed to port %s.	An administrator changed the port number for TELNET. %s is port number assigned by user
TELNET port has been changed to default port.	An administrator changed the port number for TELNET back to the default (23).
FTP certificate:%s does not exist.	An administrator assigned a nonexistent certificate to FTP. %s is certificate name assigned by user
FTP port has been changed to port %s.	An administrator changed the port number for FTP. %s is port number assigned by user
FTP port has been changed to default port.	An administrator changed the port number for FTP back to the default (21).
SNMP port has been changed to port %s.	An administrator changed the port number for SNMP. %s is port number assigned by user
SNMP port has been changed to default port.	An administrator changed the port number for SNMP back to the default (161).
Console baud has been changed to %s.	An administrator changed the console port baud rate. %s is baud rate assigned by user
Console baud has been reset to %d.	An administrator changed the console port baud rate back to the default (115200). %d is default baud rate
DHCP Server on Interface %s will not work due to Device HA status is Stand-By	If interface is stand-by mode for device HA, DHCP server can't be run. Otherwise it has conflict with the interface in master mode. %s is interface name
DHCP Server on Interface %s will be reapplied due to Device HA status is Active	When an interface has become the HA master, the DHCP server needs to start operating. %s is interface name

Table 213 Built-in Services Logs (continued)

LOG MESSAGE	DESCRIPTION
DHCP's DNS option:%s has changed.	DHCP pool's DNS option support from WAN interface. If this interface is unlink/ disconnect or link/connect, this log will be shown. %s is interface name. The DNS option of DHCP pool has retrieved from it
Set timezone to %s.	An administrator changed the time zone. %s is time zone value
Set timezone to default.	An administrator changed the time zone back to the default (0).
Enable daylight saving.	An administrator turned on daylight saving.
Disable daylight saving.	An administrator turned off daylight saving.
DNS access control rules have been reached the maximum number.	An administrator tried to add more than the maximum number of DNS access control rules (64).
DNS access control rule %u of DNS has been appended.	An administrator added a new rule. %u is rule number
DNS access control rule %u has been inserted.	An administrator inserted a new rule. %u is rule number
DNS access control rule %u has been appended	An administrator appended a new rule. %u is rule number
DNS access control rule %u has been modified	An administrator modified the rule %u. %u is rule number
DNS access control rule %u has been deleted.	An administrator removed the rule %u. %u is rule number
DNS access control rule %u has been moved to %d.	An administrator moved the rule %u to index %d. %u is previous index %d variable is current index
The default record of Zone Forwarder have reached the maximum number of 128 DNS servers.	The default record DNS servers is more than 128.
Interface %s ping check is successful. Zone Forwarder adds DNS servers in records.	Ping check ok, add DNS servers in bind. %s is interface name
Interface %s ping check is failed. Zone Forwarder removes DNS servers in records.	Ping check failed, remove DNS servers from bind. %s is interface name

Table 213 Built-in Services Logs (continued)

LOG MESSAGE	DESCRIPTION
Interface %s ping check is disabled. Zone Forwarder adds DNS servers in records.	Ping check disabled, add DNS servers in bind. %s is interface name
Wizard apply DNS server failed.	Wizard apply DNS server failed.
Wizard adds DNS server %s failed because DNS zone setting has conflictd.	Wizard apply DNS server failed because DNS zone conflicted. %s is the IP address of the DNS server
Wizard adds DNS server %s failed because Zone Forwarder numbers have reached the maximum number of 32.	Wizard apply DNS server fail because the device already has the maximum number of DNS records configured. %s is IP address of the DNS server.
Access control rules of %s have reached the maximum number of %u	The maximum number of allowable rules has been reached. %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET. %u is the maximum number of access control rules.
Access control rule %u of %s was appended.	A new built-in service access control rule was appended. %u is the index of the access control rule. %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.
Access control rule %u of %s was inserted.	An access control rule was inserted successfully. %u is the index of the access control rule. %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.
Access control rule %u of %s was modified.	An access control rule was modified successfully. %u is the index of the access control rule. %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.
Access control rule %u of %s was deleted.	An access control rule was removed successfully. %u is the index of the access control rule. %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.
Access control rule %d of %s was moved to %d.	An access control rule was moved successfully. 1st %d is the previous index . %s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET. 2nd %d is current previous index.
SNMP trap can not be sent successfully	Cannot send a SNMP trap to a remote host due to network error

Table 214 System Logs

LOG MESSAGE	DESCRIPTION
Port %d is up!!	When LINK is up, %d is the port number.
Port %d is down!!	When LINK is down, %d is the port number.
%s is dead at %s	A daemon (process) is gone (was killed by the operating system). 1st %s: Daemon Name, 2nd %s: date and time
%s process count is incorrect at %s	The count of the listed process is incorrect. 1st %s: Daemon Name, 2nd %s: date and time
%s becomes Zombie at %s	A process is present but not functioning. 1st %s: Daemon Name, 2nd %s: date and time When memory usage exceed threshold-max, memory usage reaches %d%% :mem-threshold-max. When local storage usage exceeds threshold-max, %s: Partition name file system usage reaches %d%%: disk-threshold-max. When memory usage drops below threshold-min, System Memory usage drops below the threshold of %d%%: mem-threshold-min. When local storage usage drops below threshold-min, %s: partition_name file system drops below the threshold of %d%%: disk-threshold-min.
DHCP Server executed with cautious mode enabled	DHCP Server executed with cautious mode enabled.
DHCP Server executed with cautious mode disabled	DHCP Server executed with cautious mode disabled.
Received packet is not an ARP response packet	A packet was received but it is not an ARP response packet.
Receive an ARP response	The device received an ARP response.
Receive ARP response from %s (%s)	The device received an ARP response from the listed source.
The request IP is: %s, sent from %s	The device accepted a request.
Received ARP response NOT for the request IP address	The device received an ARP response that is NOT for the requested IP address.
Receive an ARP response from the client issuing the DHCP request	The device received an ARP response from the client issuing the DHCP request.
Receive an ARP response from an unknown client	The device received an ARP response from an unknown client.
In total, received %d arp response packets for the requested IP address	The device received the specified total number of ARP response packets for the requested IP address.

Table 214 System Logs (continued)

LOG MESSAGE	DESCRIPTION
Clear arp cache successfully.	The ARP cache was cleared successfully.
Client MAC address is not an Ethernet address	A client MAC address is not an Ethernet address.
DHCP request received via interface %s (%s:%s), src_mac: %s with requested IP: %s	The device received a DHCP request through the specified interface.
IP confliction is detected. Send back DHCP-NAK.	IP conflict was detected. Send back DHCP-NAK.
Clear ARP cache done	Clear ARP cache done.
Set manual time has succeeded. Current time is %s	The device date and time was changed manually. %s is the date and time.
NTP update successful, current time is %s	The device successfully synchronized with a NTP time server . %s is the date and time.
NTP update failed	The device was not able to synchronize with the NTP time server successfully.
Device is rebooted by administrator!	An administrator restarted the device.
Insufficient memory.	Cannot allocate system memory.
Update the profile %s has failed because of strange server response.	Update profile failed because the response was strange, %s is the profile name.
Update the profile %s has succeeded because the IP address of FQDN %s was not changed.	Update profile succeeded, because the IP address of profile is unchanged, %s is the profile name.
Update the profile %s has succeeded.	Update profile succeeded, %s is the profile name.
Collect Diagnostic Information has failed - Server did not respond.	There was an error and the diagnostics were not completed.
Collect Diagnostic Infomation has succeeded.	The diagnostics scripts were executed successfully.
Port %d is up!!	The specified port has it's link up.
Port %d is down!!	The specified port has it's link down.

Table 215 Connectivity Check Logs

LOG MESSAGE	DESCRIPTION
Can't open link_up2	Cannot recover routing status which is link-down.
Can not open %s.pid	Cannot open connectivity check process ID file. %s: interface name
Can not open %s.arg	Cannot open configuration file for connectivity check process. %s: interface name
The connectivity-check is activate for %s interface	The link status of interface is still activate after check of connectivity check process. %s: interface name
The connectivity-check is fail for %s interface	The link status of interface is fail after check of connectivity check process. %s: interface name
Can't get gateway IP of %s interface	The connectivity check process can't get the gateway IP address for the specified interface. %s: interface name
Can't alloc memory	The connectivity check process can't get memory from OS.
Can't load %s module	The connectivity check process can't load module for check link-status. %s: the connectivity module, currently only ICMP available.
Can't handle 'isalive' function of %s module	The connectivity check process can't execute 'isalive' function from module for check link-status. %s: the connectivity module, currently only ICMP available.
Create socket error	The connectivity check process can't get socket to send packet.
Can't get IP address of %s interface	The connectivity check process can't get IP address of interface. %s: interface name.
Can't get flags of %s interface	The connectivity check process can't get interface configuration. %s: interface name
Can't get NETMASK address of %s interface	The connectivity check process can't get netmask address of interface. %s: interface name
Can't get BROADCAST address of %s interface	The connectivity check process can't get broadcast address of interface %s: interface name
Can't use MULTICAST IP for destination	The connectivity check process can't use multicast address to check link-status.
The destination is invalid, because destination IP is broadcast IP	The connectivity check process can't use broadcast address to check link-status.
Can't get MAC address of %s interface!	The connectivity check process can't get MAC address of interface. %s: interface name
To send ARP REQUEST error!	The connectivity check process can't send ARP request packet.

Table 215 Connectivity Check Logs (continued)

LOG MESSAGE	DESCRIPTION
The %s routing status seted to DEAD by connectivity-check	The interface routing can't forward packet. %s: interface name
The %s routing status seted ACTIVATE by connectivity-check	The interface routing can forward packet. %s: interface name
The link status of %s interface is inactive	The specified interface failed a connectivity check.

Table 216 NAT Logs

LOG MESSAGE	DESCRIPTION
The NAT range is full	The NAT mapping table is full.
%s FTP ALG has succeeded.	The FTP Application Layer Gateway (ALG) has been turned on or off. %s: Enable or Disable
Extra signal port of FTP ALG has been modified.	Extra FTP ALG port has been changed.
Signal port of FTP ALG has been modified.	Default FTP ALG port has been changed.
%s H.323 ALG has succeeded.	The H.323 ALG has been turned on or off. %s: Enable or Disable
Extra signal port of H.323 ALG has been modified.	Extra H.323 ALG port has been changed.
Signal port of H.323 ALG has been modified.	Default H.323 ALG port has been changed.
%s SIP ALG has succeeded.	The SIP ALG has been turned on or off. %s: Enable or Disable
Extra signal port of SIP ALG has been modified.	Extra SIP ALG port has been changed.
Signal port of SIP ALG has been modified.	Default SIP ALG port has been changed.
Register SIP ALG extra port=%d failed.	SIP ALG apply additional signal port failed. %d: Port number
Register SIP ALG signal port=%d failed.	SIP ALG apply signal port failed. %d: Port number
Register H.323 ALG extra port=%d failed.	H323 ALG apply additional signal port failed. %d: Port number
Register H.323 ALG signal port=%d failed.	H323 ALG apply signal port failed. %d: Port number

Table 216 NAT Logs (continued)

LOG MESSAGE	DESCRIPTION
Register FTP ALG extra port=%d failed.	FTP ALG apply additional signal port failed. %d: Port number
Register FTP ALG signal port=%d failed.	FTP ALG apply signal port failed. %d: Port number

Table 217 Certificate Path Verification Failure Reason Codes

CODE	DESCRIPTION
1	Algorithm mismatch between the certificate and the search constraints.
2	Key usage mismatch between the certificate and the search constraints.
3	Certificate was not valid in the time interval.
4	(Not used)
5	Certificate is not valid.
6	Certificate signature was not verified correctly.
7	Certificate was revoked by a CRL.
8	Certificate was not added to the cache.
9	Certificate decoding failed.
10	Certificate was not found (anywhere).
11	Certificate chain looped (did not find trusted root).
12	Certificate contains critical extension that was not handled.
13	Certificate issuer was not valid (CA specific information missing).
14	(Not used)
15	CRL is too old.
16	CRL is not valid.
17	CRL signature was not verified correctly.
18	CRL was not found (anywhere).
19	CRL was not added to the cache.
20	CRL decoding failed.
21	CRL is not currently valid, but in the future.
22	CRL contains duplicate serial numbers.
23	Time interval is not continuous.
24	Time information not available.
25	Database method failed due to timeout.
26	Database method failed.
27	Path was not verified.
28	Maximum path length reached.

Table 218 Interface Logs

LOG MESSAGE	DESCRIPTION
Interface %s has been deleted.	An administrator deleted an interface. %s is the interface name.
Interface %s has been changed.	An administrator changed an interface's configuration. %s: interface name.
Interface %s has been added.	An administrator added a new interface. %s: interface name.
Interface %s is enabled.	An administrator enabled an interface. %s: interface name.
Interface %s is disabled.	An administrator disabled an interface. %s: interface name.
Interface %s links down. Default route will not apply until interface %s links up.	An administrator set a static gateway in interface but this interface is link down. At this time the configuration will be saved but route will not take effect until the link becomes up.1st %s: interface name, 2nd %s: interface name.
name=%s,status=%s,TxPkts=%u, RxPkts=%u,Colli.=%u,TxB/s=%u, RxB/s=%u,UpTime=%s	Port statistics log. This log will be sent to the VRPT server. 1st %s: physical port name, 2nd %s: physical port status, 1st %u: physical port Tx packets, 2nd %u: physical port Rx packets, 3rd %u: physical port packets collisions, 4th %u: physical port Tx Bytes/s, 5th %u: physical port Rx Bytes/s, 3rd %s: physical port up time.
name=%s,status=%s,TxPkts=%u, RxPkts=%u,Colli.=%u,TxB/s=%u, RxB/s=%u	Interface statistics log. This log will be sent to the VRPT server. 1st %s: interface name, 2nd %s: interface status, 1st %u variable: interface Tx packets, 2nd %u variable: interface Rx packets, 3rd %u: interface packets collisions, 4th %u: interface Tx Bytes/s, 5th %u: interface Rx Bytes/s.
Interface %s connect failed: MS-CHAPv2 mutual authentication failed.	MS-CHAPv2 authentication failed (the server must support mS-CHAPv2 and verify that the authentication failed, this does not include cases where the servers does not support MS-CHAPv2). %s: interface name.
Interface %s connect failed: MS-CHAP authentication failed.	MS-CHAP authentication failed (the server must support MS-CHAP and verify that the authentication failed, this does not include cases where the server does not support MS-CHAP). %s: interface name.
Interface %s connect failed: CHAP authentication failed.	CHAP authentication failed (the server must support CHAP and verify that the authentication failed, this does not include cases where the server does not support CHAP). CHAP: interface name.
Interface %s connect failed: Peer not responding.	The interface's connection will be terminated because the server did not send any LCP packets. %s: interface name.
Interface %s connect failed: PAP authentication failed.	PAP authentication failed (the server must support PAP and verify verify that the authentication failed, this does not include cases where the server does not support PAP).
Interface %s create failed because has no member.	A bridge interface has no member. %s: bridge interface name.

Table 219 WLAN Logs

LOG MESSAGE	DESCRIPTION
Wlan %s is enabled.	The WLAN (IEEE 802.11 b and or g) feature has been turned on. %s is the slot number where the WLAN card is or can be installed.
Wlan %s is disabled.	The WLAN (IEEE 802.11 b and or g) feature has been turned off. %s is the slot number where the WLAN card is or can be installed.
Wlan %s has been configured.	The WLAN (IEEE 802.11 b and or g) feature's configuration has been changed. %s is the slot number where the WLAN card is or can be installed.
Interface %s has been configured.	The configuration of the specified WLAN interface (%s) has been changed.
Interface %s has been deleted.	The specified WLAN interface (%s) has been removed.
Create interface %s has failed. Wlan device does not exist.	The wireless device failed to create the specified WLAN interface (%s). Remove the wireless device and reinstall it.
System internal error. No 802.1X or WPA enabled!	IEEE 802.1x or WPA is not enabled.
System internal error. Error configuring WPA state!	The NXC was not able to configure the wireless device to use WPA. Remove the wireless device and reinstall it.
System internal error. Error enabling WPA/ 802.1X!	The NXC was not able to enable WPA/IEEE 802.1X.
Station has associated. Interface: %s, MAC: %s.	A wireless client with the specified MAC address (second %s) associated with the specified WLAN interface (first %s).
WPA or WPA2 enterprise EAP timeout. Interface: %s, MAC: %s.	There was an EAP timeout for a wireless client connected to the specified WLAN interface (first %s). The MAC address of the wireless client is listed (second %s).
Station association has failed. Maximum associations have reached the maximum number. Interface: %s, MAC: %s.	A wireless client with the specified MAC address (second %s) failed to connect to the specified WLAN interface (first %s) because the WLAN interface already has its maximum number of wireless clients.
WPA authentication has failed. Interface: %s, MAC: %s.	A wireless client used an incorrect WPA key and thus failed to connect to the specified WLAN interface (first %s). The MAC address of the wireless client is listed (second %s).
Incorrect password for WPA or WPA2 enterprise internal authentication. Interface: %s, MAC: %s.	A wireless client used an incorrect WPA or WPA2 user password and failed authentication by the NXC's local user database while trying to connect to the specified WLAN interface (first %s). The MAC address of the wireless client is listed (second %s).

Table 219 WLAN Logs (continued)

LOG MESSAGE	DESCRIPTION
Incorrect username or password for WPA or WPA2 enterprise internal authentication. Interface: %s, MAC: %s.	A wireless client used an incorrect WPA or WPA2 user name or user password and failed authentication by the NXC's local user database while trying to connect to the specified WLAN interface (first %s). The MAC address of the wireless client is listed (second %s).
System internal error. %s: STA %s could not extract EAP-Message from RADIUS message	There was an error when attempting to extract the EAP-Message from a RADIUS message. The first %s is the WLAN interface. The second %s is the MAC address of the wireless client.

Table 220 Account Logs

LOG MESSAGE	DESCRIPTION
Account %s %s has been deleted.	A user deleted an ISP account profile. 1st %s: profile type, 2nd %se: profile name.
Account %s %s has been changed.	A user changed an ISP account profile's options. 1st %s: profile type, 2nd %s: profile name.
Account %s %s has been added.	A user added a new ISP account profile. 1st %s: profile type, 2nd %s: profile name.

Table 221 Force Authentication Logs

LOG MESSAGE	DESCRIPTION
Force User Authentication will be enabled due to http server is enabled.	Force user authentication will be turned on because HTTP server was turned on.
Force User Authentication will be disabled due to http server is disabled.	Force user authentication will be turned off because HTTP server was turned off.
Force User Authentication may not work properly!	

Table 222 File Manager Logs

LOG MESSAGE	DESCRIPTION
ERROR:#%s, %s	Apply configuration failed, this log will be what CLI command is and what error message is. 1st %s is CLI command. 2nd %s is error message when apply CLI command.
WARNING:#%s, %s	Apply configuration failed, this log will be what CLI command is and what warning message is. 1st %s is CLI command. 2nd %s is warning message when apply CLI command.
ERROR:#%s, %s	Run script failed, this log will be what wrong CLI command is and what error message is. 1st %s is CLI command. 2nd %s is error message when apply CLI command.
WARNING:#%s, %s	Run script failed, this log will be what wrong CLI command is and what warning message is. 1st %s is CLI command. 2nd %s is warning message when apply CLI command.
Resetting system...	Before apply configuration file.
System resetted. Now apply %s..	After the system reset, it started to apply the configuration file. %s is configuration file name.
Running %s...	An administrator ran the listed shell script. %s is script file name.

Table 223 DHCP Logs

LOG MESSAGE	DESCRIPTION
Can't find any lease for this client - %s, DHCP pool full!	All of the IP addresses in the DHCP pool are already assigned to DHCP clients, so there is no IP address to give to the listed DHCP client.
DHCP server offered %s to %s(%s)	The DHCP server feature gave the listed IP address to the computer with the listed hostname and MAC address.
Requested %s from %s(%s)	The NXC received a DHCP request for the specified IP address from the computer with the listed hostname and MAC address.
No applicable lease found for DHCP request - %s !	There is no matching DHCP lease for a DHCP client's request for the specified IP address.
DHCP released %s with %s(%s)	A DHCP client released the specified IP address. The DHCP client's hostname and MAC address are listed.
Sending ACK to %s	The DHCP server feature received a DHCP client's inform packet and is sending an ACK to the client.
DHCP server assigned %s to %s(%s)	The DHCP server feature assigned a client the IP address that it requested. The DHCP client's hostname and MAC address are listed.

