ZYXEL
Your Networking Ally

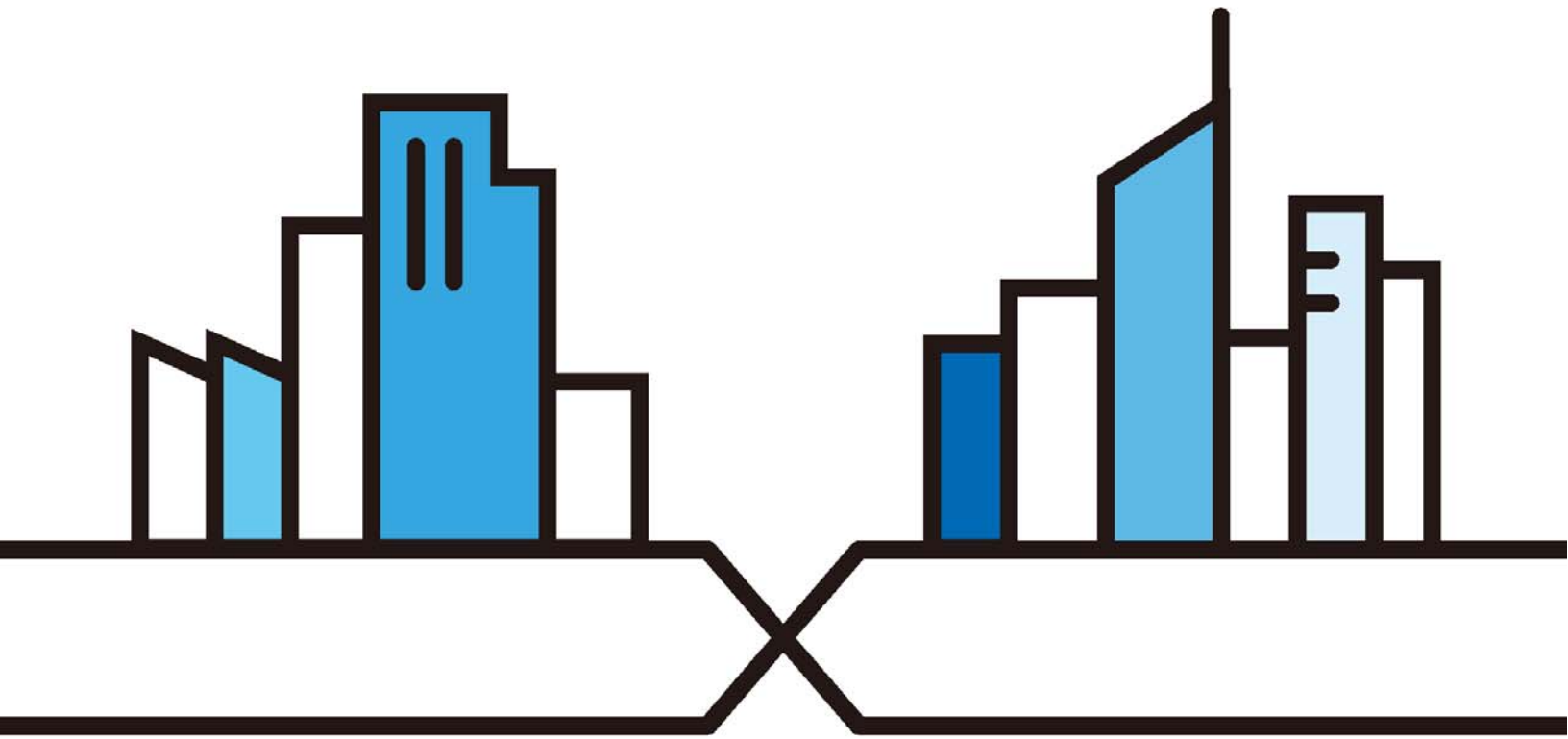
# User's Guide

# NXC Series

## Wireless LAN Controller

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

Version 5.00 Edition 1, 02/2017



**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.

- 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.

# 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 |
|---|---|---|
| Two USB Ports | Yes | Yes |
| Console Port (Serial Port) | DB-9 Connector | RJ-45 Connector |

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**<br>(LAN) | A zone is a group of interfaces. Use zones to apply security settings such as firewall. |
| **Interfaces**<br>(Ethernet, VLAN) | Interfaces are logical entities that (layer-3) packets pass through. Use interfaces in configuring zones, policy routes, static routes, and NAT.<br>Port combine physical ports into interfaces. |
| **Physical Ethernet Ports**<br>(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

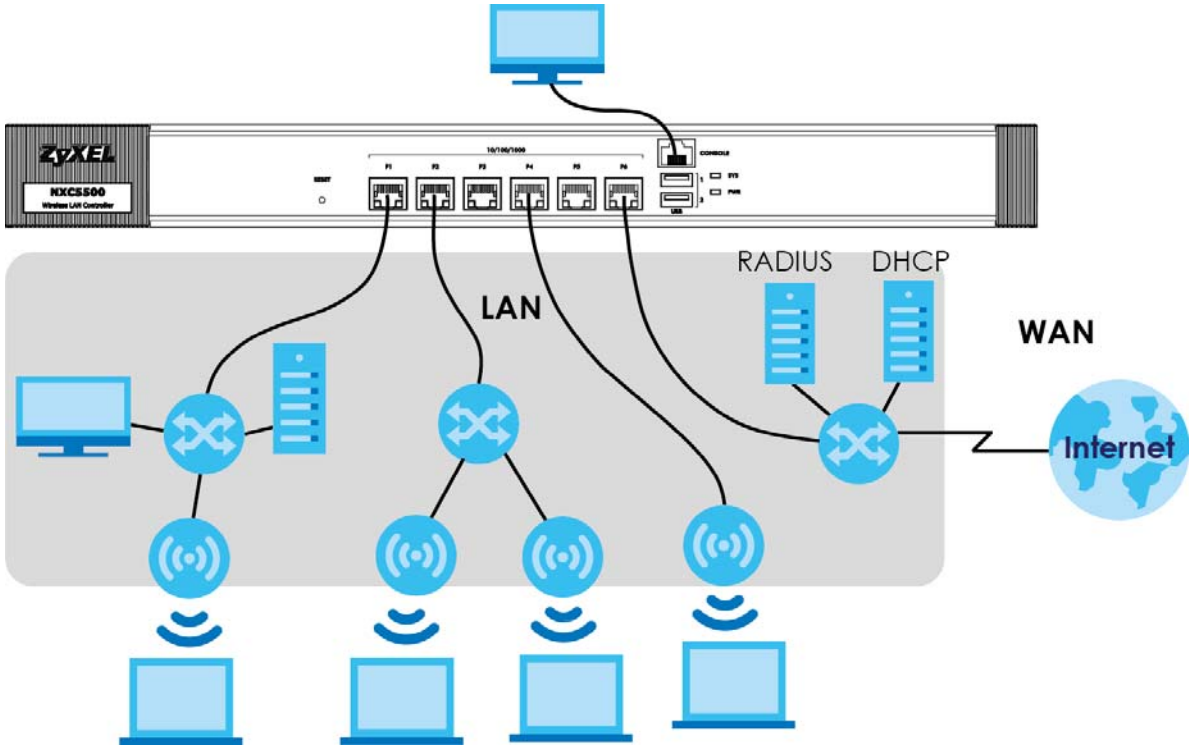



Table 3 Default Interfaces Configuration

| 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.

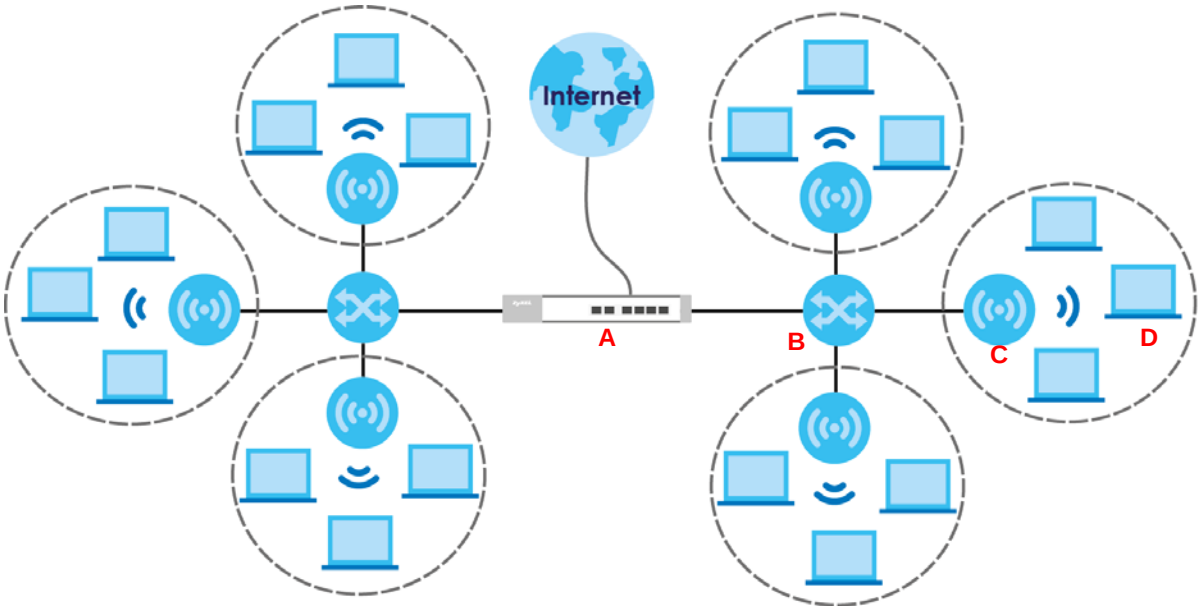
# 1.3 Applications

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.

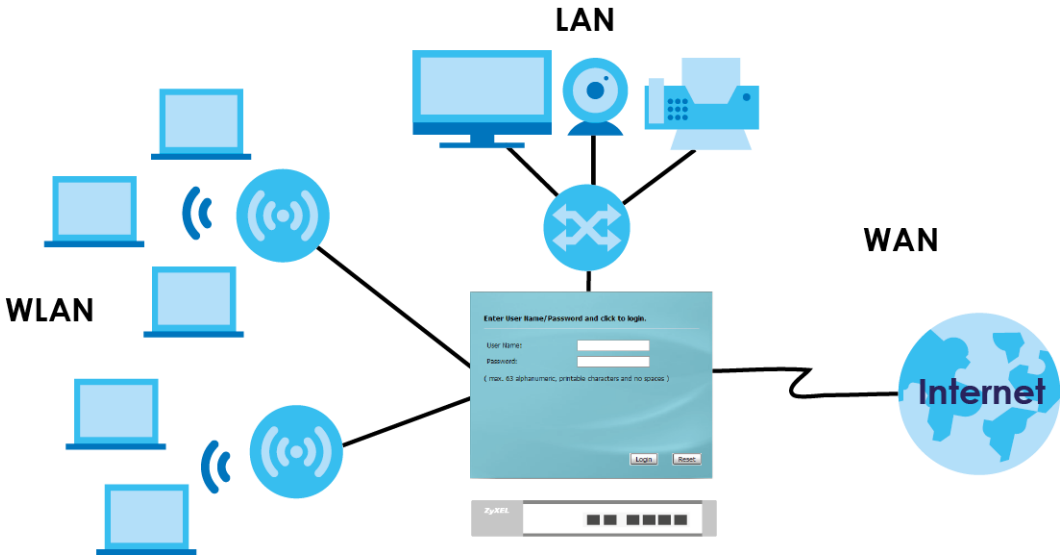
## 1.3.2 Wireless Security

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 Rack-mounted Installation

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

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: Leave 10 cm of clearance at the sides and 20 cm in the rear.

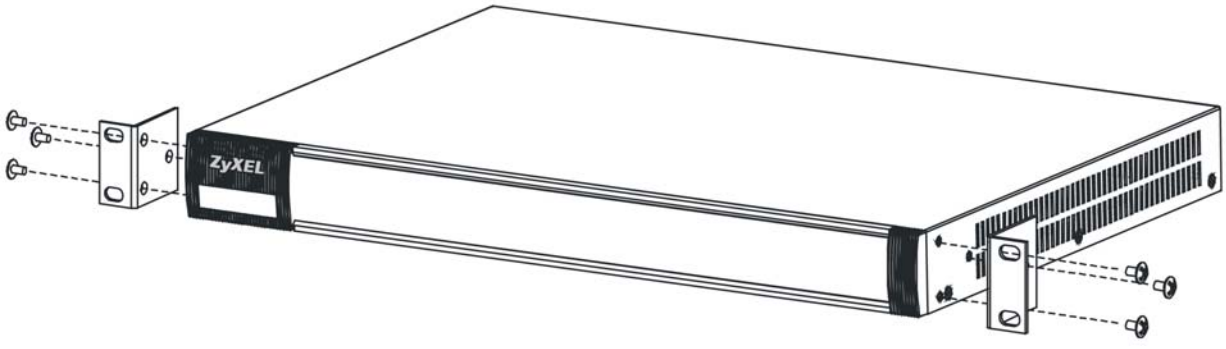
Use a #2 Phillips screwdriver to install the screws.