Table 224 E-mail Daily Report Logs

LOG MESSAGE	DESCRIPTION
Email Daily Report has been activated.	The daily e-mail report function has been turned on. The NXC will e-mail a daily report about the selected items at the scheduled time if the required settings are configured correctly.
Email Daily Report has been deactivated.	The daily e-mail report function has been turned off. The NXC will not e-mail daily reports.
Email daily report has been sent successfully.	The NXC sent a daily e-mail report mail successfully.
Cannot resolve mail server address %s.	The (listed) SMTP address configured for the daily e-mail report function is incorrect.
Mail server authentication failed.	The user name or password configured for authenticating with the e-mail server is incorrect.
Failed to send report. Mail From address %s1 is inconsistent with SMTP account %s2.	The user name and password configured for authenticating with the e-mail server are correct, but the (listed) sender e-mail address does not match the (listed) SMTP e-mail account.
Failed to connect to mail server %s.	The NXC could not connect to the SMTP e-mail server (%s). The address configured for the server may be incorrect or there may be a problem with the NXC's or the server's network connection.

Table 225 IP-MAC Binding Logs

LOG MESSAGE	DESCRIPTION
Drop packet %s-%u.%u.%u.%u-%02X:%02X:%02X:%02X:%02X:%02X	The IP-MAC binding feature dropped an Ethernet packet. The interface the packet came in through and the sender's IP address and MAC address are also shown.
Cannot bind ip-mac from dhcpd: %s#%u.%u.%u.%u#%02X:%02X:%02X:%02X:%02X:%02X.	The IP-MAC binding feature could not create an IP-MAC binding hash table entry. The interface the packet came in through, the sender's IP address and MAC address, are also shown along with the binding type ("s" for static or "d" for dynamic).
Cannot remove ip-mac binding from dhcpd: %s#%u.%u.%u.%u#%02X:%02X:%02X:%02X:%02X:%02X.	The IP-MAC binding feature could not delete an IP-MAC binding hash table entry. The interface the packet came in through, the sender's IP address and MAC address, are also shown along with the binding type ("s" for static or "d" for dynamic).

Table 226 CAPWAP Server Logs

LOG MESSAGE	DESCRIPTION
WLAN Controller Start. Registration Type:%s	Start the AP management service. 1st %s: Registration Type. {Always Accept | Manual}
WLAN Controller Reset. Registration Type:%s	Reset the AP management service. 1st %s: Registration Type. {Always Accept | Manual}
WLAN Controller End.	Stop/End the AP management service.
AP Connect. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	A Managed AP connected to the CAPWAP Server. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Model of AP is fake. MAC:%02x%02x%02x%02x%02x%02x, Model ID:%x	A Managed AP's model is not support by CAPWAP Server. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %x: Managed AP's Model ID.
AP Disconnect. MAC:%02x%02x%02x%02x%02x%02x, Name:%s, Reason:%s in %s State,Model:%s	A Managed AP disconnected from the CAPWAP Server. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Disconnect Reason. 9th %s: Managed AP Model Name.
AP Add. MAC:%02x%02x%02x%02x%02x%02x, Model:%s	Add an AP from un-managed list to managed list. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Model Name.
AP Delete. MAC:%02x%02x%02x%02x%02x%02x, Model:%s	Delete an AP from managed list. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Model Name.
Update AP Configure. MAC:%02x%02x%02x%02x%02x%02x, Model:%s	Send configuration to an AP in the managed list. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Model Name.
Update AP Configure Fail. Wrong Configure Apply,MAC:%02x%02x%02x%02x%02x%02x, Model:%s	Send configuration to an AP in the managed list, but AP sent back an apply fail response. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Model Name.

Table 226 CAPWAP Server Logs

LOG MESSAGE	DESCRIPTION
AP Reboot. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Reboot the specified AP in the managed list. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Upgrade AP Firmware. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Update AP Firmware in the managed list. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Start Send Configuration to AP. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Start Send Configuration to an AP in the Managed List. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Sucess Send Configuration to AP. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Receiving Send Configuration Respons from an AP in the Managed List. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Start Send Updating Configuration to AP. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Start Send Updating Configuration to an AP in the Managed List. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name.
Sucess Send Updating Configuration to AP. MAC:%02x%02x%02x%02x%02x%02x, Name:%s,Model:%s	Receiving Send Updating Configuration Response from an AP in the Managed List. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Model Name. 8th %s: Managed AP Description.
Send Retransmit Configuration to AP. MAC:%02x%02x%02x%02x%02x%02x, Name:%s, Retry Count=%d,Model:%s,	Retransmit Configuration to an AP in the Managed List. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %s: Managed AP Model Name. 9th %d: Retry count.
AP SSID Stop. MAC:%02x%02x%02x%02x%02x%02x, Radio:%d, SSID:%s Stop.	A Managed AP's stops broadcasting the SSID due to DTLS (Datagram Transport Layer Security) is disabled. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th: %d: Managed AP's Radio Number. 8th: %s: Managed AP Stop SSID Name.

Table 226 CAPWAP Server Logs

LOG MESSAGE	DESCRIPTION
VLAN setting is conflict.MAC:%02x:%02x:%02x:%02x:%02x:%02x,Model:%s, Mgmt. VID(AC):%d, %s, Mgmt. VID(AP):%d,%s	The VLAN ID of the AC is not the same as the VLAN ID of the AP. 1st %02x~6th%02x: Managed AP MAC Address. 7th %s: Managed AP Description. 8th %d: VID , 9th %s: tag or untag 10th %d: VID , 11th %s: tag or untag
AP doesn't support %s feature. MAC:%02x:%02x:%02x:%02x:%02x:%02x,AP:%s	An AP doesn't support a feature. 1st %s: feature name 2st %02x~7th%02x: Managed AP MAC Address. 8th %s: Managed AP Description.

Table 227 CAPWAP Client Logs

LOG MESSAGE	DESCRIPTION
AP Start. Discovery Type:%s	Start the CAPWAP Client service. 1st %s: Discovery type {Static | DHCP | DNS | Broadcast}
AP Reset. Discovery Type:%s	Reset the CAPWAP Client service. 1st %s: Discovery type {Static | DHCP | DNS | Broadcast}
Connect to WLAN Controller. IP:%s	CAPWAP Client connected to the WLAN Controller. 1st %s: WLAN Controller IP Address.
Disconnect from WLAN Controller. IP:%s	CAPWAP Client disconnected from to the WLAN Controller. 1st %s: WLAN Controller IP Address.
Updated Configuration by a WLAN Controller Success. Partial Update	Configuration upgraded success by WLAN Controller.
Updated Configuration by a WLAN Controller Fail.	Configuration upgraded fail by WLAN Controller.
ReBoot by a WLAN Controller. IP:%s	Reboot the WTP by WLAN Controller. 1st %s: WLAN Controller IP Address.
Firmware Upgraded by WLAN Controller. IP:%s	Firmware upgraded by WLAN Controller. 1st %s: WLAN Controller IP Address.
Apply Configuration by a WLAN Controller Success.%s	Configuration apply success by WLAN Controller. 1st %s: Complete Update
WLAN Controller IP Changed. New Discovery Type:%s, WLAN Controller IP: %s	Changed WTP's AC IP. 1st %s: Discovery type {Static | DHCP | DNS | Broadcast} 2nd %s: WLAN Controller IP Address

Table 227 CAPWAP Client Logs

LOG MESSAGE	DESCRIPTION
AP Receiving Complete ZySH Configuration from WLAN Controller.	WTP receiving total configuration from WLAN Controller during CAPWAP protocol handshaking. (Configuration Change State)
AP Receiving Updating ZySH Configuration from WLAN Controller.	WTP receiving total configuration from WLAN Controller When AC changed configuration. (RUN State)
STA List Full. STA List of AP [%s] is Full	Number of stations connecting to the specified AP has reached its upper limit. 1st %s: WTP's description.
DNS Query result is NULL.	A DNS query failed.

Table 228 AP Load Balancing Logs

LOG MESSAGE	DESCRIPTION
kick station %02x:%02x:%02x:%02x:%02x:%02x	Indicates that the specified station was removed from an AP's wireless network because the AP became overloaded.

Table 229 Rogue AP Logs

LOG MESSAGE	DESCRIPTION
rogue ap detection is enabled.	Indicates that rogue AP detection is enabled.

Table 230 Wireless Frame Capture Logs

LOG MESSAGE	DESCRIPTION
Capture done! check_size:%d, max_file_size:%d\n	This message displays check_size %d and max_file_size %d when the wireless frame capture has been completed. 1st %d: total files size of directory. 2nd %d: max files size.
Can not initial monitor mode signal handler.\n	While an AP is in Monitor mode, the handler functions as a daemon; if it fails to initialize the handler, then this message is returned.

Table 231 DCS Logs

LOG MESSAGE	DESCRIPTION
dcs init failed!\n	Indicates that the NXC failed to initialize the dcs daemon.
init zylog fail\n	Indicates that the NXC failed to initialize zylog.

Table 231 DCS Logs

LOG MESSAGE	DESCRIPTION
channel changed: %s %d -> %d\n	DCS has changed the wireless interface %s channel from %d to channel %d. 1st %s: interface name 1st %d: current channel 2nd %d: new channel
dcs is terminated!	DCS was terminated for an unknown reason.

Table 232 WLAN Station Info

LOG MESSAGE	DESCRIPTION
STA Association. Addr:%02x%02x%02x%02x%02x%02x, AP:%s	A wireless client is connected to the AP. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP's description.
STA Disassociation. Addr:%02x%02x%02x%02x%02x%02x, AP:%s	A wireless client is disconnected from the AP. 1st %02x ~ 6th %02x: Managed AP MAC Address. 7th %s: Managed AP's description.
STA Roaming. MAC:%02x:%02x:%02x:%02x:%02x:%02x, From:%s, To:%s	A wireless client roams from one AP to another. 1st %02x~6th%02x: Station MAC Address. 7th %s: Source WTP's description. 8th %s: Destination WTP's description.
STA List Full. STA List of AP [%s] is Full	The number of wireless clients connected to the AP has reached the maximium limit. 1st %s: Managed AP's description.
STA Disassociation(%s).MAC:%02x:%02x:%02x:%02x:%02x:%02x,AP:%s	Indicates the reason why a wireless client is disassociated from an AP. 1st %s: Disassociation reason. 2nd %02x~7th%02x: Wireless client's MAC Address. 8th %s: Managed AP Description.
AP Radio MAC=%02x:%02x:%02x:%02x:%02x:%02x, Reject Station MAC%02x:%02x:%02x:%02x:%02x:%02x, RSSI=%d dBm	An AP rejected a wireless client's association request. 1st %02x~6th%02x: AP's MAC Address. 7th %02x~12th%02x: Wireless client's MAC Address. 13th %d: RSSI value

APPENDIX B
Common Services

The following table lists some commonly-used services and their associated protocols and port numbers. For a comprehensive list of port numbers, ICMP type/code numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**. Please refer to RFC 1700 for further information about port numbers.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 233 Commonly Used Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM/New-ICQ	TCP	5190	AOL's Internet Messenger service. It is also used as a listening port by ICQ.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for example www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.

Table 233 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic or routing purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	Simple File Transfer Protocol.
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH	TCP/UDP	22	Secure Shell Remote Login Program.

Table 233 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP	7000	Another videoconferencing solution.

APPENDIX C
Importing Certificates

This appendix shows you how to import public key certificates into your web browser.

Public key certificates are used by web browsers to ensure that a secure web site is legitimate. When a certificate authority such as VeriSign, Comodo, or Network Solutions, to name a few, receives a certificate request from a website operator, they confirm that the web domain and contact information in the request match those on public record with a domain name registrar. If they match, then the certificate is issued to the website operator, who then places it on the site to be issued to all visiting web browsers to let them know that the site is legitimate.

Many Zyxel products, such as the NXC, issue their own public key certificates. These can be used by web browsers on a LAN or WAN to verify that they are in fact connecting to the legitimate device and not one masquerading as it. However, because the certificates were not issued by one of the several organizations officially recognized by the most common web browsers, you will need to import the Zyxel-created certificate into your web browser and flag that certificate as a trusted authority.

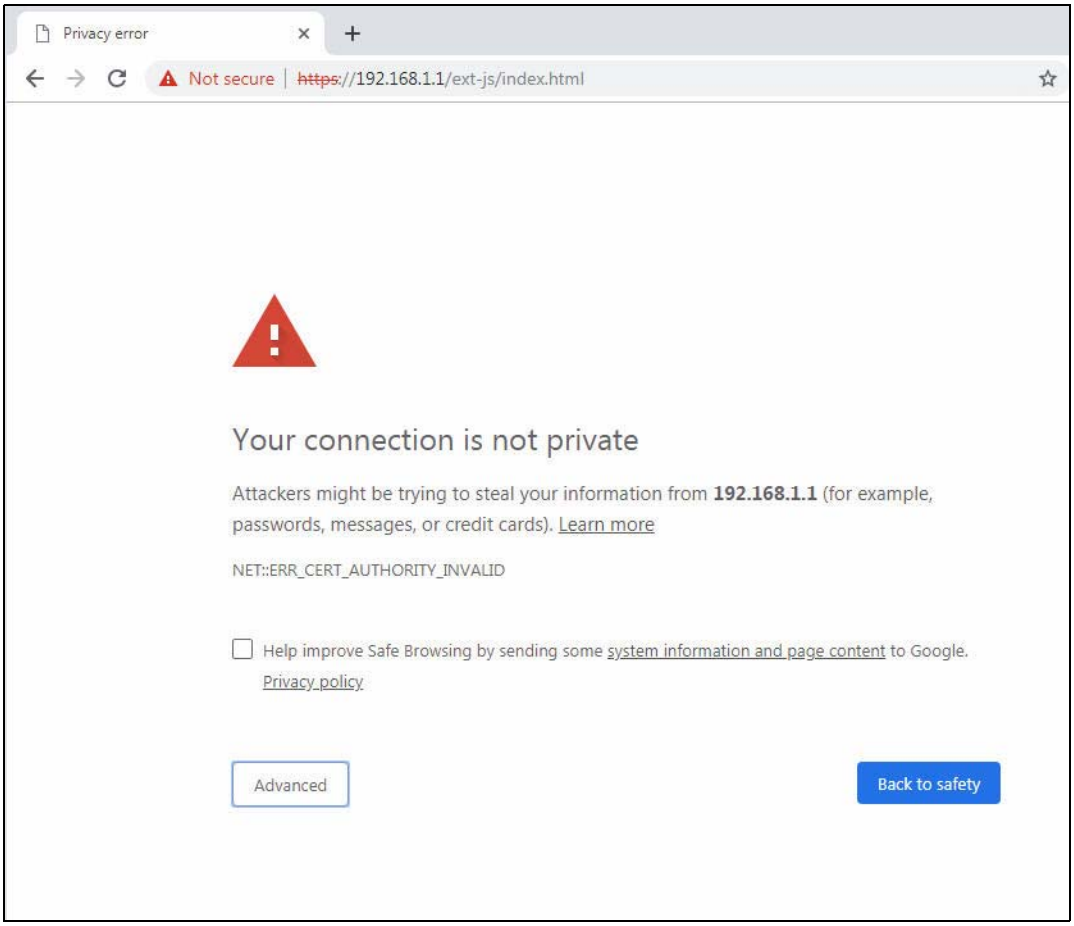
Note: You can see if you are browsing on a secure website if the URL in your web browser's address bar begins with `https://` or there is a sealed padlock icon () somewhere in the main browser window (not all browsers show the padlock in the same location).

Google Chrome

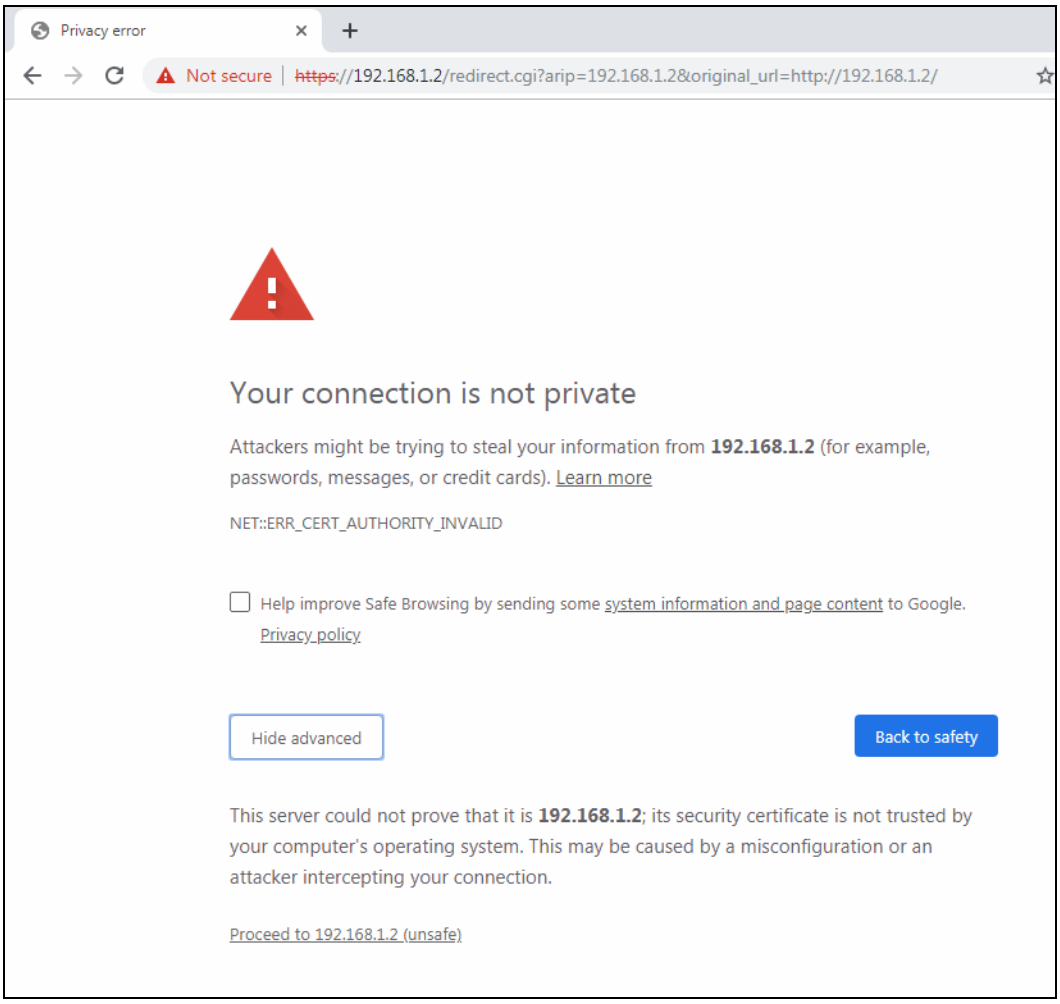
The following example uses Google Chrome on Windows 7. You first have to store the certificate in your computer and then install it as a Trusted Root CA, as shown in the following tutorials.

Export a Certificate

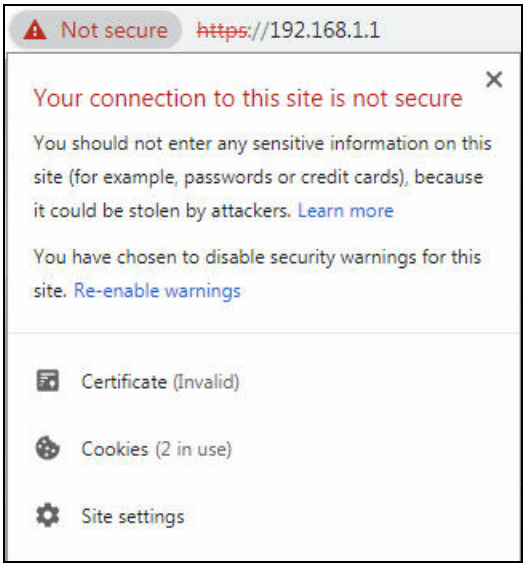
1 If your device's Web Configurator is set to use SSL certification, then upon browsing with it for the first time, you are presented with a certification error.



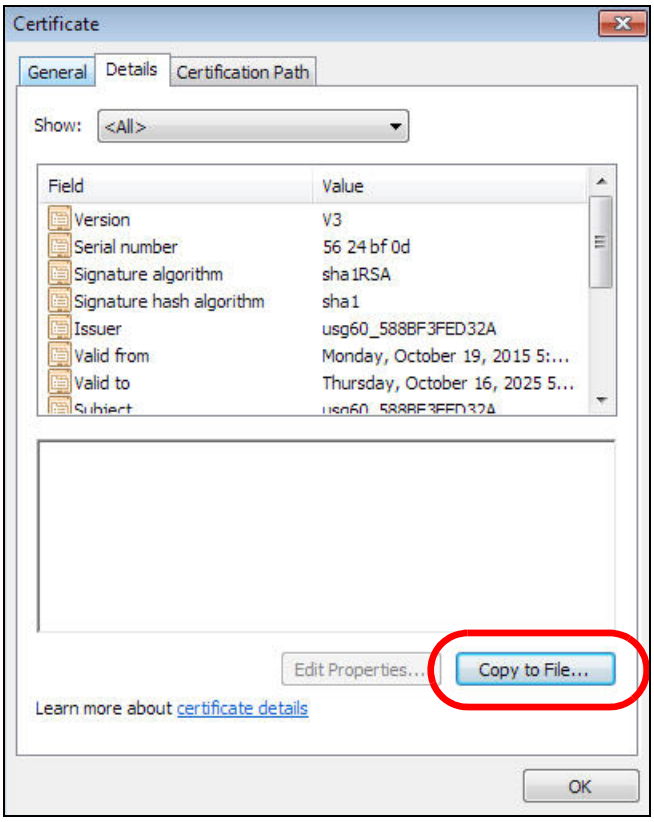
2 Click **Advanced > Proceed to *x.x.x.x* (unsafe)**.