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

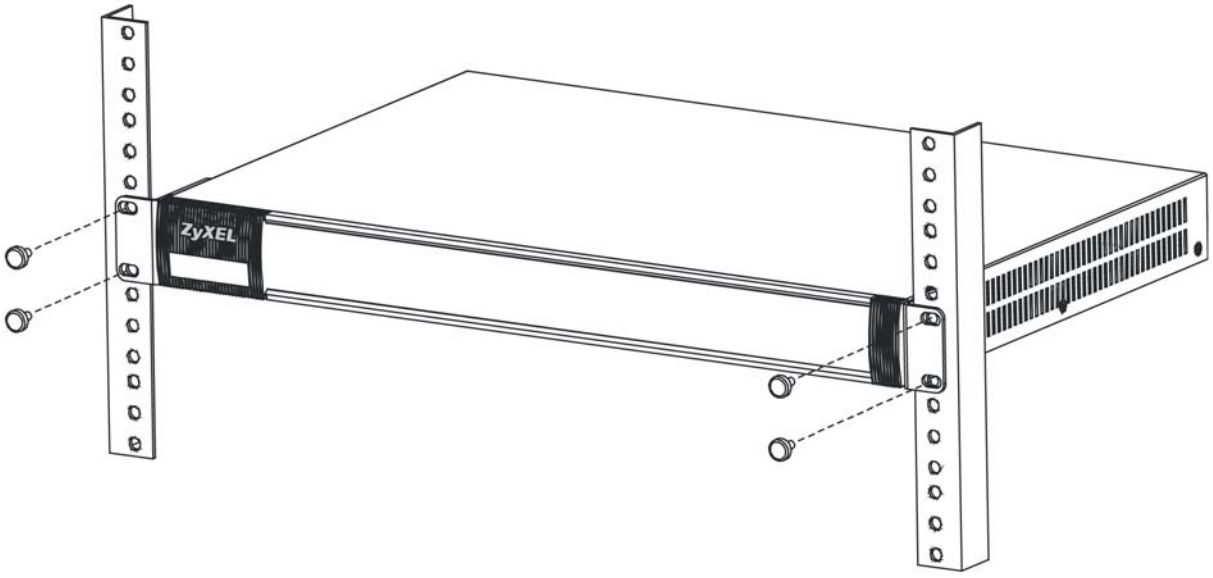
### 2.1.1 Rack-Mounted Installation Procedure

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.



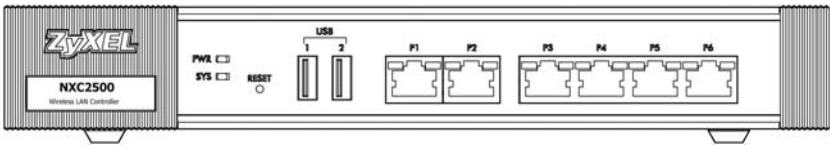

# 2.2 Front Panel

This section gives you an overview of the front panel.

## 2.2.1 NXC2500

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

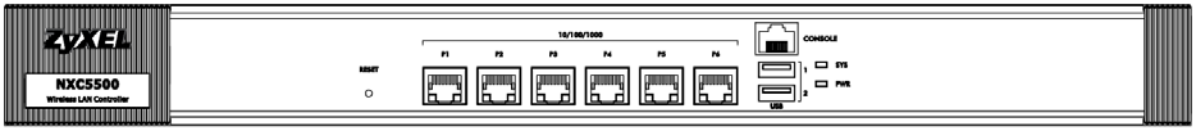
**Figure 4** Front Panel: NXC2500




## 2.2.2 NXC5500

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

**Figure 5** 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.

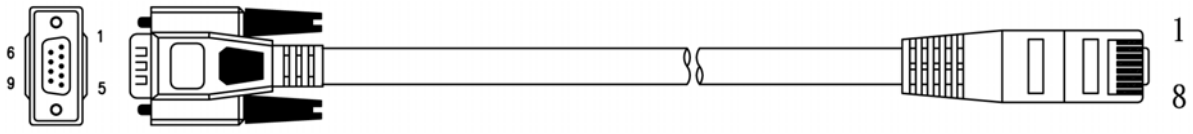



Table 6 RJ-45-to-DB-9 Console Cable Color Codes

| 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 |

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

| DB-9 SIGNAL | DB-9 PIN# | WIRE COLOR | RJ45 PIN# |
|---|---|---|---|
| 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.

## 2.2.3 Front Panel LEDs

This section describes the front panel LEDs.

### 2.2.3.1 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 21). 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. |

### 2.2.3.2 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. |

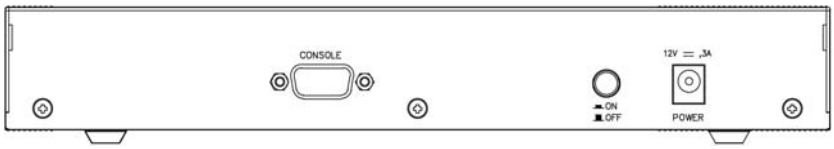
Table 8 Front Panel LEDs: NXC5500 (continued)

| LED | COLOR | STATUS | DESCRIPTION |
|---|---|---|---|
| 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 21). 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. |

# 2.3 Rear Panel

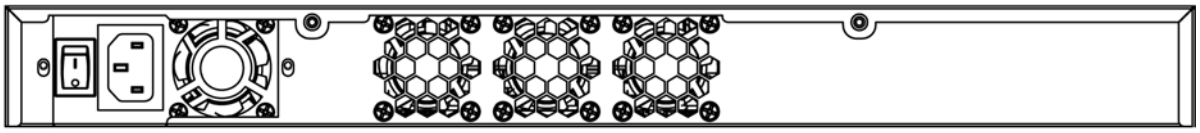
The NXC2500 rear panel contains a console port, a power switch and a connector for the power receptacle.

**Figure 6** Rear Panel: NXC2500




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

**Figure 7** 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:

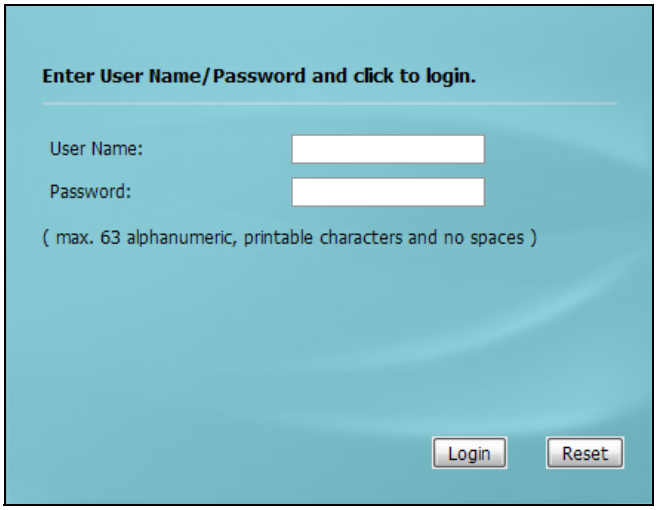
- Firefox 36.0.1 or later
- Chrome 41.0 or later
- IE 10 or later

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").

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

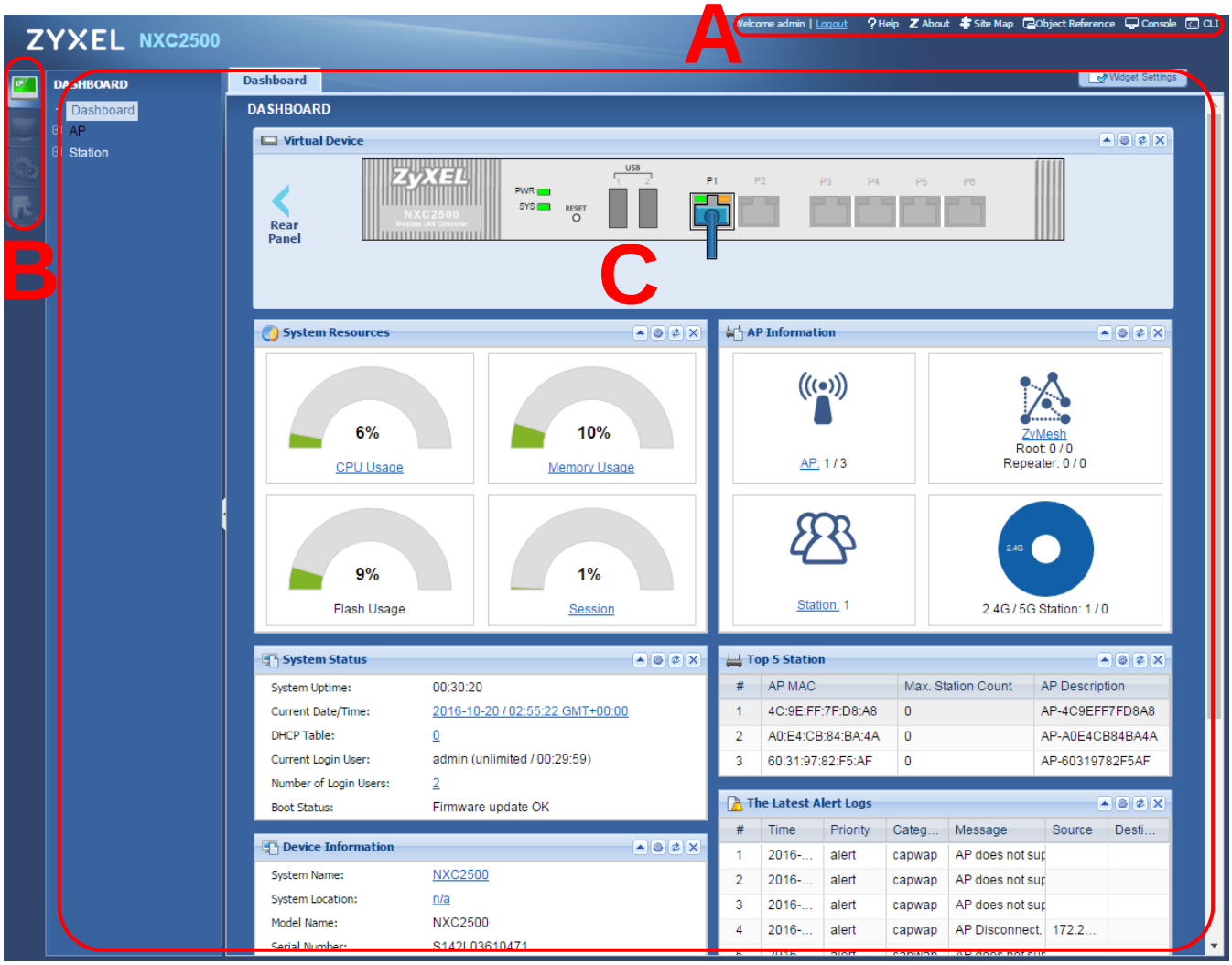

This screen appears every time you log in using the default user name and default password. If you change the password for the default user account, this screen does not appear anymore.

# 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 8** 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 9** Title Bar


The icons provide the following functions.

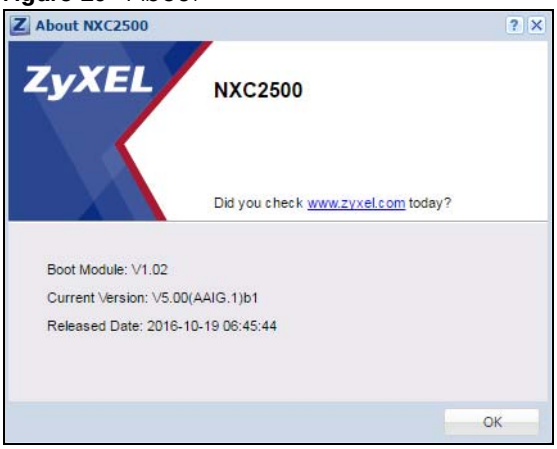
Table 9 Title Bar: Web Configurator Icons

| LABEL | DESCRIPTION |
|---|---|
| Logout | Click this to log out of the Web Configurator. |
| 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. |
| Object Reference | Click this to open a screen where you can check which configuration items reference an object. |
| Console | Click this to open the console in which you can use the command line interface (CLI). See the NXC CLI Reference Guide for details. |
| CLI | 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 10** About




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

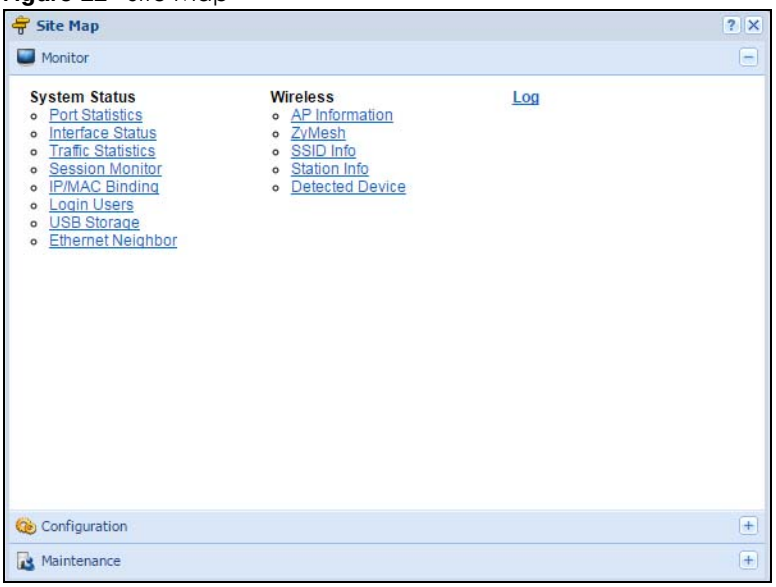
Table 10 About

| 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.