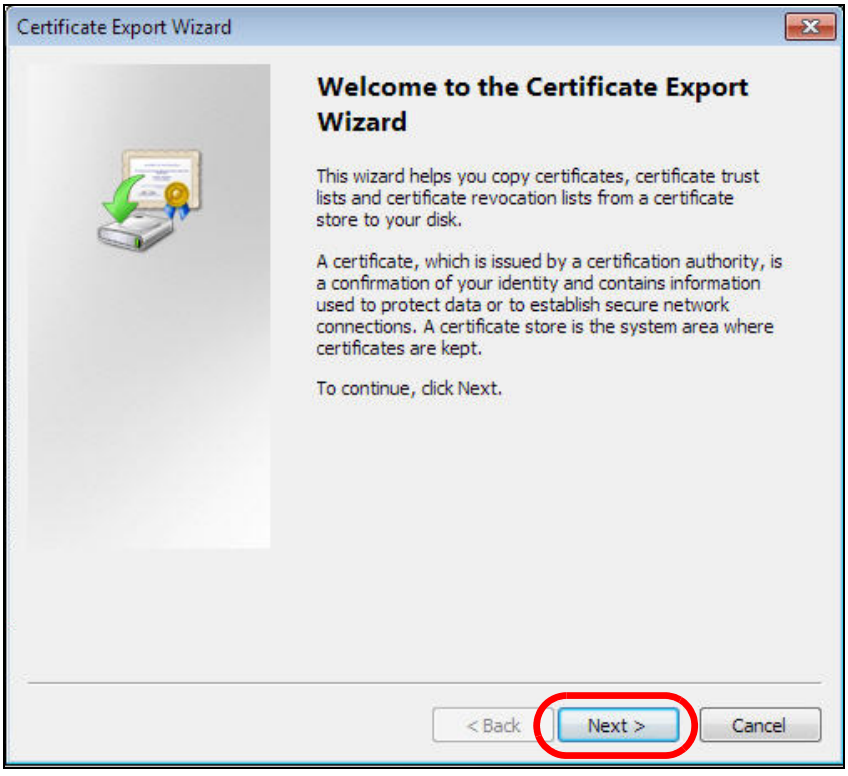
3 In the **Address Bar**, click **Not Secure** > **Certificate (Invalid)**.



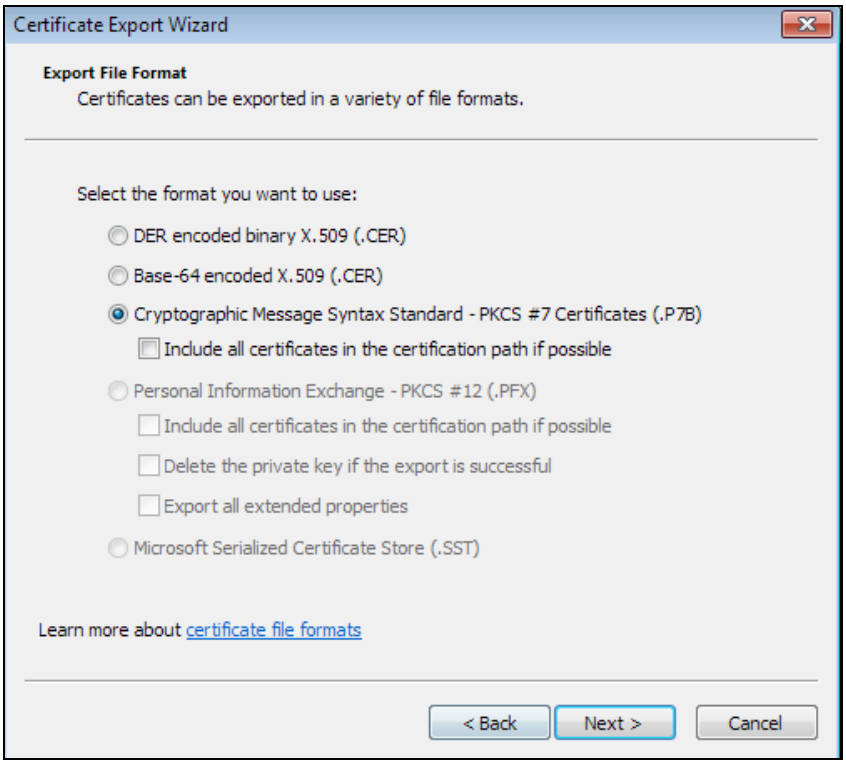
4 In the **Certificate** dialog box, click **Details > Copy to File**.



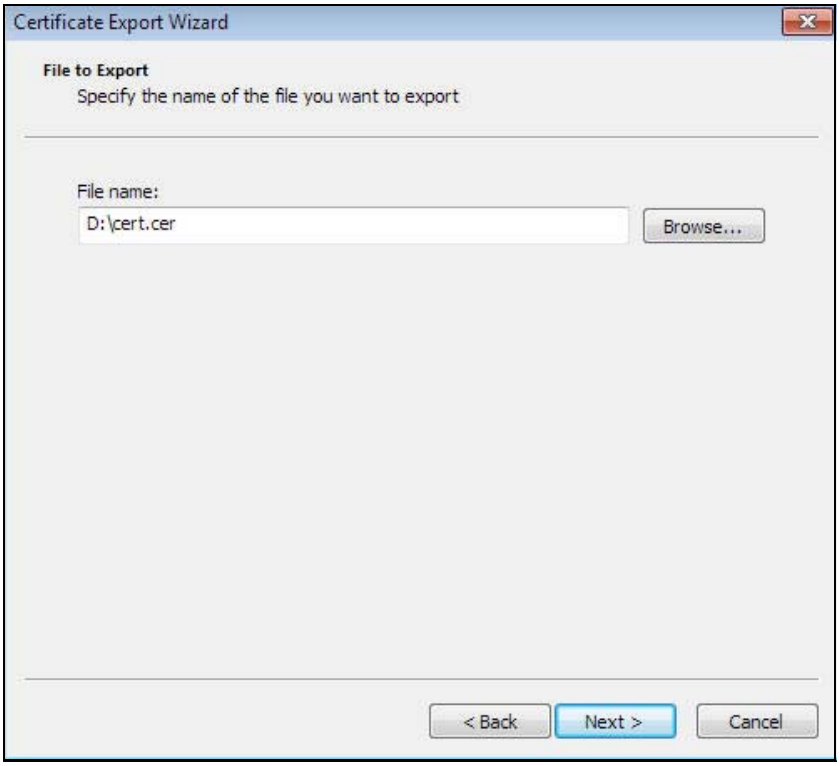
5 In the **Certificate Export Wizard**, click **Next**.



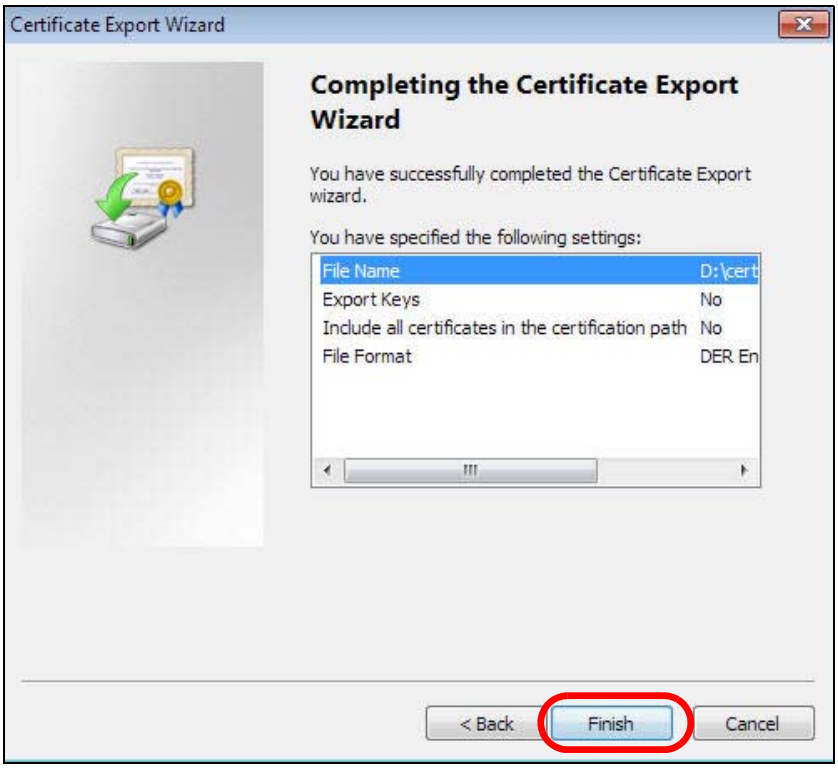
6 Select the format and settings you want to use and then click **Next**.



7 Type a filename and specify a folder to save the certificate in. Click **Next**.



8 In the **Completing the Certificate Export Wizard** screen, click **Finish**.

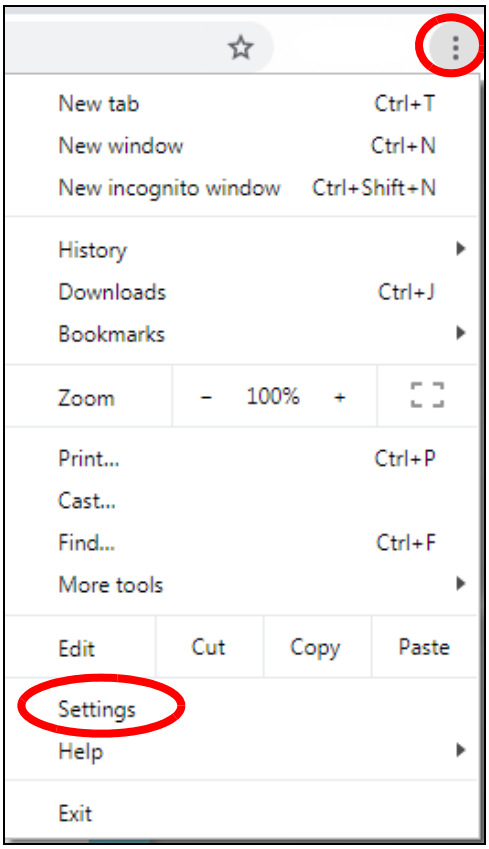


9 Finally, click **OK** when presented with the successful certificate export message.

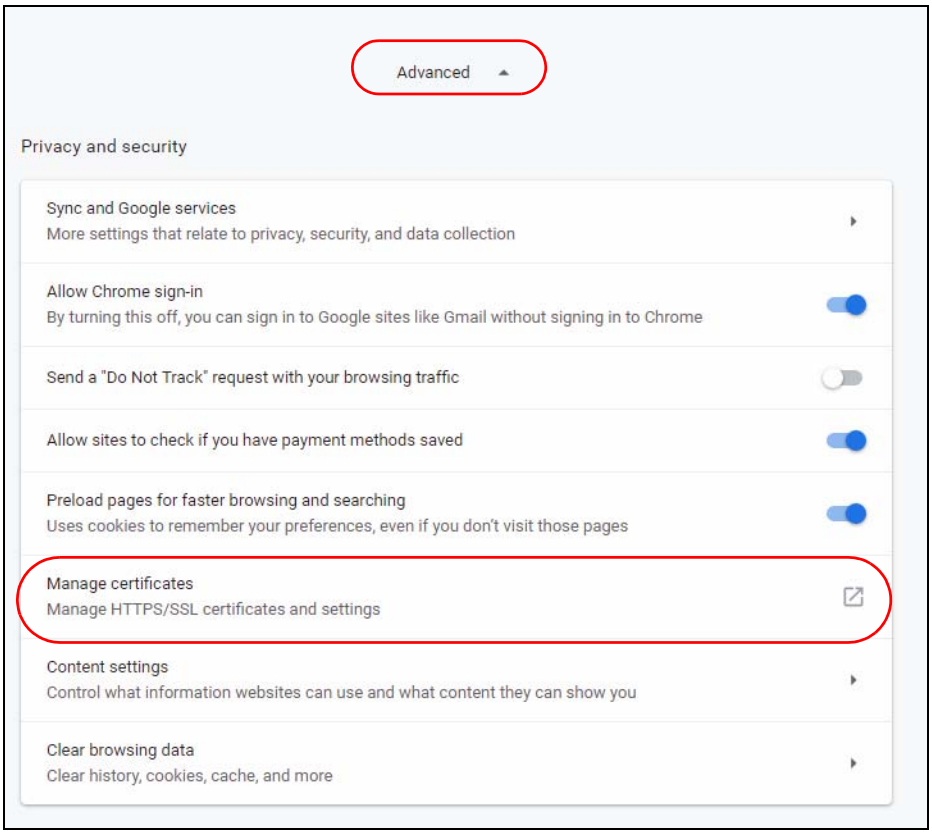
Import a Certificate

After storing the certificate in your computer (see Export a Certificate), you need to install it as a trusted root certification authority using the following steps:

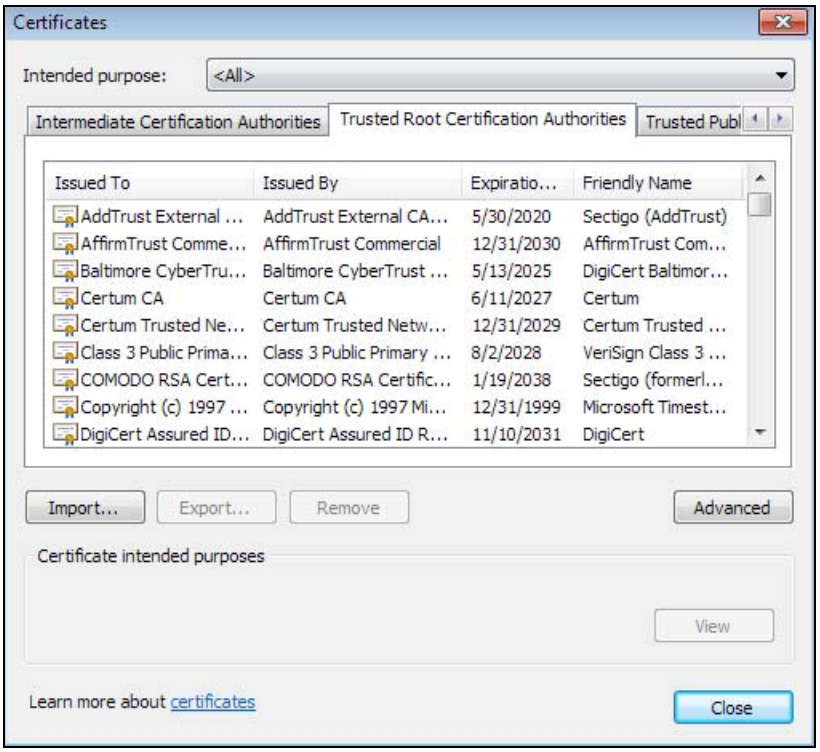
1 Open your web browser, click the menu icon, and click **Settings**.



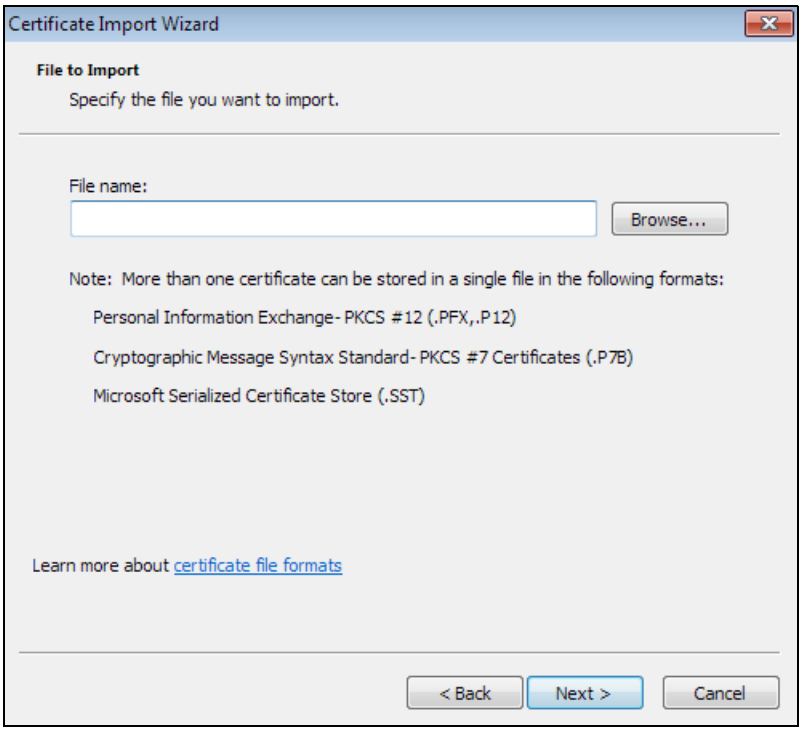
2 Scroll down and click **Advanced** to expand the menu. Under **Privacy and security**, click **Manage certificates**.



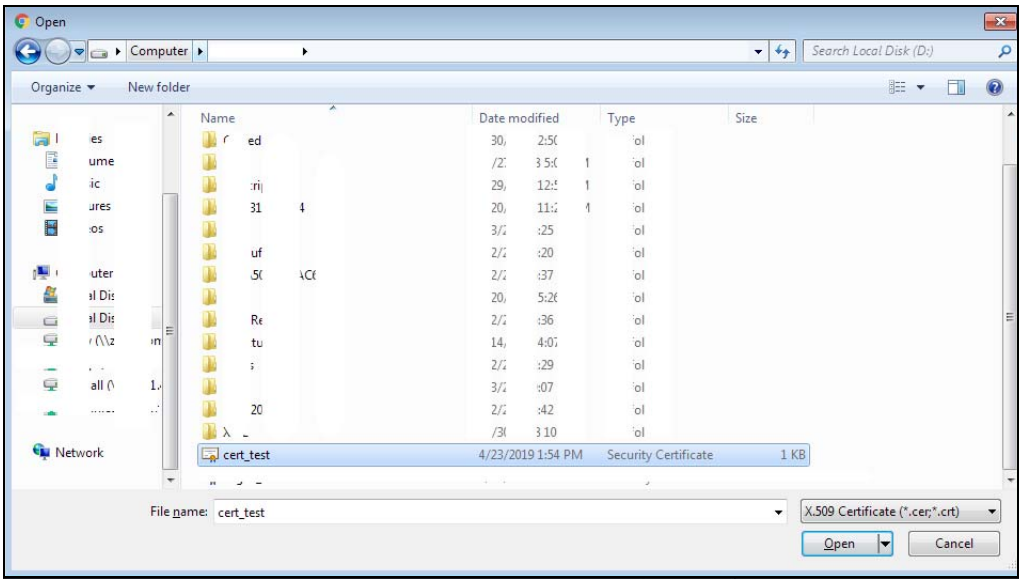
3 In the **Certificates** pop-up screen, click **Trusted Root Certification Authorities**. Click **Import** to start the **Certificate Import Wizard**.