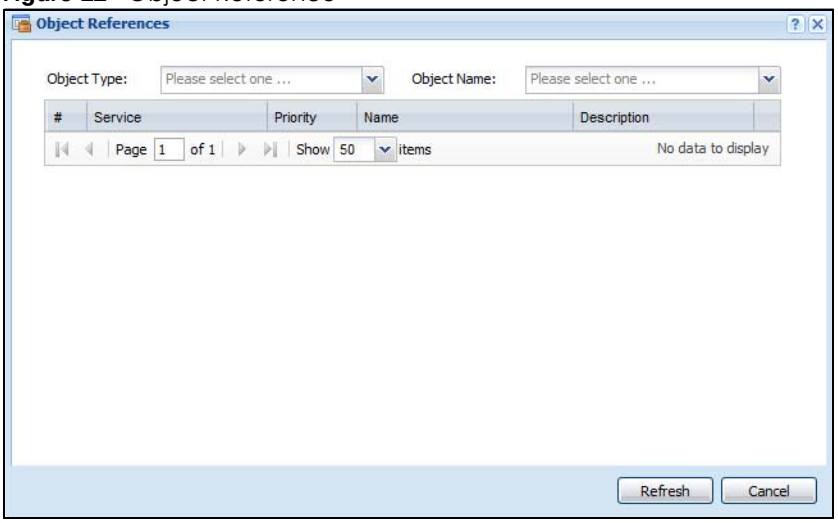
**Figure 11** Site Map




## 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 12** 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 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. |

Table 11 Object References (continued)

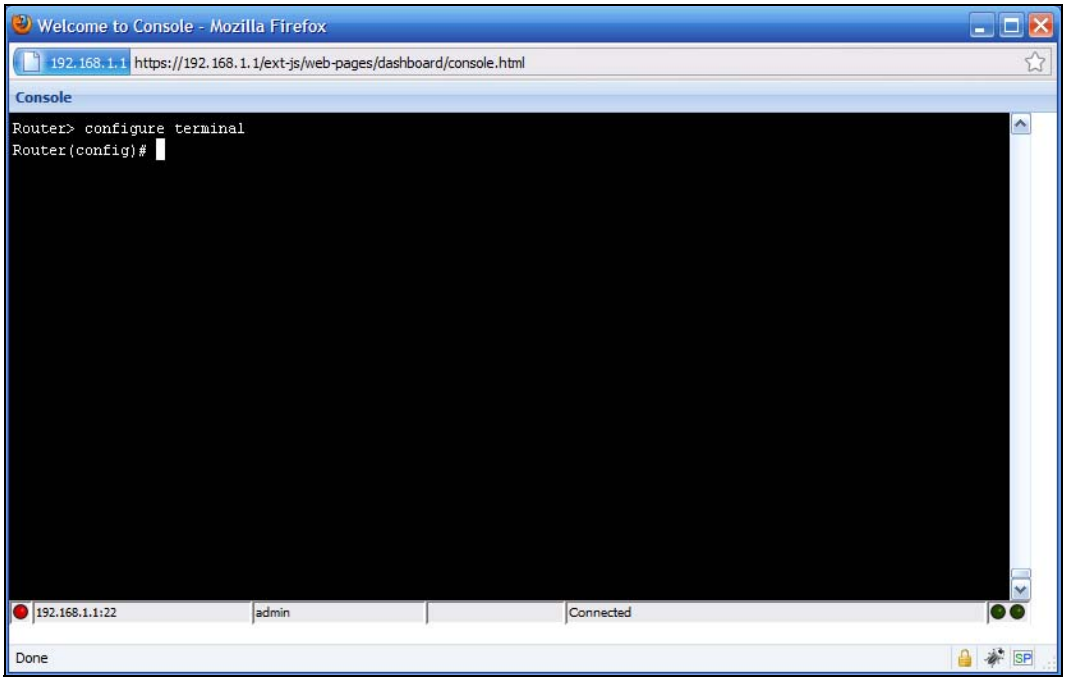
| LABEL | DESCRIPTION |
|---|---|
| Priority | If it is applicable, this field lists the referencing configuration item's position in its list, otherwise **N/A** displays. |
| Name | This field identifies the configuration item that references the object. |
| Description | If the referencing configuration 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. |

## Console

The Console allows you to use CLI commands from directly within the Web Configurator rather than having to use a separate terminal program. In addition to logging in directly to the NXC's CLI, you can also log into other devices on the network through this Console. It uses SSH to establish a connection.

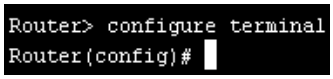
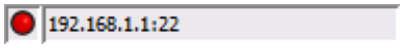
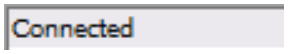
Note: To view the functions in the Web Configurator user interface that correspond directly to specific NXC CLI commands, use the CLI Messages window (see CLI Messages on page 36) in tandem with this one.

**Figure 13** Console



The following table describes the elements in this screen.

Table 12 Console

| LABEL | DESCRIPTION |
|---|---|
| Command Line |  <br>Enter commands for the device that you are currently logged into here. If you are logged into the NXC, see the CLI Reference Guide for details on using the command line to configure it. |
| Device IP Address |  <br>This is the IP address of the device that you are currently logged into. |
| Logged-In User |  <br>This displays the username of the account currently logged into the NXC through the Console Window.<br>Note: You can log into the Web Configurator with a different account than used to log into the NXC through the Console. |
| Connection Status |  <br>This displays the connection status of the account currently logged in.<br>If you are logged in and connected, then this displays 'Connected'.<br>If you lose the connection, get disconnected, or logout, then this displays 'Not Connected'. |
| Tx/RX Activity Monitor |  <br>This displays the current upload / download activity. The faster and more frequently an LED flashes, the faster the data connection. |

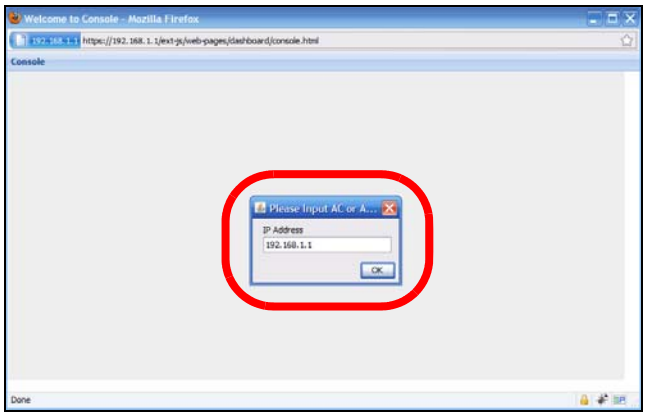
Before you use the Console, ensure that:

- Your web browser of choice allows pop-up windows from the IP address assigned to your NXC.
- Your web browser allows Java programs.
- You are using the latest version of the Java program (http://www.java.com).