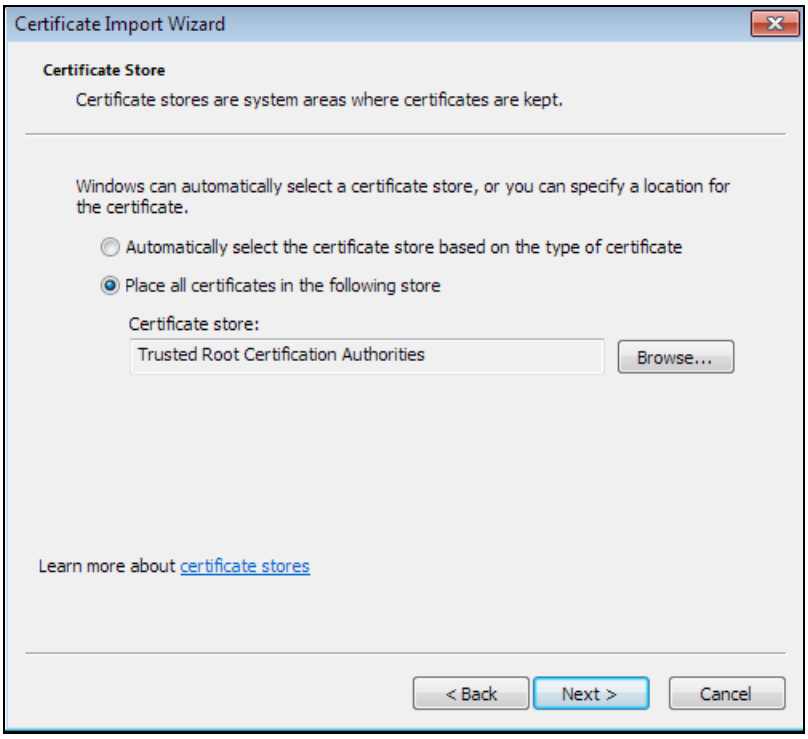
4 Click **Next** when the wizard pops up, and then on the following screen click **Browse**.



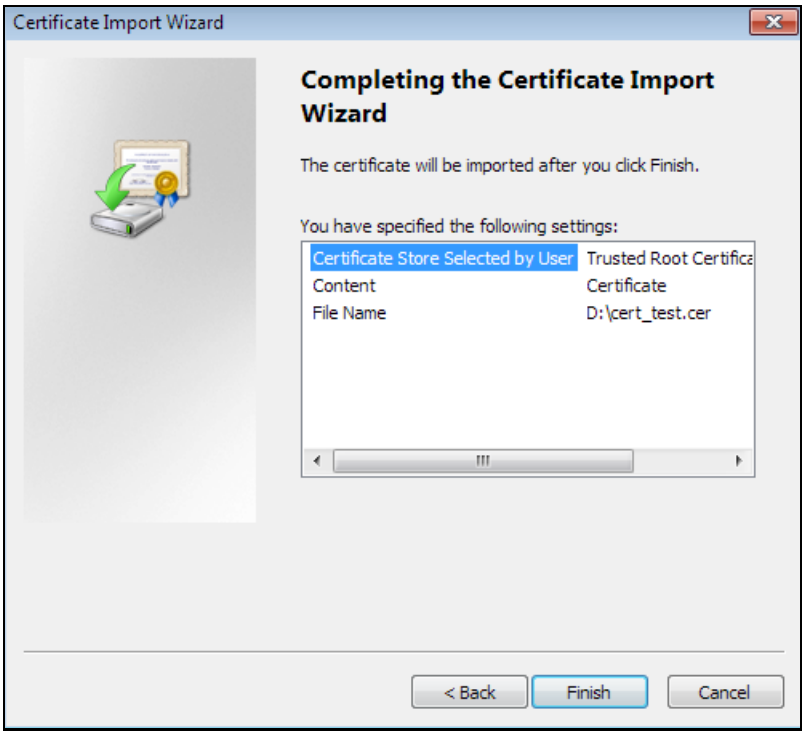
5 Select the certificate file you want to import and click **Open**.



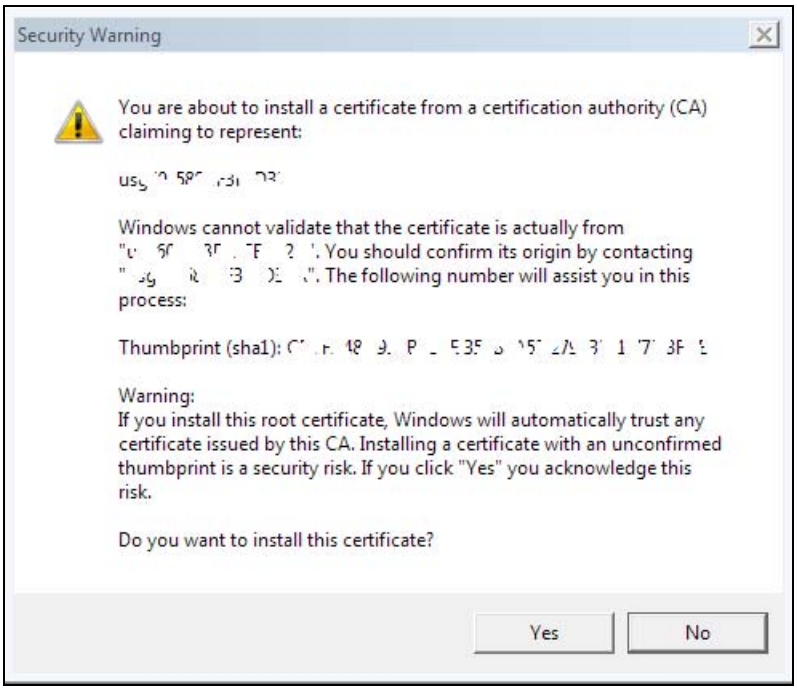
6 Click **Next.**



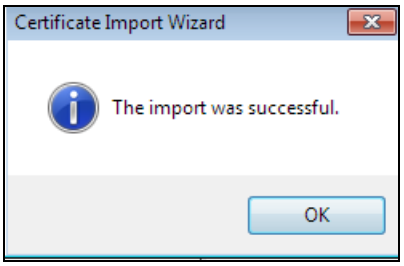
7 Confirm the settings displayed and click **Finish**.



8 If presented with a security warning, click **Yes**.



9 Finally, click **OK** when you are notified of the successful import.

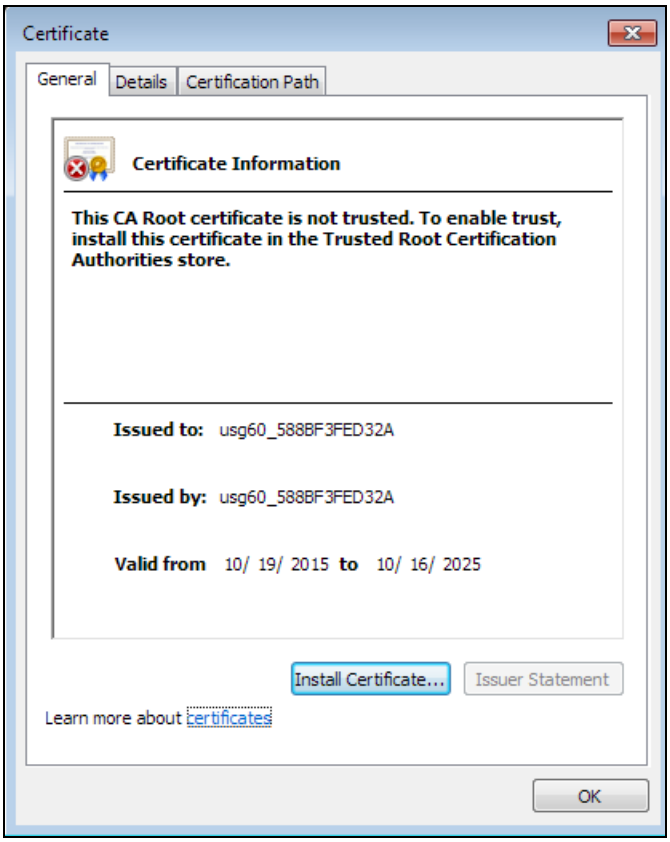


Install a Stand-Alone Certificate File

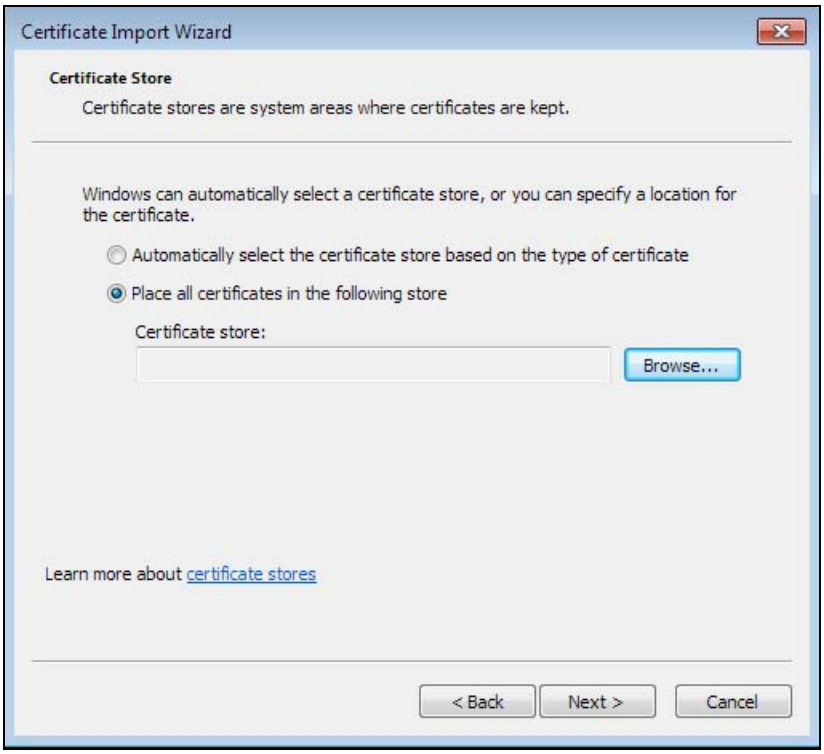
Rather than installing a public key certificate using web browser settings, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.

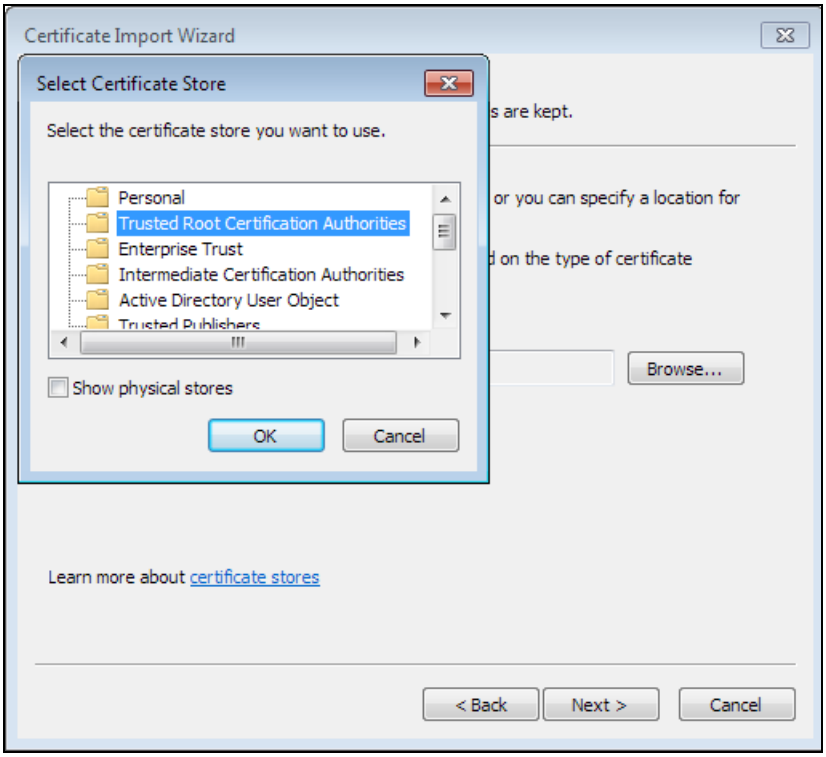
2 Click **Install Certificate**.



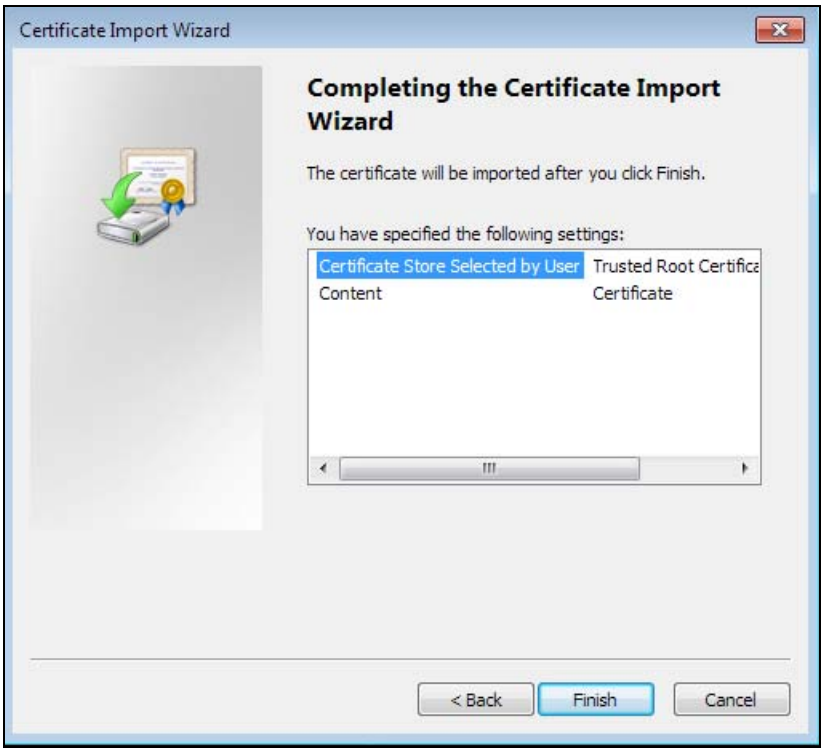
3 Click **Next** on the first wizard screen, click **Place all certificates in the following store**, and click **Browse**.



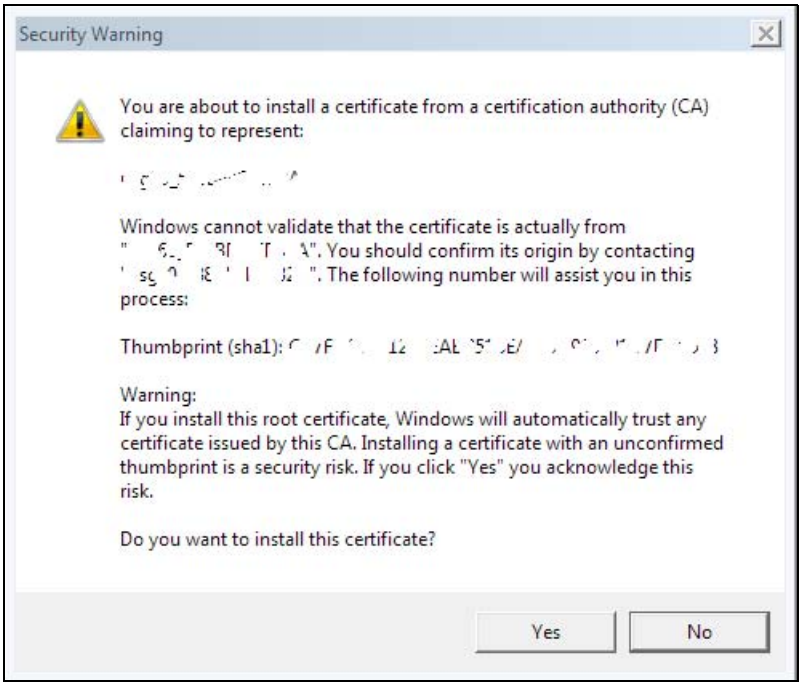
4 Select **Trusted Root Certificate Authorities** > **OK**, and then click **Next**.



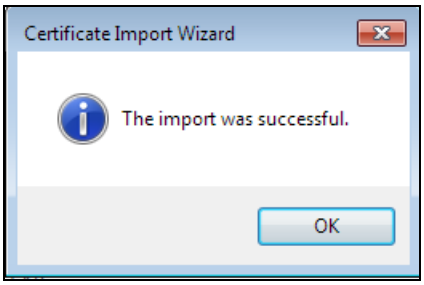
5 Confirm the information shown on the final wizard screen and click **Finish**.



6 If presented with a security warning, click **Yes**.



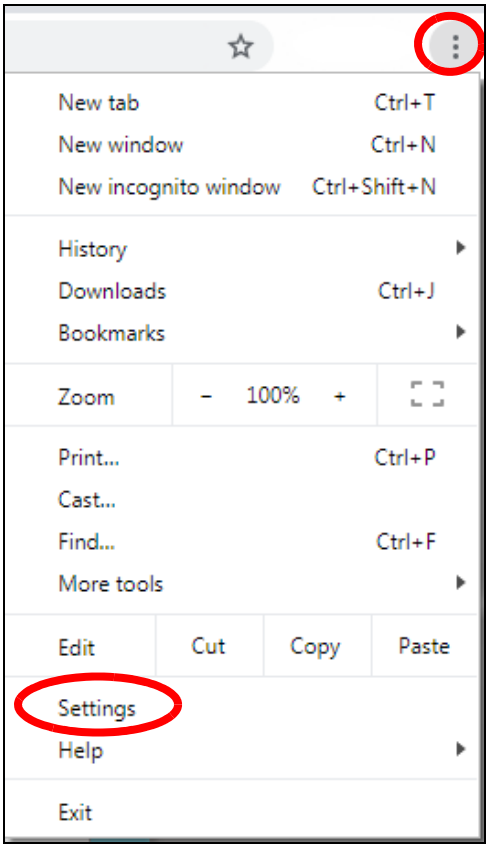
7 Finally, click **OK** when you are notified of the successful import.



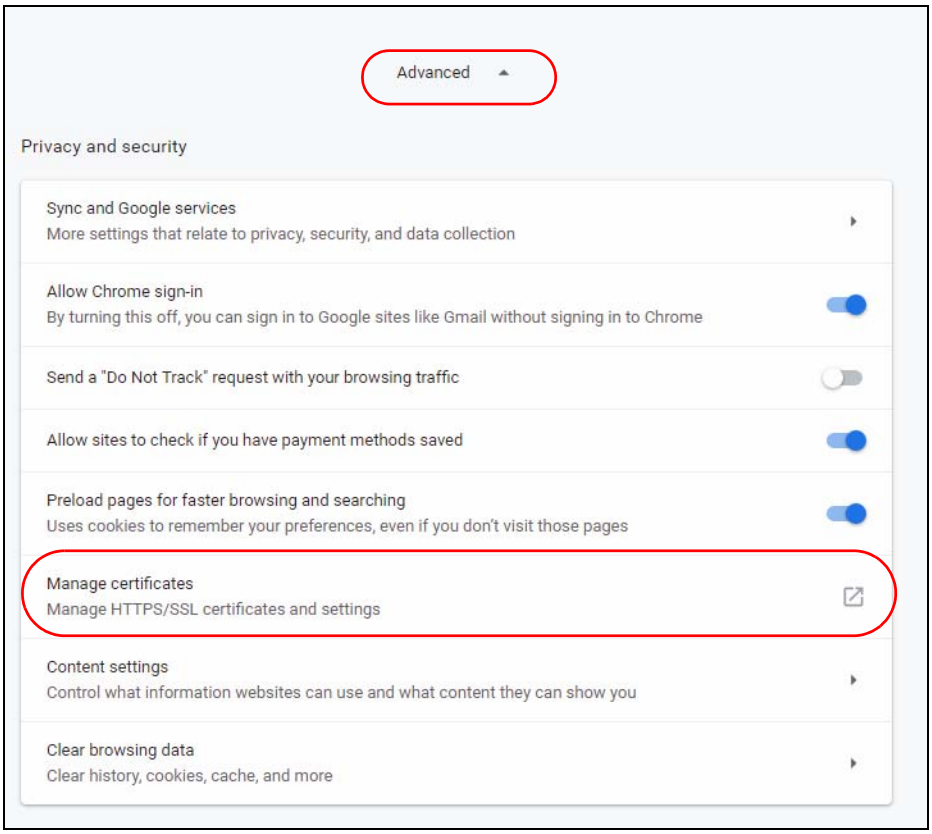
Remove a Certificate in Google Chrome

This section shows you how to remove a public key certificate in Google Chrome on Windows 7.

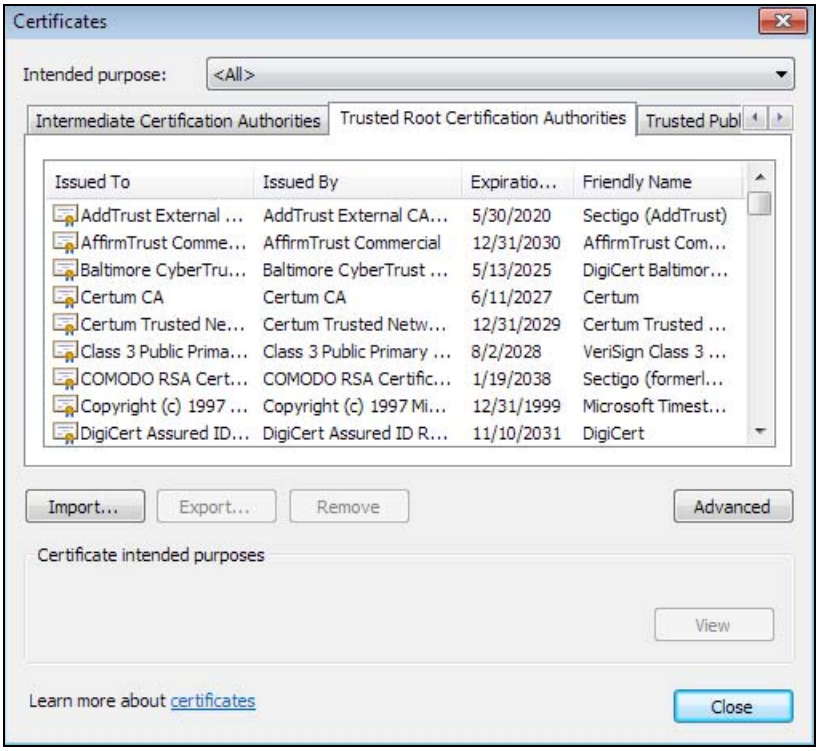
1 Open your web browser, click the menu icon, and click **Settings**.



2 Scroll down and click **Advanced** to expand the menu. Under **Privacy and security**, click **Manage certificates**.

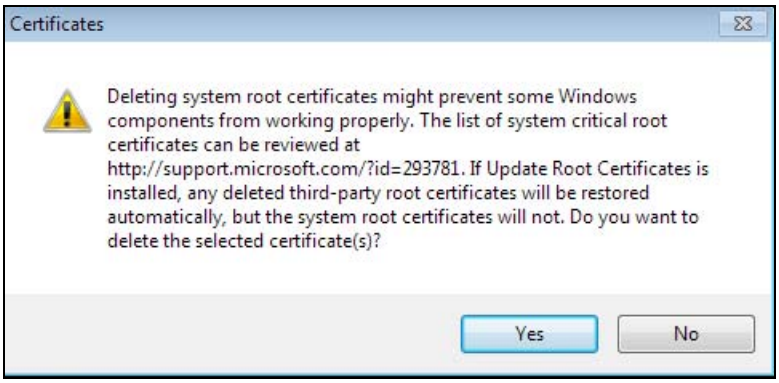


3 In the Certificates pop-up screen, click **Trusted Root Certification Authorities**.

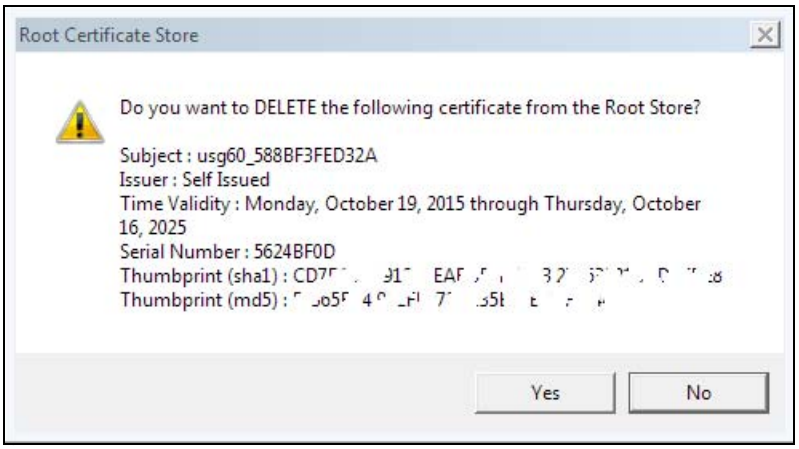


4 Select the certificate you want to remove and click **Remove**.

5 Click **Yes** when you see the following warning message.



6 Confirm the details displayed in the warning message and click **Yes**.

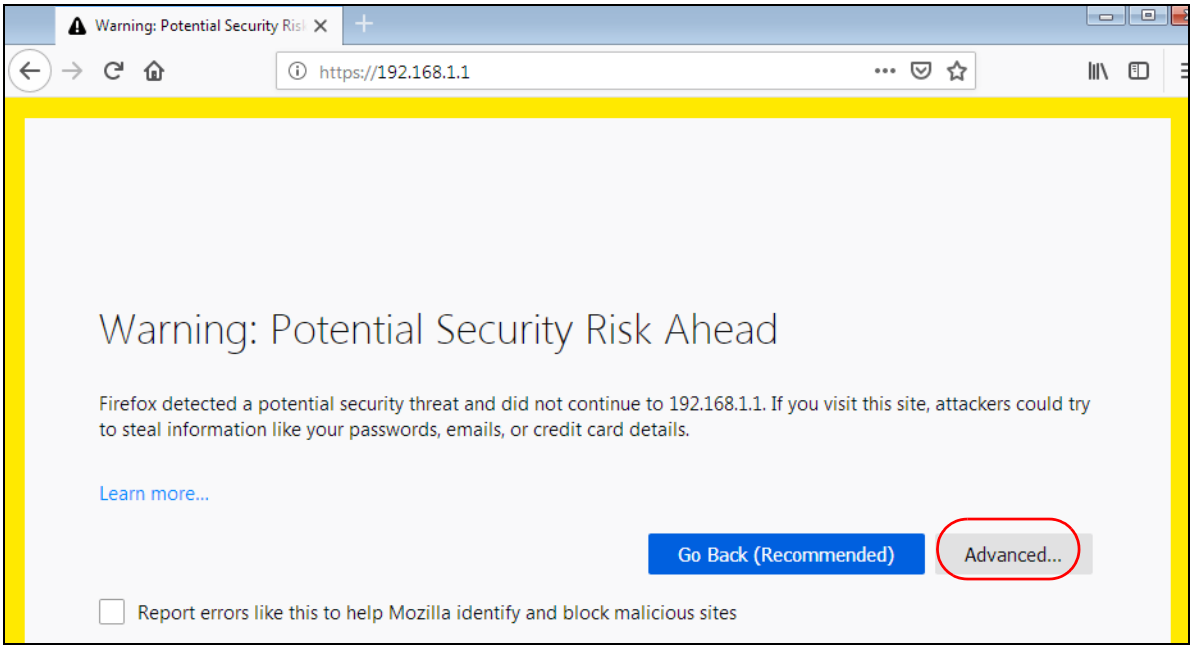


Firefox

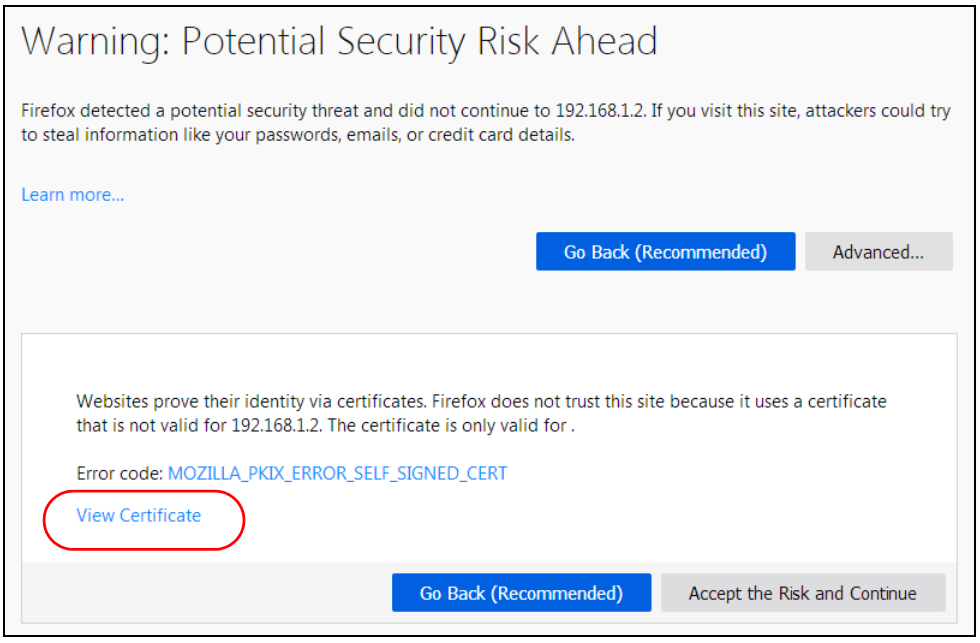
The following example uses Mozilla Firefox on Windows 7. You first have to store the certificate in your computer and then install it as a Trusted Root CA, as shown in the following tutorials.

Export a Certificate

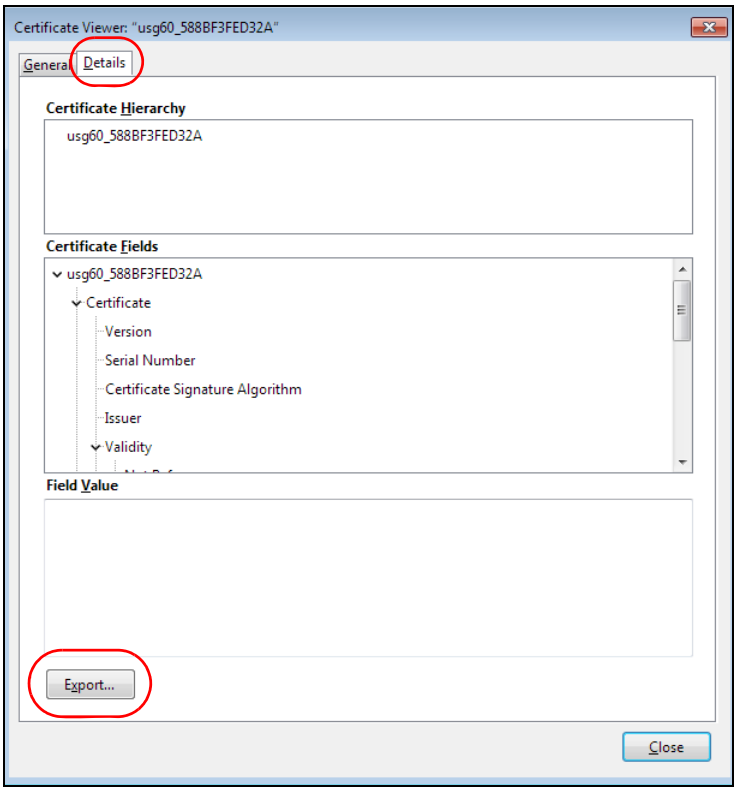
1 If your device's Web Configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error. Click **Advanced**.



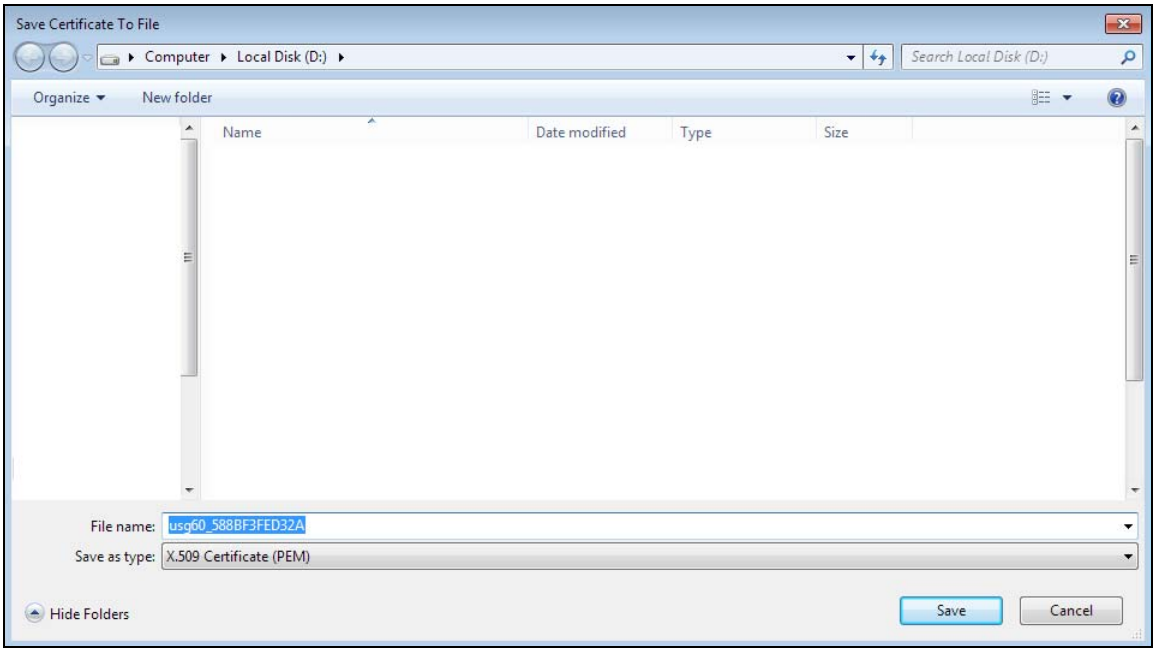
2 Click **View Certificate.**



3 Click **Details** > **Export.**



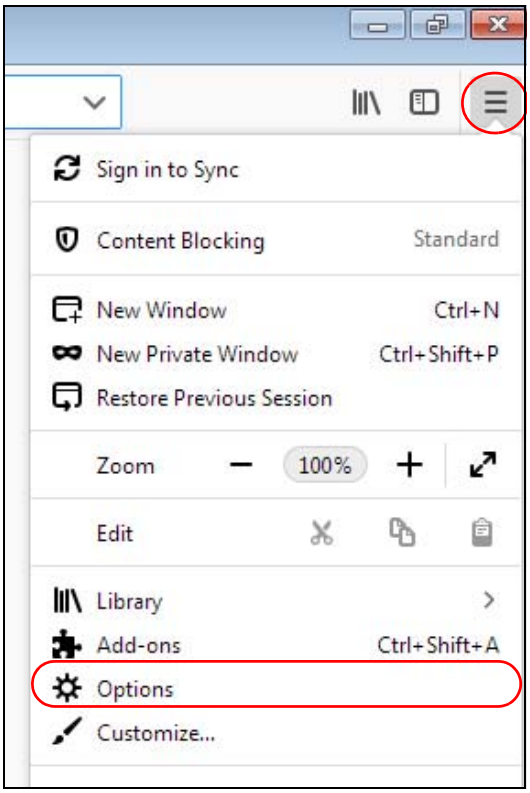
4 Type a filename and click **Save**.



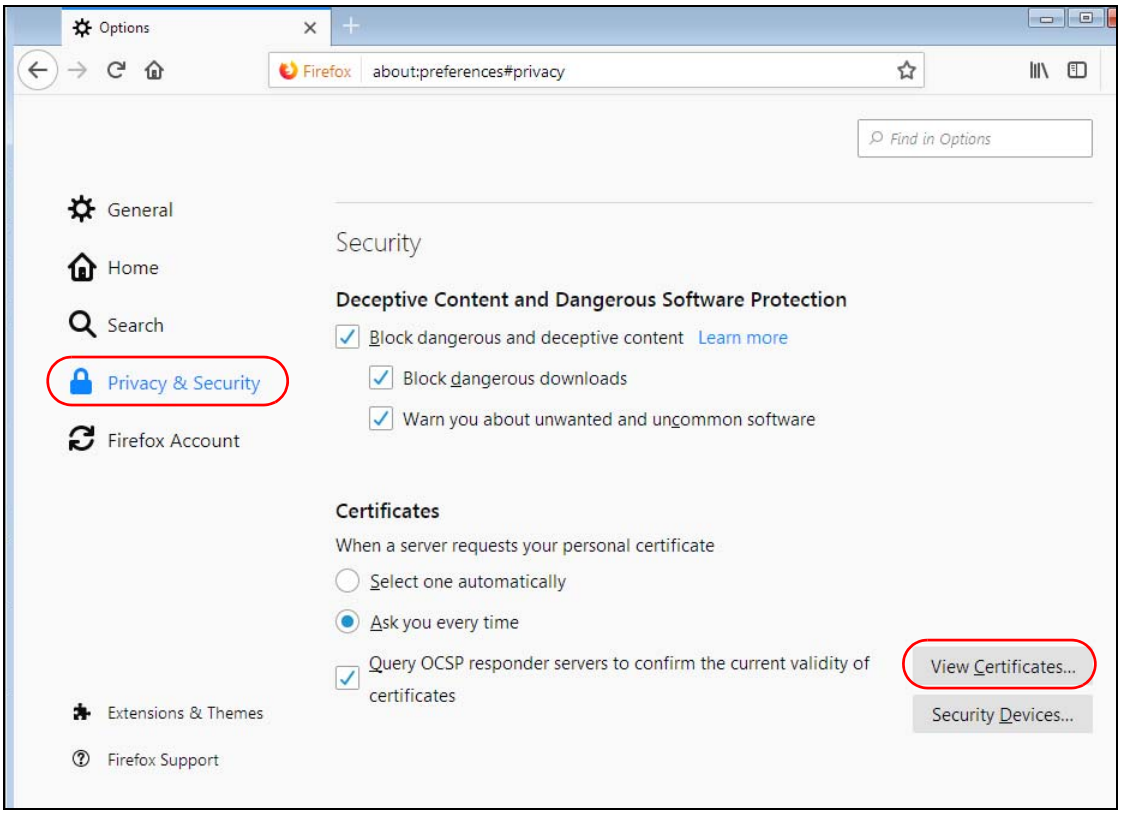
Import a Certificate

After storing the certificate in your computer, you need to import it in trusted root certification authorities using the following steps:

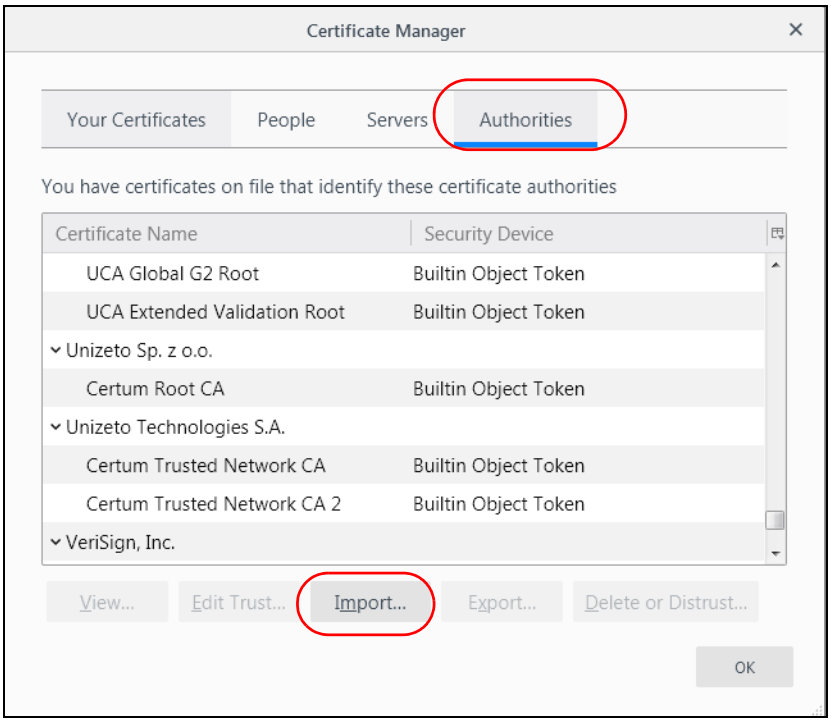
1 Open **Firefox** and click **Tools > Options**.



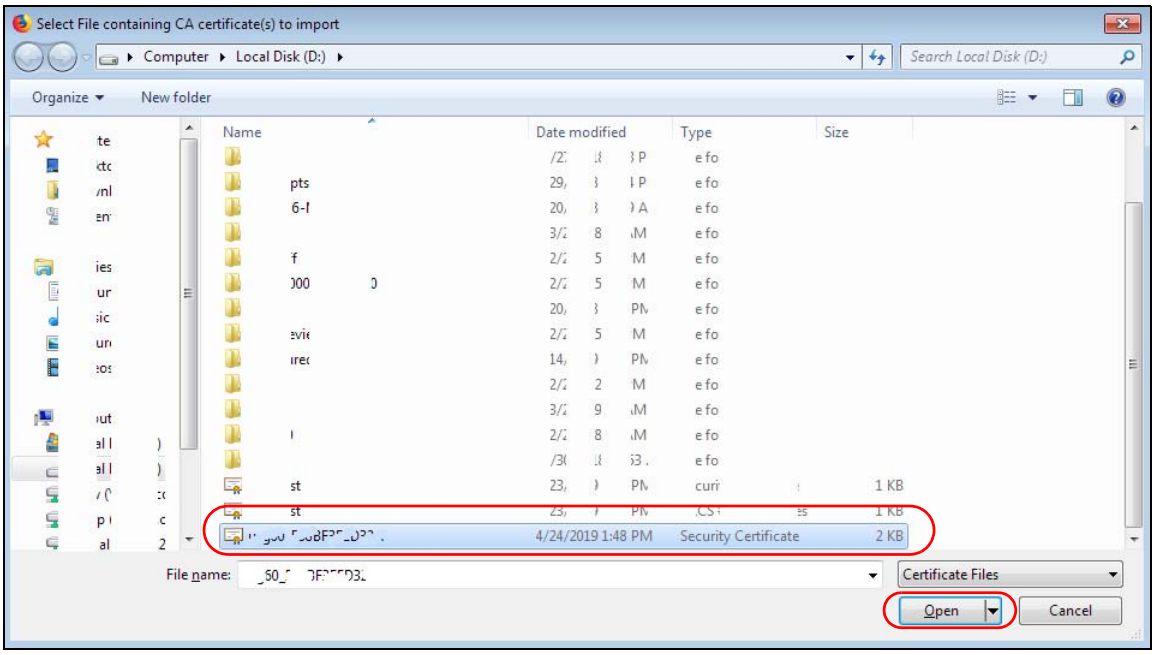
2 In the **Options** page, click **Privacy & Security**, scroll to the bottom of the page, and then click **View Certificates**.