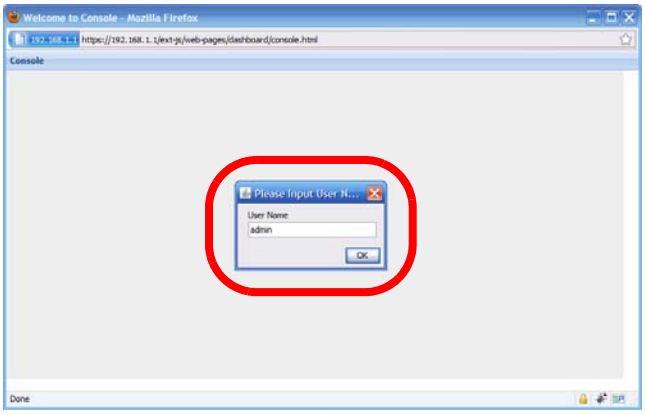
To login in through the Console:

1 Click the **Console** button on the Web Configurator title bar.

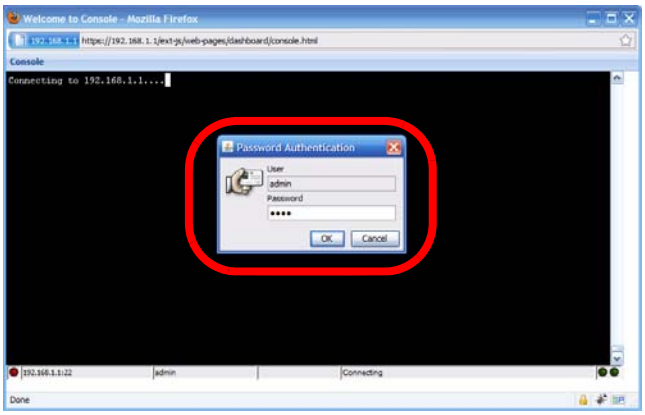
2 Enter the IP address of the NXC and click **OK**.



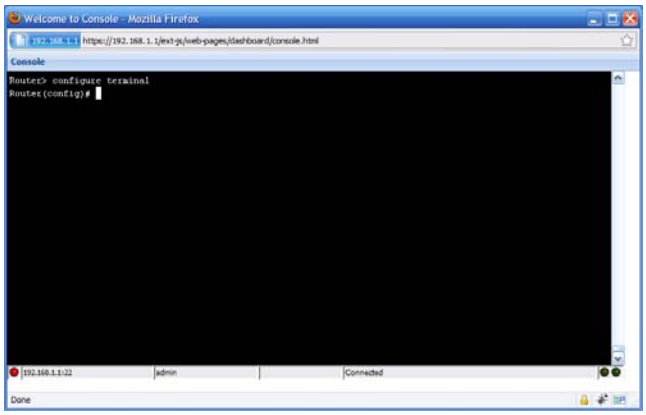

3 Next, enter the User Name of the account being used to log into your target device and then click **OK**.




4 You may be prompted to authenticate your account password, depending on the type of device that you are logging into. Enter the password and click **OK**.



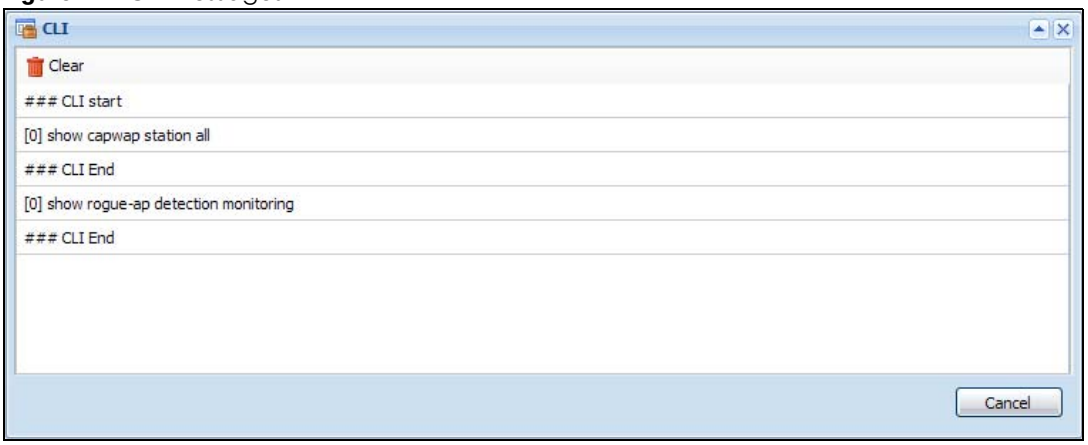
5 If your login is successful, the command line appears and the status bar at the bottom of the Console updates to reflect your connection state.




### 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 14** CLI Messages



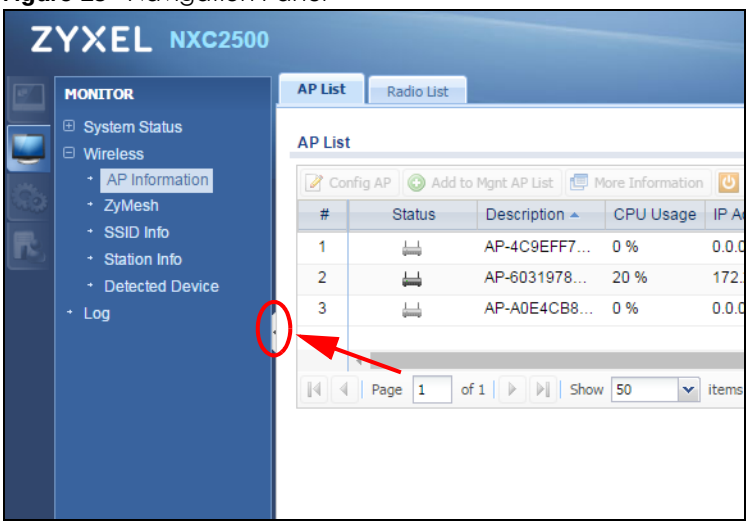

Click **Clear** to remove the currently displayed information.

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 15** Navigation Panel




### 3.3.2.1 Dashboard

The dashboard menu screens display status information about the NXC.

Table 13 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 4 on page 46.