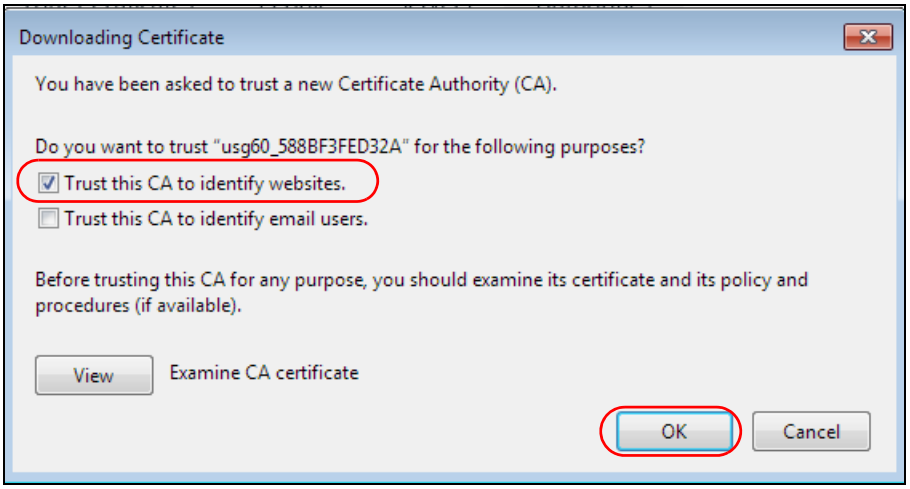
3 In the **Certificate Manager**, click **Authorities** > **Import**.



4 Use the **Select File** dialog box to locate the certificate and then click **Open**.



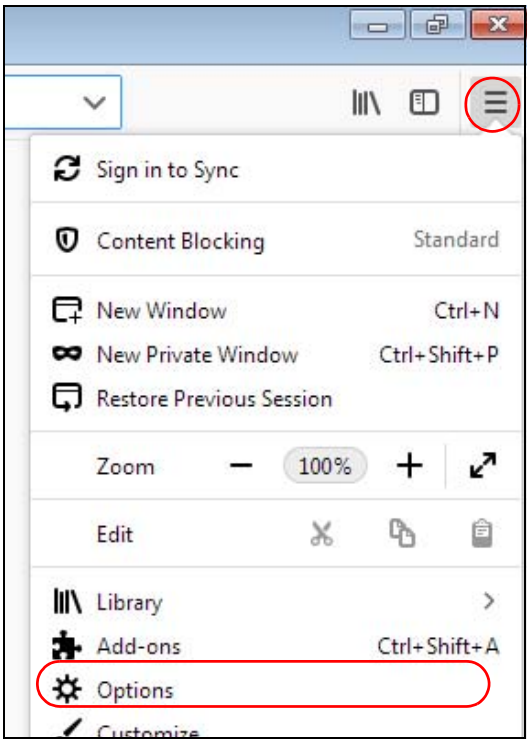
5 Select **Trust this CA to identify websites** and click **OK**.



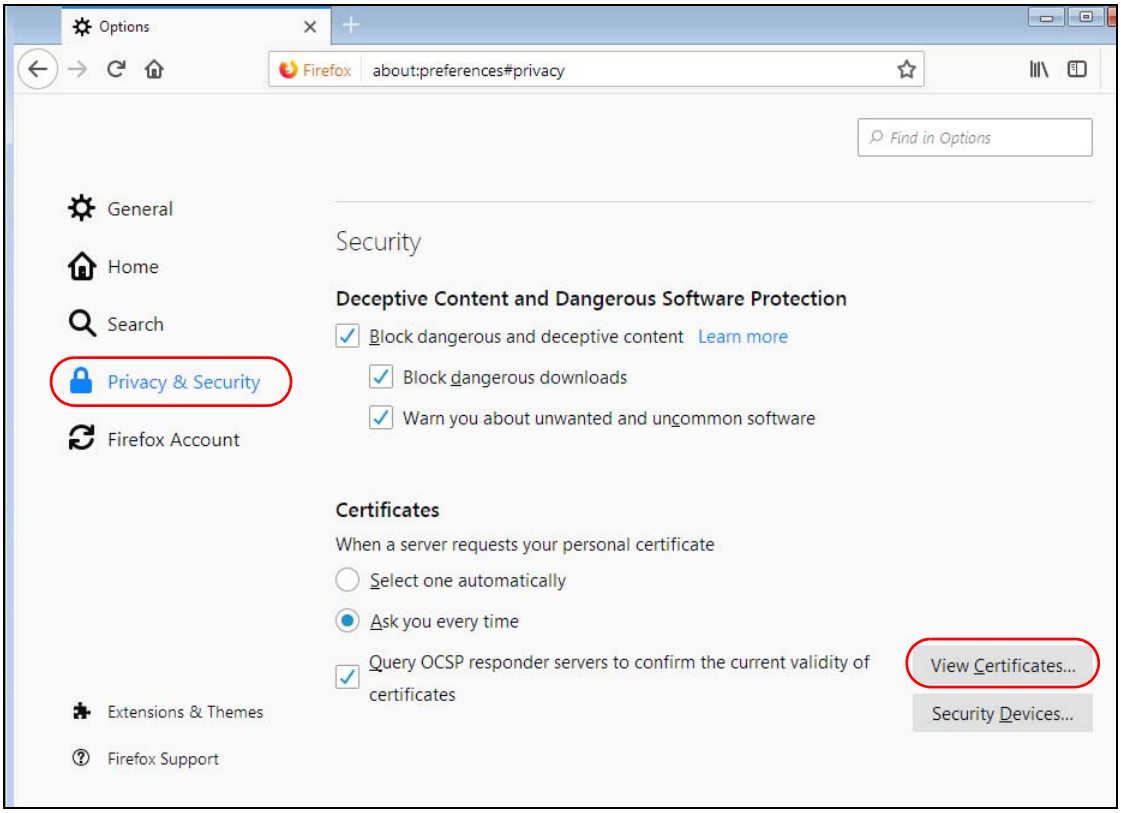
Removing a Certificate in Firefox

This section shows you how to remove a public key certificate in Firefox.

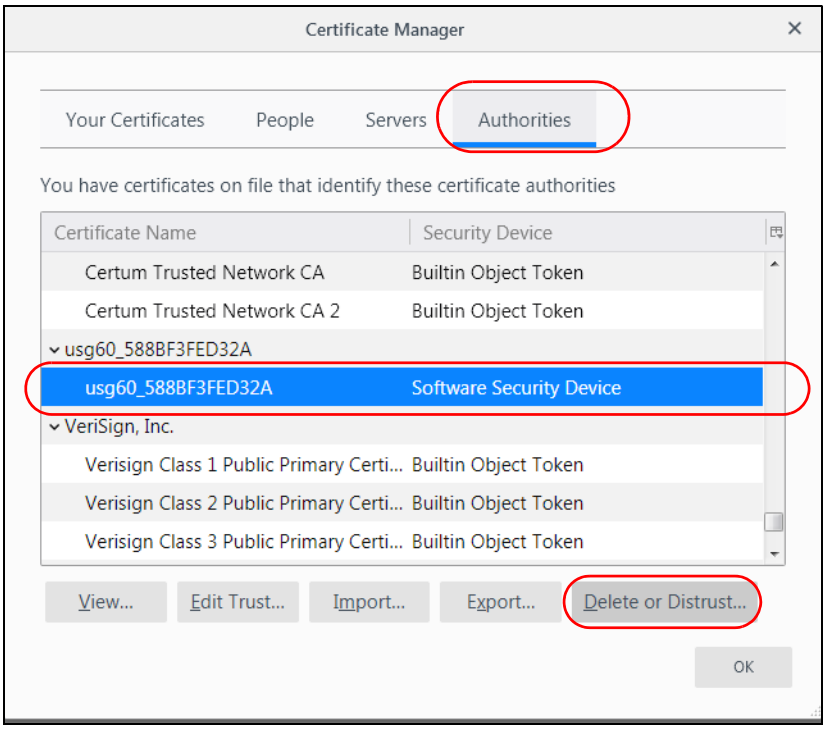
1 Open **Firefox** and click **Tools > Options**.



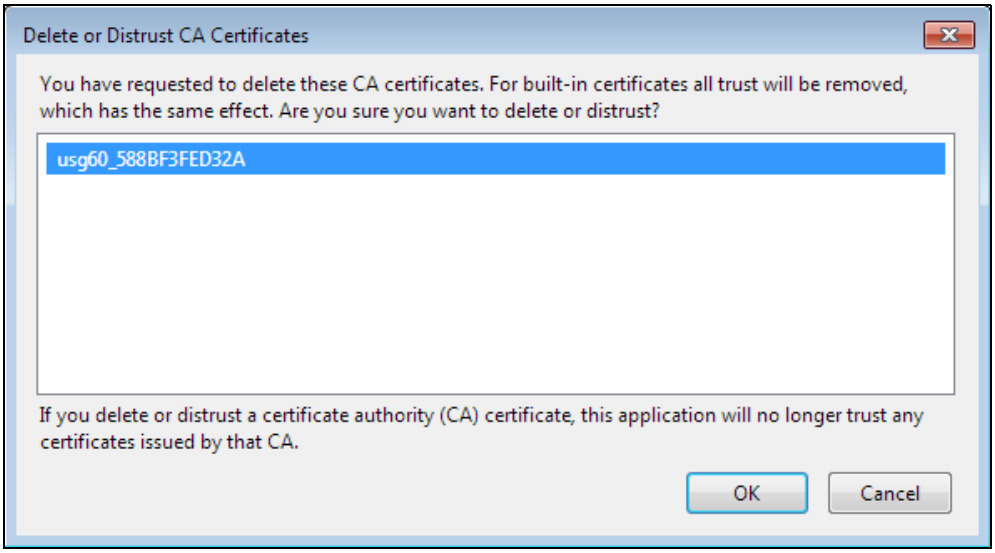
2 In the **Options** page, click **Privacy & Security**, scroll to the bottom of the page, and then click **View Certificates**.



3 In the **Certificate Manager**, click **Authorities** and select the certificate you want to remove, Click **Delete or Distrust**.



4 In the following dialog box, click **OK**.



5 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

APPENDIX D
Wireless LANs

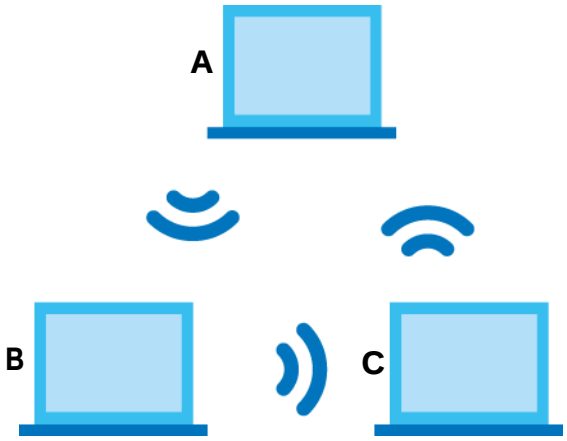
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

Figure 266 Peer-to-Peer Communication in an Ad-hoc Network

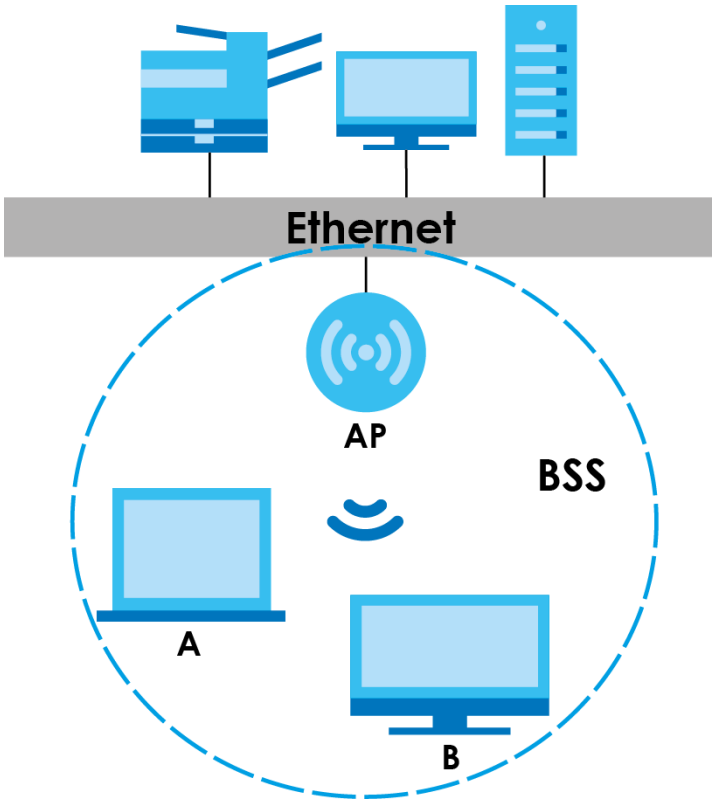


BSS

A Basic Service Set (BSS) exists when all communications between wireless clients or between a wireless client and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between wireless clients in the BSS. When Intra-BSS is enabled, wireless clients **A** and **B** can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless clients **A** and **B** can still access the wired network but cannot communicate with each other.

Figure 267 Basic Service Set



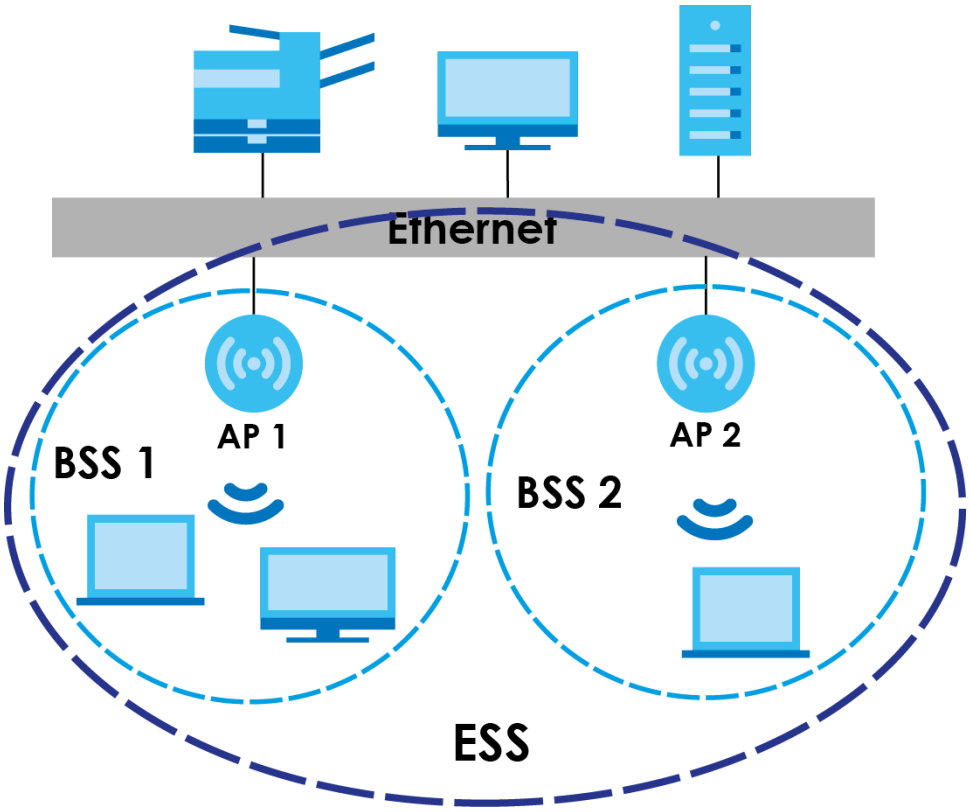
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless clients within the same ESS must have the same ESSID in order to communicate.

Figure 268 Infrastructure WLAN



Channel

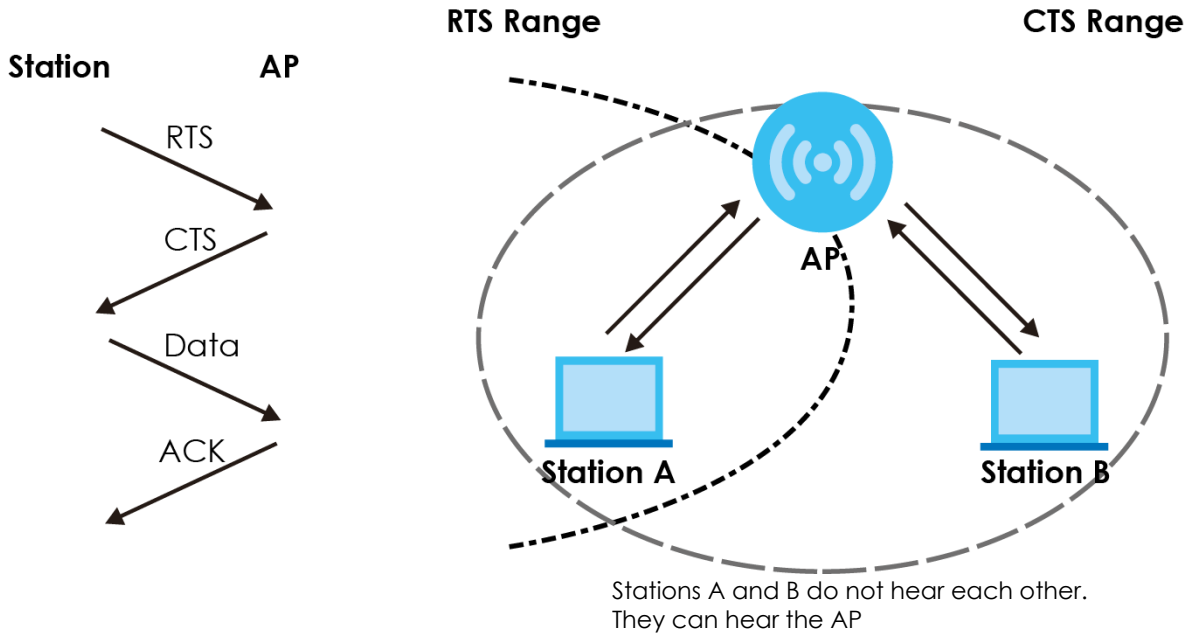
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 269 RTS/CTS



When station **A** sends data to the AP, it might not know that station **B** is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Note: Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Preamble Type

Preamble is used to signal that data is coming to the receiver. Short and long refer to the length of the synchronization field in a packet.

Short preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11 compliant wireless adapters support long preamble, but not all support short preamble.

Use long preamble if you are unsure what preamble mode other wireless devices on the network support, and to provide more reliable communications in busy wireless networks.

Use short preamble if you are sure all wireless devices on the network support it, and to provide more efficient communications.

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the NXC uses short preamble.

Note: The wireless devices MUST use the same preamble mode in order to communicate.

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 234 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless clients, access points and the wired network.

Wireless security methods available on the NXC are data encryption, wireless client authentication, restricting access by device MAC address and hiding the NXC identity.

The following figure shows the relative effectiveness of these wireless security methods available on your NXC.

Table 235 Wireless Security Levels

SECURITY LEVEL	SECURITY TYPE
Least Secure	Unique SSID (Default)
	Unique SSID with Hide SSID Enabled
	MAC Address Filtering
	WEP Encryption
	IEEE802.1x EAP with RADIUS Server Authentication
	WiFi Protected Access (WPA)
Most Secure	WPA2

Note: You must enable the same wireless security settings on the NXC and on all wireless clients that you want to associate with it.

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.
- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless clients.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication

  Determines the identity of the users.
- Authorization

  Determines the network services available to authenticated users once they are connected to the network.

- Accounting

  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless client and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request

  Sent by an access point requesting authentication.
- Access-Reject

  Sent by a RADIUS server rejecting access.
- Access-Accept

  Sent by a RADIUS server allowing access.
- Access-Challenge

  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request

  Sent by the access point requesting accounting.
- Accounting-Response

  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. .

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless client. The wireless client 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless clients for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the wireless security configuration screen. You may still configure and store keys, but they will not be used while dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 236 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

WiFi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA or WPA2 and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a WiFi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless clients using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

Wireless Client WPA Supplicants

A wireless client supplicant is the software that runs on an operating system instructing the wireless client how to use WPA. At the time of writing, the most widely available supplicant is the WPA patch for Windows XP, Funk Software's Odyssey client.

The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

WPA(2) with RADIUS Application Example

To set up WPA(2), you need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

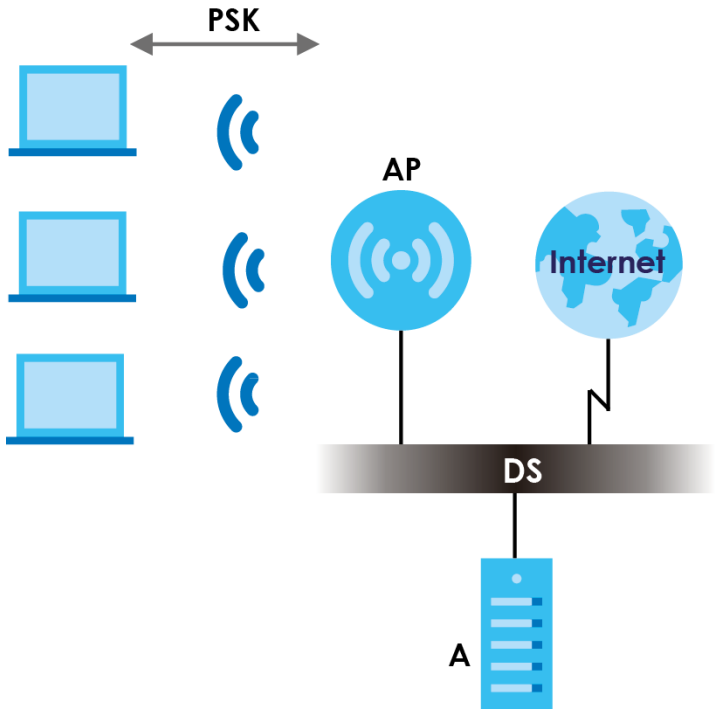
1 The AP passes the wireless client's authentication request to the RADIUS server.

2 The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.

3 A 256-bit Pairwise Master Key (PMK) is derived from the authentication process by the RADIUS server and the client.

4 The RADIUS server distributes the PMK to the AP. The AP then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys. The keys are used to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 270 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

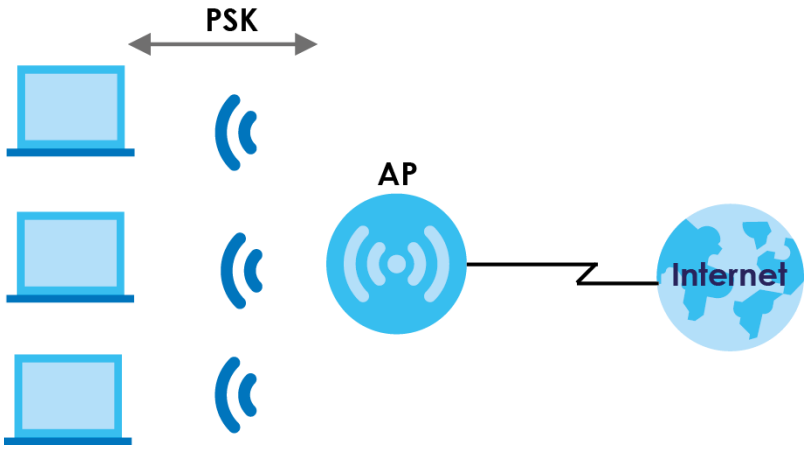
1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).

2 The AP checks each wireless client's password and allows it to join the network only if the password matches.

3 The AP and wireless clients generate a common PMK (Pairwise Master Key). The key itself is not sent over the network, but is derived from the PSK and the SSID.

4 The AP and wireless clients use the TKIP or AES encryption process, the PMK and information exchanged in a handshake to create temporal encryption keys. They use these keys to encrypt data exchanged between them.

Figure 271 WPA(2)-PSK Authentication



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each authentication method or key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 237 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

APPENDIX E
IPv6

Overview

IPv6 (Internet Protocol version 6), is designed to enhance IP address size and features. The increase in IPv6 address size to 128 bits (from the 32-bit IPv4 address) allows up to 3.4 x 10^{38} IP addresses.

IPv6 Addressing

The 128-bit IPv6 address is written as eight 16-bit hexadecimal blocks separated by colons (:). This is an example IPv6 address `2001:0db8:1a2b:0015:0000:0000:1a2f:0000`.

IPv6 addresses can be abbreviated in two ways:

- Leading zeros in a block can be omitted. So `2001:0db8:1a2b:0015:0000:0000:1a2f:0000` can be written as `2001:db8:1a2b:15:0:0:1a2f:0`.
- Any number of consecutive blocks of zeros can be replaced by a double colon. A double colon can only appear once in an IPv6 address. So `2001:0db8:0000:0000:1a2f:0000:0000:0015` can be written as `2001:0db8::1a2f:0000:0000:0015`, `2001:0db8:0000:0000:1a2f::0015`, `2001:db8::1a2f:0:0:15` or `2001:db8:0:0:1a2f::15`.

Prefix and Prefix Length

Similar to an IPv4 subnet mask, IPv6 uses an address prefix to represent the network address. An IPv6 prefix length specifies how many most significant bits (start from the left) in the address compose the network address. The prefix length is written as "/x" where x is a number. For example,

```
2001:db8:1a2b:15::1a2f:0/32
```

means that the first 32 bits (`2001:db8`) is the subnet prefix.

Link-local Address

A link-local address uniquely identifies a device on the local network (the LAN). It is similar to a "private IP address" in IPv4. You can have the same link-local address on multiple interfaces on a device. A link-local unicast address has a predefined prefix of fe80::/10. The link-local unicast address format is as follows.

Table 238 Link-local Unicast Address Format

1111 1110 10	0	Interface ID
10 bits	54 bits	64 bits

Global Address

A global address uniquely identifies a device on the Internet. It is similar to a "public IP address" in IPv4. A global unicast address starts with a 2 or 3.

Unspecified Address

An unspecified address (0:0:0:0:0:0:0:0 or ::) is used as the source address when a device does not have its own address. It is similar to "0.0.0.0" in IPv4.

Loopback Address

A loopback address (0:0:0:0:0:0:0:1 or ::1) allows a host to send packets to itself. It is similar to "127.0.0.1" in IPv4.

Multicast Address

In IPv6, multicast addresses provide the same functionality as IPv4 broadcast addresses. Broadcasting is not supported in IPv6. A multicast address allows a host to send packets to all hosts in a multicast group.

Multicast scope allows you to determine the size of the multicast group. A multicast address has a predefined prefix of ff00::/8. The following table describes some of the predefined multicast addresses.

Table 239 Predefined Multicast Address

MULTICAST ADDRESS	DESCRIPTION
FF01:0:0:0:0:0:0:1	All hosts on a local node.
FF01:0:0:0:0:0:0:2	All routers on a local node.
FF02:0:0:0:0:0:0:1	All hosts on a local connected link.
FF02:0:0:0:0:0:0:2	All routers on a local connected link.
FF05:0:0:0:0:0:0:2	All routers on a local site.
FF05:0:0:0:0:0:1:3	All DHCP severs on a local site.

The following table describes the multicast addresses which are reserved and can not be assigned to a multicast group.

Table 240 Reserved Multicast Address

MULTICAST ADDRESS
FF00:0:0:0:0:0:0:0
FF01:0:0:0:0:0:0:0
FF02:0:0:0:0:0:0:0
FF03:0:0:0:0:0:0:0
FF04:0:0:0:0:0:0:0
FF05:0:0:0:0:0:0:0
FF06:0:0:0:0:0:0:0
FF07:0:0:0:0:0:0:0
FF08:0:0:0:0:0:0:0
FF09:0:0:0:0:0:0:0
FF0A:0:0:0:0:0:0:0
FF0B:0:0:0:0:0:0:0
FF0C:0:0:0:0:0:0:0
FF0D:0:0:0:0:0:0:0
FF0E:0:0:0:0:0:0:0
FF0F:0:0:0:0:0:0:0

Subnet Masking

Both an IPv6 address and IPv6 subnet mask compose of 128-bit binary digits, which are divided into eight 16-bit blocks and written in hexadecimal notation. Hexadecimal uses four bits for each character (1 ~ 10, A ~ F). Each block's 16 bits are then represented by four hexadecimal characters. For example, FFFF:FFFF:FFFF:FFFF:FC00:0000:0000:0000.

Interface ID

In IPv6, an interface ID is a 64-bit identifier. It identifies a physical interface (for example, an Ethernet port) or a virtual interface (for example, the management IP address for a VLAN). One interface should have a unique interface ID.

EUI-64

The EUI-64 (Extended Unique Identifier) defined by the IEEE (Institute of Electrical and Electronics Engineers) is an interface ID format designed to adapt with IPv6. It is derived from the 48-bit (6-byte) Ethernet MAC address as shown next. EUI-64 inserts the hex digits fffe between the third and fourth bytes of the MAC address and complements the seventh bit of the first byte of the MAC address. See the following example.

Table 241

MAC	00	:	13	:	49	: 12	:	34	:	56	

Table 242

EUI-64	02	:	13	:	49	:	FF	:	FE	: 12	:	34	:	56

Stateless Autoconfiguration

With stateless autoconfiguration in IPv6, addresses can be uniquely and automatically generated. Unlike DHCPv6 (Dynamic Host Configuration Protocol version six) which is used in IPv6 stateful autoconfiguration, the owner and status of addresses don't need to be maintained by a DHCP server. Every IPv6 device is able to generate its own and unique IP address automatically when IPv6 is initiated on its interface. It combines the prefix and the interface ID (generated from its own Ethernet MAC address, see Interface ID and EUI-64) to form a complete IPv6 address.

When IPv6 is enabled on a device, its interface automatically generates a link-local address (beginning with fe80).

When the interface is connected to a network with a router and the NXC is set to automatically obtain an IPv6 network prefix from the router for the interface, it generates [2]another address which combines its interface ID and global and subnet information advertised from the router. This is a routable global IP address.

DHCPv6

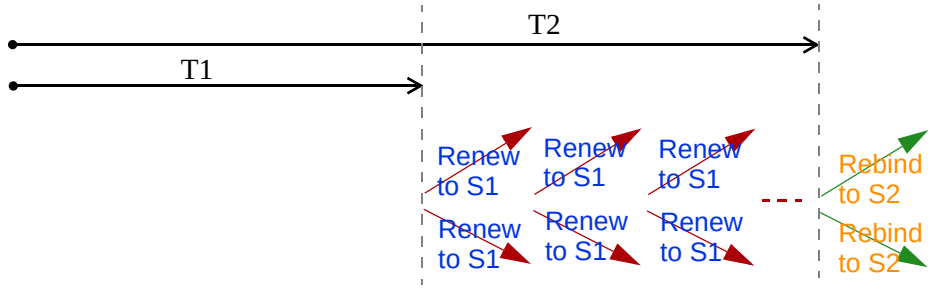
The Dynamic Host Configuration Protocol for IPv6 (DHCPv6, RFC 3315) is a server-client protocol that allows a DHCP server to assign and pass IPv6 network addresses, prefixes and other configuration information to DHCP clients. DHCPv6 servers and clients exchange DHCP messages using UDP.

2. In IPv6, all network interfaces can be associated with several addresses.

Each DHCP client and server has a unique DHCP Unique IDentifier (DUID), which is used for identification when they are exchanging DHCPv6 messages. The DUID is generated from the MAC address, time, vendor assigned ID and/or the vendor's private enterprise number registered with the IANA. It should not change over time even after you reboot the device.

Identity Association

An Identity Association (IA) is a collection of addresses assigned to a DHCP client, through which the server and client can manage a set of related IP addresses. Each IA must be associated with exactly one interface. The DHCP client uses the IA assigned to an interface to obtain configuration from a DHCP server for that interface. Each IA consists of a unique IAID and associated IP information.
The IA type is the type of address in the IA. Each IA holds one type of address. IA_NA means an identity association for non-temporary addresses and IA_TA is an identity association for temporary addresses. An IA_NA option contains the T1 and T2 fields, but an IA_TA option does not. The DHCPv6 server uses T1 and T2 to control the time at which the client contacts with the server to extend the lifetimes on any addresses in the IA_NA before the lifetimes expire. After T1, the client sends the server (**S1**) (from which the addresses in the IA_NA were obtained) a Renew message. If the time T2 is reached and the server does not respond, the client sends a Rebind message to any available server (**S2**). For an IA_TA, the client may send a Renew or Rebind message at the client's discretion.



DHCP Relay Agent

A DHCP relay agent is on the same network as the DHCP clients and helps forward messages between the DHCP server and clients. When a client cannot use its link-local address and a well-known multicast address to locate a DHCP server on its network, it then needs a DHCP relay agent to send a message to a DHCP server that is not attached to the same network.

The DHCP relay agent can add the remote identification (remote-ID) option and the interface-ID option to the Relay-Forward DHCPv6 messages. The remote-ID option carries a user-defined string, such as the system name. The interface-ID option provides slot number, port information and the VLAN ID to the DHCPv6 server. The remote-ID option (if any) is stripped from the Relay-Reply messages before the relay agent sends the packets to the clients. The DHCP server copies the interface-ID option from the Relay-Forward message into the Relay-Reply message and sends it to the relay agent. The interface-ID should not change even after the relay agent restarts.

Prefix Delegation

Prefix delegation enables an IPv6 router to use the IPv6 prefix (network address) received from the ISP (or a connected uplink router) for its LAN. The NXC uses the received IPv6 prefix (for example, 2001:db2::/48) to generate its LAN IP address. Through sending Router Advertisements (RAs) regularly by multicast, the NXC passes the IPv6 prefix information to its LAN hosts. The hosts then can use the prefix to generate their IPv6 addresses.

ICMPv6

Internet Control Message Protocol for IPv6 (ICMPv6 or ICMP for IPv6) is defined in RFC 4443. ICMPv6 has a preceding Next Header value of 58, which is different from the value used to identify ICMP for IPv4. ICMPv6 is an integral part of IPv6. IPv6 nodes use ICMPv6 to report errors encountered in packet processing and perform other diagnostic functions, such as "ping".

Neighbor Discovery Protocol (NDP)

The Neighbor Discovery Protocol (NDP) is a protocol used to discover other IPv6 devices and track neighbor's reachability in a network. An IPv6 device uses the following ICMPv6 messages types:

- Neighbor solicitation: A request from a host to determine a neighbor's link-layer address (MAC address) and detect if the neighbor is still reachable. A neighbor being "reachable" means it responds to a neighbor solicitation message (from the host) with a neighbor advertisement message.
- Neighbor advertisement: A response from a node to announce its link-layer address.
- Router solicitation: A request from a host to locate a router that can act as the default router and forward packets.
- Router advertisement: A response to a router solicitation or a periodical multicast advertisement from a router to advertise its presence and other parameters.

IPv6 Cache

An IPv6 host is required to have a neighbor cache, destination cache, prefix list and default router list. The NXC maintains and updates its IPv6 caches constantly using the information from response messages. In IPv6, the NXC configures a link-local address automatically, and then sends a neighbor solicitation message to check if the address is unique. If there is an address to be resolved or verified, the NXC also sends out a neighbor solicitation message. When the NXC receives a neighbor advertisement in response, it stores the neighbor's link-layer address in the neighbor cache. When the NXC uses a router solicitation message to query for a router and receives a router advertisement message, it adds the router's information to the neighbor cache, prefix list and destination cache. The NXC creates an entry in the default router list cache if the router can be used as a default router.

When the NXC needs to send a packet, it first consults the destination cache to determine the next hop. If there is no matching entry in the destination cache, the NXC uses the prefix list to determine whether the destination address is on-link and can be reached directly without passing through a router. If the address is onlink, the address is considered as the next hop. Otherwise, the NXC determines the next-hop from the default router list or routing table. Once the next hop IP address is known, the NXC looks into the neighbor cache to get the link-layer address and sends the packet when the neighbor is reachable. If the NXC cannot find an entry in the neighbor cache or the state for the neighbor is not reachable, it starts the address resolution process. This helps reduce the number of IPv6 solicitation and advertisement messages.

Multicast Listener Discovery

The Multicast Listener Discovery (MLD) protocol (defined in RFC 2710) is derived from IPv4's Internet Group Management Protocol version 2 (IGMPv2). MLD uses ICMPv6 message types, rather than IGMP message types. MLDv1 is equivalent to IGMPv2 and MLDv2 is equivalent to IGMPv3.

MLD allows an IPv6 switch or router to discover the presence of MLD listeners who wish to receive multicast packets and the IP addresses of multicast groups the hosts want to join on its network.

MLD snooping and MLD proxy are analogous to IGMP snooping and IGMP proxy in IPv4.

MLD filtering controls which multicast groups a port can join.

MLD Messages

A multicast router or switch periodically sends general queries to MLD hosts to update the multicast forwarding table. When an MLD host wants to join a multicast group, it sends an MLD Report message for that address.

An MLD Done message is equivalent to an IGMP Leave message. When an MLD host wants to leave a multicast group, it can send a Done message to the router or switch. The router or switch then sends a group-specific query to the port on which the Done message is received to determine if other devices connected to this port should remain in the group.

Example - Enabling IPv6 on Windows XP/2003/Vista

By default, Windows XP and Windows 2003 support IPv6. This example shows you how to use the `ipv6 install` command on Windows XP/2003 to enable IPv6. This also displays how to use the `ipconfig` command to see auto-generated IP addresses.

```
C:\>ipv6 install
Installing...
Succeeded.

C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 10.1.1.46
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        IP Address. . . . . . . . . . . . : fe80::2d0:59ff:feb8:103c%4
        Default Gateway . . . . . . . . . : 10.1.1.254
```

IPv6 is installed and enabled by default in Windows Vista. Use the `ipconfig` command to check your automatic configured IPv6 address as well. You should see at least one IPv6 address available for the interface on your computer.

Example - Enabling DHCPv6 on Windows XP

Windows XP does not support DHCPv6. If your network uses DHCPv6 for IP address assignment, you have to additionally install a DHCPv6 client software on your Windows XP. (Note: If you use static IP addresses or Router Advertisement for IPv6 address assignment in your network, ignore this section.)

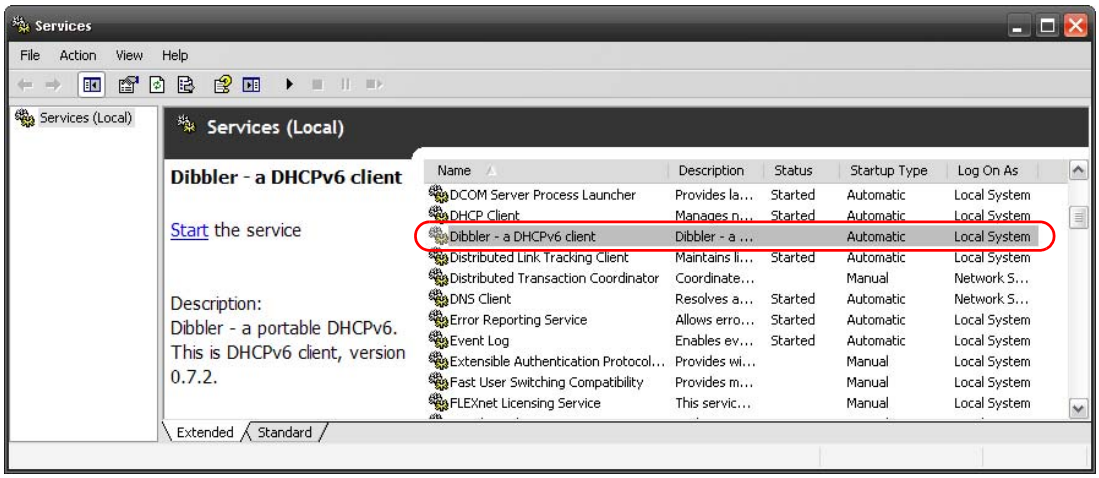
This example uses Dibbler as the DHCPv6 client. To enable DHCPv6 client on your computer:

1 Install Dibbler and select the DHCPv6 client option on your computer.

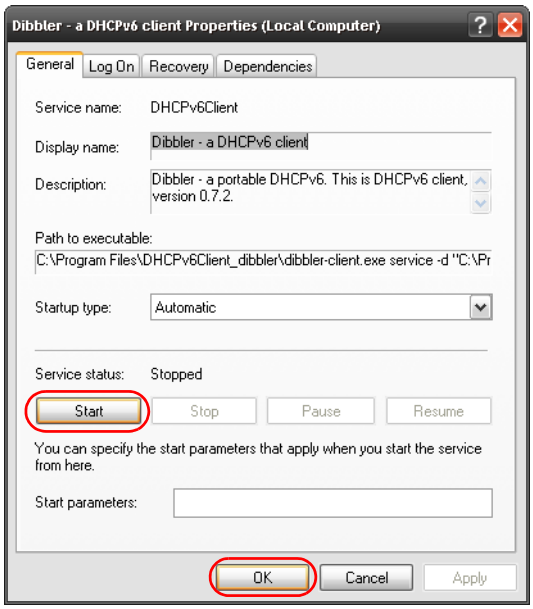
2 After the installation is complete, select **Start** > **All Programs** > **Dibbler-DHCPv6** > **Client Install as service**.

3 Select **Start** > **Control Panel** > **Administrative Tools** > **Services**.

4 Double click **Dibbler - a DHCPv6 client**.



5 Click **Start** and then **OK**.



6 Now your computer can obtain an IPv6 address from a DHCPv6 server.

Example - Enabling IPv6 on Windows 7

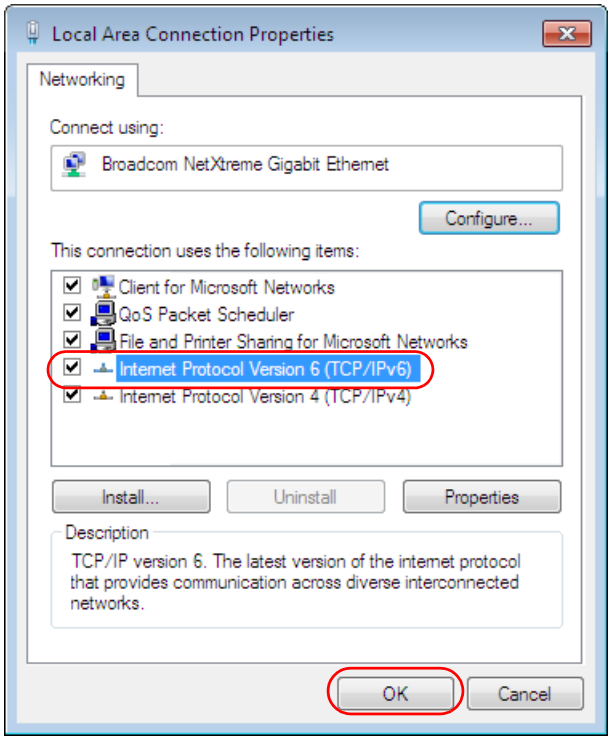
Windows 7 supports IPv6 by default. DHCPv6 is also enabled when you enable IPv6 on a Windows 7 computer.

To enable IPv6 in Windows 7:

1 Select **Control Panel** > **Network and Sharing Center** > **Local Area Connection**.

2 Select the **Internet Protocol Version 6 (TCP/IPv6)** checkbox to enable it.

3 Click **OK** to save the change.



4 Click **Close** to exit the **Local Area Connection Status** screen.

5 Select **Start** > **All Programs** > **Accessories** > **Command Prompt**.

6 Use the `ipconfig` command to check your dynamic IPv6 address. This example shows a global address (2001:b021:2d::1000) obtained from a DHCP server.

```
C:\>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:b021:2d::1000
   Link-local IPv6 Address . . . . . : fe80::25d8:dcab:c80a:5189%11
   IPv4 Address. . . . . . . . . . . : 172.16.100.61
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::213:49ff:feaa:7125%11
                                       172.16.100.254
```

APPENDIX F
Customer Support

In the event of problems that cannot be solved by using this manual, you should contact your vendor. If you cannot contact your vendor, then contact a Zyxel office for the region in which you bought the device.

See *https://www.zyxel.com/homepage.shtml* and also *https://www.zyxel.com/about_zyxel/zyxel_worldwide.shtml* for the latest information.

Please have the following information ready when you contact an office.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

Corporate Headquarters (Worldwide)

Taiwan

- Zyxel Communications Corporation
- http://www.zyxel.com

Asia

China

- Zyxel Communications (Shanghai) Corp.
  Zyxel Communications (Beijing) Corp.
  Zyxel Communications (Tianjin) Corp.
- https://www.zyxel.com/cn/zh/

India

- Zyxel Technology India Pvt Ltd
- https://www.zyxel.com/in/en/

Kazakhstan

- Zyxel Kazakhstan
- https://www.zyxel.kz

Korea

- Zyxel Korea Corp.
- http://www.zyxel.kr

Malaysia

- Zyxel Malaysia Sdn Bhd.
- http://www.zyxel.com.my

Pakistan

- Zyxel Pakistan (Pvt.) Ltd.
- http://www.zyxel.com.pk

Philippines

- Zyxel Philippines
- http://www.zyxel.com.ph

Singapore

- Zyxel Singapore Pte Ltd.
- http://www.zyxel.com.sg

Taiwan

- Zyxel Communications Corporation
- https://www.zyxel.com/tw/zh/

Thailand

- Zyxel Thailand Co., Ltd
- https://www.zyxel.com/th/th/

Vietnam

- Zyxel Communications Corporation-Vietnam Office
- https://www.zyxel.com/vn/vi

Europe

Belarus

- Zyxel BY
- https://www.zyxel.by

Belgium

- Zyxel Communications B.V.
- https://www.zyxel.com/be/nl/

- https://www.zyxel.com/be/fr/

Bulgaria

- Zyxel България
- https://www.zyxel.com/bg/bg/

Czech Republic

- Zyxel Communications Czech s.r.o
- https://www.zyxel.com/cz/cs/

Denmark

- Zyxel Communications A/S
- https://www.zyxel.com/dk/da/

Estonia

- Zyxel Estonia
- https://www.zyxel.com/ee/et/

Finland

- Zyxel Communications
- https://www.zyxel.com/fi/fi/

France

- Zyxel France
- https://www.zyxel.fr

Germany

- Zyxel Deutschland GmbH
- https://www.zyxel.com/de/de/

Hungary

- Zyxel Hungary & SEE
- https://www.zyxel.com/hu/hu/

Italy

- Zyxel Communications Italy
- https://www.zyxel.com/it/it/

Latvia

- Zyxel Latvia
- https://www.zyxel.com/lv/lv/

Lithuania

- Zyxel Lithuania
- https://www.zyxel.com/lt/lt/

Netherlands

- Zyxel Benelux
- https://www.zyxel.com/nl/nl/

Norway

- Zyxel Communications
- https://www.zyxel.com/no/no/

Poland

- Zyxel Communications Poland
- https://www.zyxel.com/pl/pl/

Romania

- Zyxel Romania
- https://www.zyxel.com/ro/ro

Russia

- Zyxel Russia
- https://www.zyxel.com/ru/ru/

Slovakia

- Zyxel Communications Czech s.r.o. organizacna zlozka
- https://www.zyxel.com/sk/sk/

Spain

- Zyxel Communications ES Ltd
- https://www.zyxel.com/es/es/

Sweden

- Zyxel Communications
- https://www.zyxel.com/se/sv/

Switzerland

- Studerus AG
- https://www.zyxel.ch/de
- https://www.zyxel.ch/fr

Turkey

- Zyxel Turkey A.S.
- https://www.zyxel.com/tr/tr/

UK

- Zyxel Communications UK Ltd.
- https://www.zyxel.com/uk/en/

Ukraine

- Zyxel Ukraine
- http://www.ua.zyxel.com

South America

Argentina

- Zyxel Communications Corporation
- https://www.zyxel.com/co/es/

Brazil

- Zyxel Communications Brasil Ltda.
- https://www.zyxel.com/br/pt/

Colombia

- Zyxel Communications Corporation
- https://www.zyxel.com/co/es/

Ecuador

- Zyxel Communications Corporation
- https://www.zyxel.com/co/es/

South America

- Zyxel Communications Corporation
- https://www.zyxel.com/co/es/

Middle East

Israel

- Zyxel Communications Corporation
- http://il.zyxel.com/

Middle East

- Zyxel Communications Corporation
- https://www.zyxel.com/me/en/

North America

USA

- Zyxel Communications, Inc. - North America Headquarters
- https://www.zyxel.com/us/en/

Oceania

Australia

- Zyxel Communications Corporation
- https://www.zyxel.com/au/en/

Africa

South Africa

- Nology (Pty) Ltd.
- https://www.zyxel.com/za/en/

APPENDIX G
Legal Information

Copyright

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Your use of the NXC is subject to the terms and conditions of any related service providers.

Trademarks

Trademarks mentioned in this publication are used for identification purposes only and may be properties of their respective owners.

Regulatory Notice and Statement

UNITED STATEs of AMERICA

The following information applies if you use the product within USA area.

FCC EMC Statement

- 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.

(2) This device must accept any interference received, including interference that may cause undesired operations.

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Class A Products (NXC5500 for example):

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Class B Products (NXC2500 for example):

- This product has been tested and complies with the specifications 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 device generates, uses, and can radiate radio frequency energy and, if not installed and used according to 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 device does cause harmful interference to radio or television reception, which is found by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving antenna.
  - Increase the separation between the devices.
  - Connect the equipment to an outlet other than the receiver's.
  - Consult a dealer or an experienced radio/TV technician for assistance.

CANADA

The following information applies if you use the product within Canada area.

Innovation, Science and Economic Development Canada ICES Statement

Class A Products (NXC5500 for example):

CAN ICES-3 (A)/NMB-3(A)

Class B Products (NXC2500 for example):

CAN ICES-3 (B)/NMB-3(B)

EUROPEAN UNION

The following information applies if you use the product within the European Union.

CE EMC Statement (Class A Products Only, NXC5500 for example)

WARNING: This equipment is compliant with Class A of EN55032. In a residential environment this equipment may cause radio interference.

List of national codes

COUNTRY	ISO 3166 2 LETTER CODE	COUNTRY	ISO 3166 2 LETTER CODE
Austria	AT	Liechtenstein	LI
Belgium	BE	Lithuania	LT
Bulgaria	BG	Luxembourg	LU
Croatia	HR	Malta	MT
Cyprus	CY	Netherlands	NL
Czech Republic	CZ	Norway	NO
Denmark	DK	Poland	PL
Estonia	EE	Portugal	PT
Finland	FI	Romania	RO
France	FR	Serbia	RS
Germany	DE	Slovakia	SK
Greece	GR	Slovenia	SI
Hungary	HU	Spain	ES
Iceland	IS	Switzerland	CH
Ireland	IE	Sweden	SE
Italy	IT	Turkey	TR
Latvia	LV	United Kingdom	GB

Safety Warnings

- Do not use this product near water, for example, in a wet basement or near a swimming pool.
- Do not expose your device to dampness, dust or corrosive liquids.
- Do not store things on the device.
- Do not obstruct the device ventilation slots as insufficient airflow may harm your device. For example, do not place the device in an enclosed space such as a box or on a very soft surface such as a bed or sofa.
- Do not install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do not open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks.
- Only qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Do not remove the plug and connect it to a power outlet by itself; always attach the plug to the power adaptor first before connecting it to a power outlet.
- Do not allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Please use the provided or designated connection cables/power cables/ adaptors. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe). If the power adaptor or cord is damaged, it might cause electrocution. Remove it from the device and the power source, repairing the power adapter or cord is prohibited. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Caution: Risk of explosion if battery is replaced by an incorrect type, dispose of used batteries according to the instruction. Dispose them at the applicable collection point for the recycling of electrical and electronic device. For detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the store where you purchased the product.
- Use ONLY power wires of the appropriate wire gauge for your device. Connect it to a power supply of the correct voltage.
- Fuse Warning! Replace a fuse only with a fuse of the same type and rating.
- The POE (Power over Ethernet) devices that supply or receive power and their connected Ethernet cables must all be completely indoors.

- The following warning statements apply, where the disconnect device is not incorporated in the device or where the plug on the power supply cord is intended to serve as the disconnect device,
  - For permanently connected devices, a readily accessible disconnect device shall be incorporated external to the device;
  - For pluggable devices, the socket-outlet shall be installed near the device and shall be easily accessible.

Class A Products Only (NXC5500 for example):

- This device must be grounded by qualified service personnel. Never defeat the ground conductor or operate the device in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.
- When connecting or disconnecting power to hot-pluggable power supplies, if offered with your system, observe the following guidelines:
  - Install the power supply before connecting the power cable to the power supply.
  - Unplug the power cable before removing the power supply.
  - If the system has multiple sources of power, disconnect power from the system by unplugging all power cables from the power supply.

Important Safety Instructions (Class A Products Only, NXC5500 for example)

1 Warning! Energy Hazard. Remove all metal jewelry, watches, and so on from your hands and wrists before serving this device.

2 Do not open the device, opening or removing covers can expose you to dangerous high voltage points or other risks please, contact your vendor for further information.

3 Caution! The RJ-45 jacks are not used for telephone line connection.

4  Hazardous Moving Parts. Keep body parts away from fan blades.

1 Avertissement: Risque de choc électrique. Retirer tout bijoux en métal et votre montre de vos mains et poignets avant de manipuler cet appareil.

2 Ne pas ouvrir l'appareil, l'ouverture ou le retrait des couvercles peut vous exposer à des points comportant des tensions élevées ou à d'autres risques. Veuillez contacter votre vendeur pour plus d'informations.

3 Attention: Les câbles RJ-45 ne doivent pas être utilisés pour les connections téléphoniques.

4  Mobilité des pièces détachées. S'assurer que les pièces détachées ne sont pas en contact avec les pales du ventilateur.

Environment Statement

ErP (Energy-related Products) (Class B Products Only, NXC2500 for example)

Zyxel products put on the EU market in compliance with the requirement of the European Parliament and the Council published

Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products (recast), so called

as "ErP Directive (Energy-related Products directive) as well as ecodesign requirement laid down in applicable implementing measures, power consumption has satisfied regulation requirements which are:

Network standby power consumption < 8W, and/or

Off mode power consumption < 0.5W, and/or

Standby mode power consumption < 0.5W.

European Union - Disposal and Recycling Information

The symbol below means that according to local regulations your product and/or its battery shall be disposed of separately from domestic waste. If this product is end of life, take it to a recycling station designated by local authorities. At the time of disposal, the separate collection of your product and/or its battery will help save natural resources and ensure that the environment is sustainable development.

Die folgende Symbol bedeutet, dass Ihr Produkt und/oder seine Batterie gemäß den örtlichen Bestimmungen getrennt vom Hausmüll entsorgt werden muss. Wenden Sie sich an eine Recyclingstation, wenn dieses Produkt das Ende seiner Lebensdauer erreicht hat. Zum Zeitpunkt der Entsorgung wird die getrennte Sammlung von Produkt und/oder seiner Batterie dazu beitragen, natürliche Ressourcen zu sparen und die Umwelt und die menschliche Gesundheit zu schützen.

El símbolo de abajo indica que según las regulaciones locales, su producto y/o su batería deberán depositarse como basura separada de la doméstica. Cuando este producto alcance el final de su vida útil, llévelo a un punto limpio. Cuando llegue el momento de desechar el producto, la recogida por separado éste y/o su batería ayudará a salvar los recursos naturales y a proteger la salud humana y medioambiental.

Le symbole ci-dessous signifie que selon les réglementations locales votre produit et/ou sa batterie doivent être éliminés séparément des ordures ménagères. Lorsque ce produit atteint sa fin de vie, amenez-le à un centre de recyclage. Au moment de la mise au rebut, la collecte séparée de votre produit et/ou de sa batterie aidera à économiser les ressources naturelles et protéger l'environnement et la santé humaine.

Il simbolo sotto significa che secondo i regolamenti locali il vostro prodotto e/o batteria deve essere smaltito separatamente dai rifiuti domestici. Quando questo prodotto raggiunge la fine della vita di servizio portarlo a una stazione di riciclaggio. Al momento dello smaltimento, la raccolta separata del vostro prodotto e/o della sua batteria aiuta a risparmiare risorse naturali e a proteggere l'ambiente e la salute umana.

Symbolen innebär att enligt lokal lagstiftning ska produkten och/eller dess batteri kastas separat från hushållsavfallet. När den här produkten når slutet av sin livslängd ska du ta den till en återvinningsstation. Vid tiden för kasseringen bidrar du till en bättre miljö och mänsklig hälsa genom att göra dig av med den på ett återvinningsställe.

台灣

以下訊息僅適用於產品銷售至台灣地區 (只適用於甲類產品 , 如 NXC5500)

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

安全警告

為了您的安全，請先閱讀以下警告及指示：

- 請勿將此產品接近水、火焰或放置在高溫的環境。
- 避免設備接觸
  任何液體 - 切勿讓設備接觸水、雨水、高濕度、污水腐蝕性的液體或其他水份。
  灰塵及污物 - 切勿接觸灰塵、污物、沙土、食物或其他不合適的材料。
- 雷雨天氣時，不要安裝，使用或維修此設備。有遭受電擊的風險。
- 切勿重摔或撞擊設備，並勿使用不正確的電源變壓器。
- 若接上不正確的電源變壓器會有爆炸的風險。。
- 請勿隨意更換產品內的電池。
- 如果更換不正確之電池型式，會有爆炸的風險，請依製造商說明書處理使用過之電池。
- 請將廢電池丟棄在適當的電器或電子設備回收處。
- 請勿將設備解體。
- 請勿阻礙設備的散熱孔，空氣對流不足將會造成設備損害。
- 請插在正確的電壓供給插座 (如：北美 / 台灣電壓 110V AC，歐洲是 230V AC)。
- 假若電源變壓器或電源變壓器的纜線損壞，請從插座拔除，若您還繼續插電使用，會有觸電死亡的風險。
- 請勿試圖修理電源變壓器或電源變壓器的纜線，若有毀損，請直接聯絡您購買的店家，購買一個新的電源變壓器。
- 請勿將此設備安裝於室外，此設備僅適合放置於室內。
- 請勿隨一般垃圾丟棄。
- 請參閱產品背貼上的設備額定功率。
- 請參考產品型錄或是彩盒上的作業溫度。
- 設備必須接地，接地導線不允許被破壞或沒有適當安裝接地導線，如果不確定接地方式是否符合要求可聯繫相應的電氣檢驗機構檢驗。
- 如果您提供的系統中有提供熱插拔電源，連接或斷開電源請遵循以下指導原則
  - 先連接電源線至設備連，再連接電源。
  - 先斷開電源再拔除連接至設備的電源線。
  - 如果系統有多個電源，需拔除所有連接至電源的電源線再關閉設備電源。
- 產品沒有斷電裝置或者採用電源線的插頭視為斷電裝置的一部分，以下警語將適用：
  - 對永久連接之設備， 在設備外部須安裝可觸及之斷電裝置；
  - 對插接式之設備， 插座必須接近安裝之地點而且是易於觸及的。

About the Symbols

Various symbols are used in this product to ensure correct usage, to prevent danger to the user and others, and to prevent property damage. The meaning of these symbols are described below. It is important that you read these descriptions thoroughly and fully understand the contents.

Explanation of the Symbols

SYMBOL	EXPLANATION
	Alternating current (AC): AC is an electric current in which the flow of electric charge periodically reverses direction.
	Direct current (DC): DC if the unidirectional flow or movement of electric charge carriers.
	Earth; ground: A wiring terminal intended for connection of a Protective Earthing Conductor.
	Class II equipment: The method of protection against electric shock in the case of class II equipment is either double insulation or reinforced insulation.

Viewing Certifications

Go to http://www.zyxel.com to view this product's documentation and certifications..

Zyxel Limited Warranty

Zyxel warrants to the original end user (purchaser) that this product is free from any defects in material or workmanship for a specific period (the Warranty Period) from the date of purchase. The Warranty Period varies by region. Check with your vendor and/or the authorized Zyxel local distributor for details about the Warranty Period of this product. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, Zyxel will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal or higher value, and will be solely at the discretion of Zyxel. This warranty shall not apply if the product has been modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

Note

Repair or replacement, as provided under this warranty, is the exclusive remedy of the purchaser. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular use or purpose. Zyxel shall in no event be held liable for indirect or consequential damages of any kind to the purchaser.

To obtain the services of this warranty, contact your vendor. You may also refer to the warranty policy for the region in which you bought the device at http://www.zyxel.com/web/support_warranty_info.php.

Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com.

Open Source Licenses

This product contains in part some free software distributed under GPL license terms and/or GPL like licenses. Open source licenses are provided with the firmware package. You can download the latest firmware at www.zyxel.com. If you cannot find it there, contact your vendor or Zyxel Technical Support at support@zyxel.com.tw.

To obtain the source code covered under those Licenses, please contact your vendor or Zyxel Technical Support at support@zyxel.com.tw.

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