### 3.3.2.2 Monitor Menu

The monitor menu screens display status and statistics information.

Table 14 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. |
| IP/MAC Binding | IP/MAC Binding | List the devices that have received an IP address from NXC interfaces using IP/MAC binding. |

Table 14 Monitor Menu Screens Summary (continued)

| FOLDER OR LINK | TAB | FUNCTION |
|---|---|---|
| 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 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/WDS 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 15 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 | Mgnt. 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. |
| MON Mode | 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 | | |
| Interface | Ethernet | Manage Ethernet interfaces and virtual Ethernet interfaces. |
| | VLAN | Create and manage VLAN interfaces and virtual VLAN interfaces. |

Table 15 Configuration Menu Screens Summary (continued)

| FOLDER OR LINK | TAB | FUNCTION |
|---|---|---|
| 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. |
| | 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. |
| | Login Page | Creates a customized login page built into the NXC for captive portal. |
| RTLS | Real Time Location System | Use the managed APs as part of an Ekahau RTLS to track the location of Ekahau Wi-Fi 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. |
| 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. |

Table 15 Configuration Menu Screens Summary (continued)

| FOLDER OR LINK | TAB | FUNCTION |
|---|---|---|
| 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 16 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. |
| Diagnostics | Diagnostic | 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. |

Table 16 Maintenance Menu Screens Summary (continued)

| FOLDER OR LINK | TAB | FUNCTION |
|---|---|---|
| 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 16** Warning Message

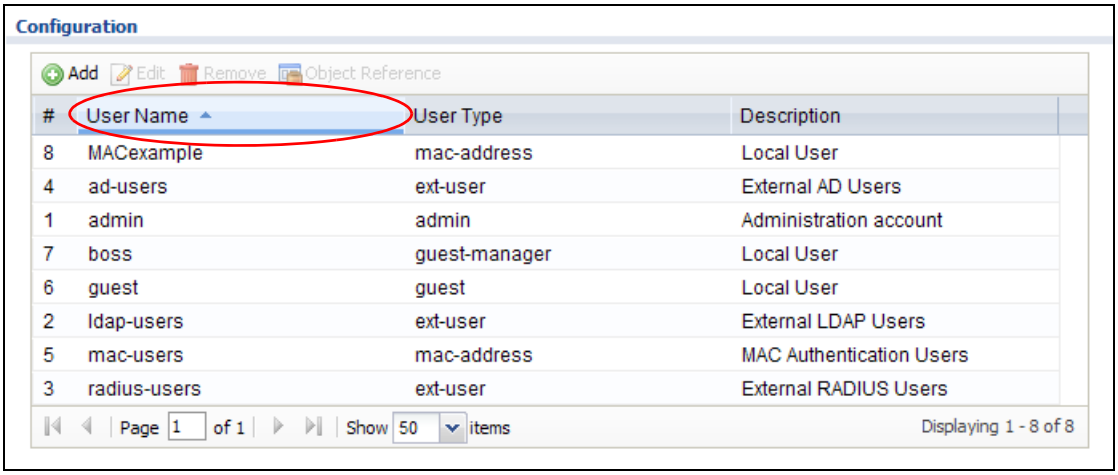

## 3.3.4 Tables and Lists

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.

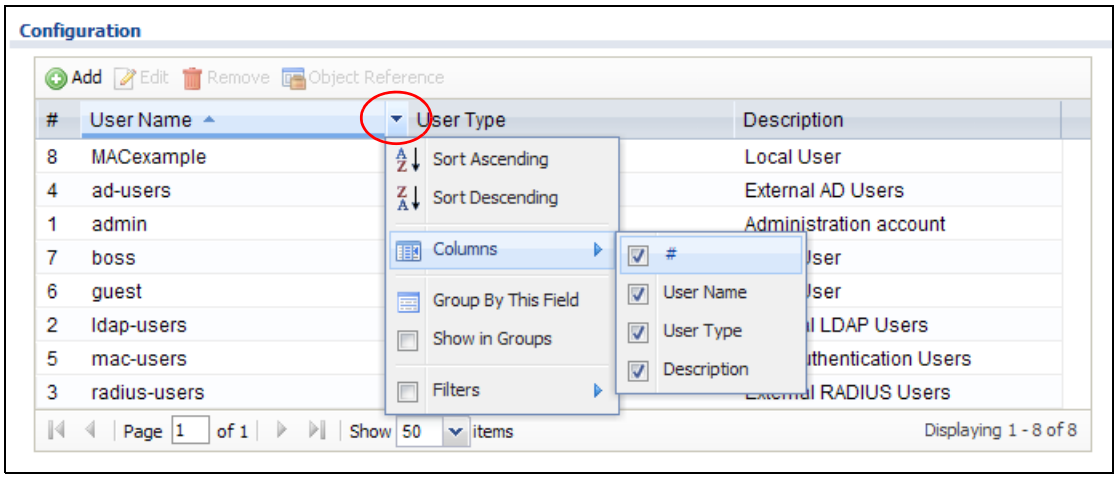
1 Click a column heading to sort the table's entries according to that column's criteria.



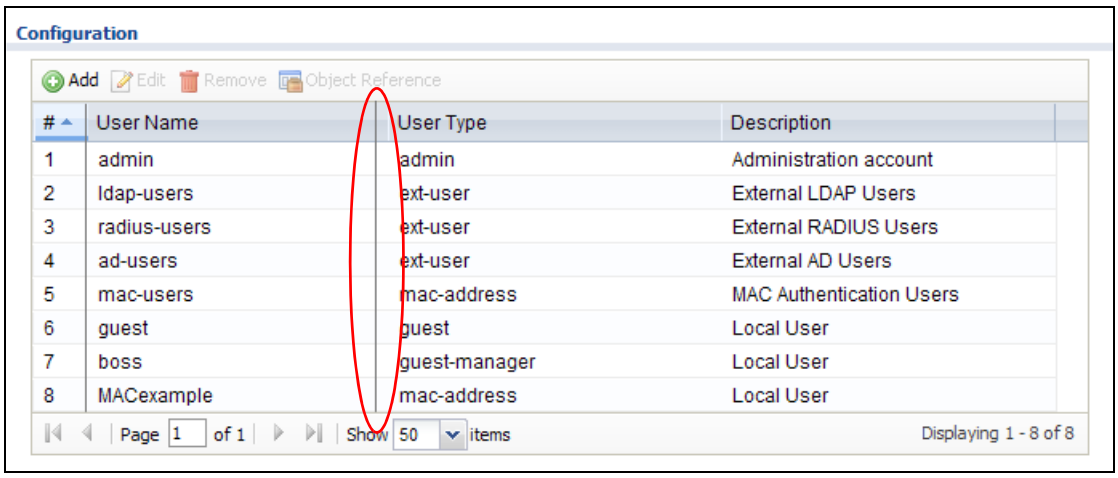

2 Click the down arrow next to a column heading for more options about how to display the entries. The options available vary depending on the type of fields in the column. Here are some examples of what you can do:

- Sort in ascending alphabetical order
- Sort in descending (reverse) alphabetical order

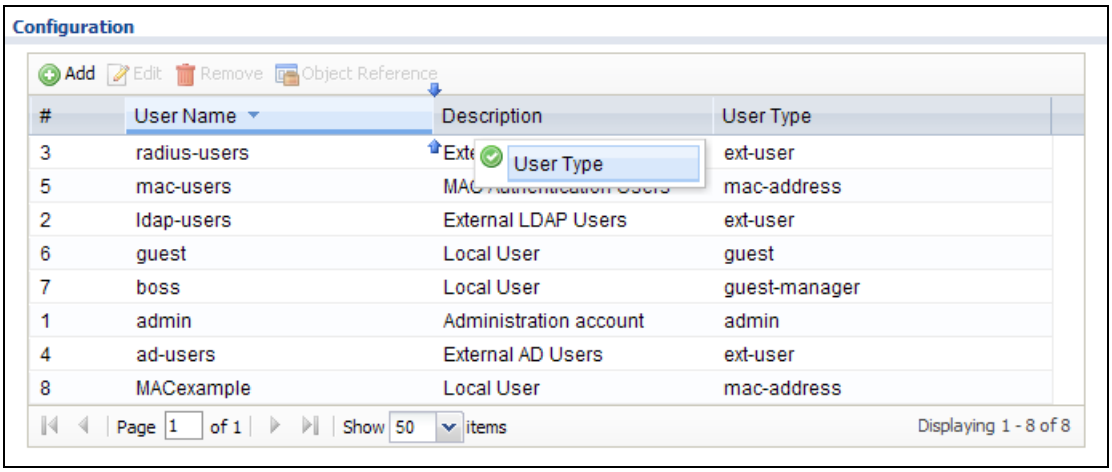
- Select which columns to display
- Group entries by field
- Show entries in groups
- Filter by mathematical operators (<, >, or =) or searching for text.



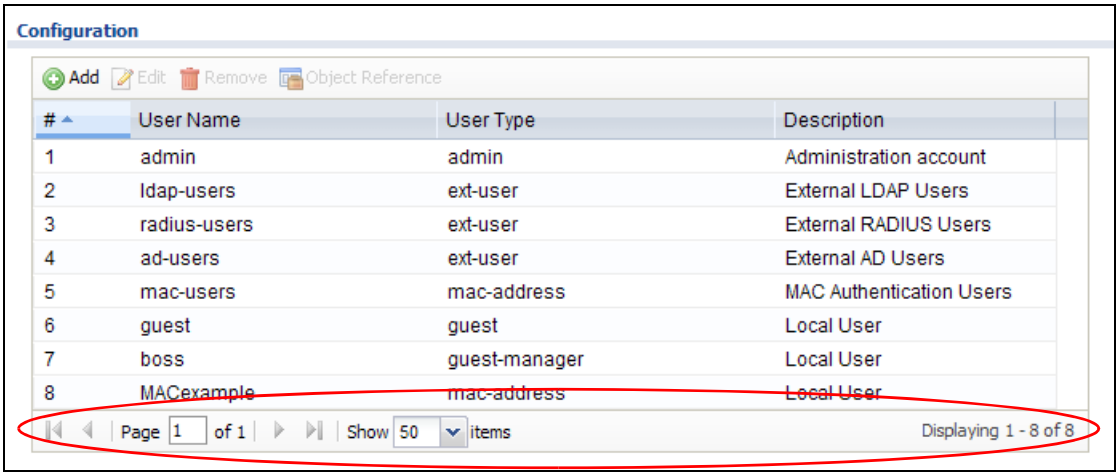

3 Select a column heading cell's right border and drag to re-size the column.



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.



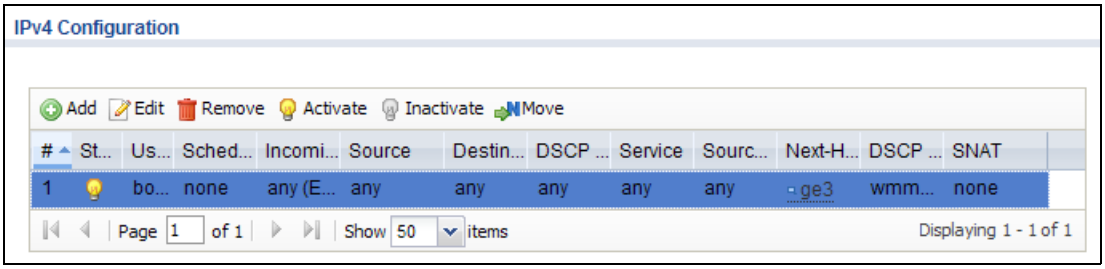

5 Use the icons and fields at the bottom of the table to navigate to different pages of entries and control how many entries display at a time.




## 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 17 Common Table Icons



Here are descriptions for the most common table icons.

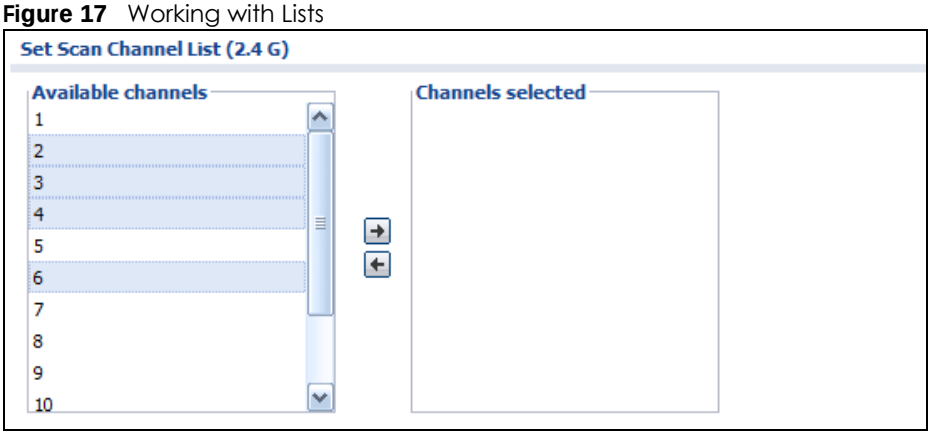
Table 18 Common Table Icons

| 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. |
| Activate | To turn on an entry, select it and click **Activate**. |
| Inactivate | To turn off an entry, 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. |
| 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 17** Working with Lists



# PART II
# Technical Reference

# CHAPTER 4
# Dashboard

## 4.1 Overview

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

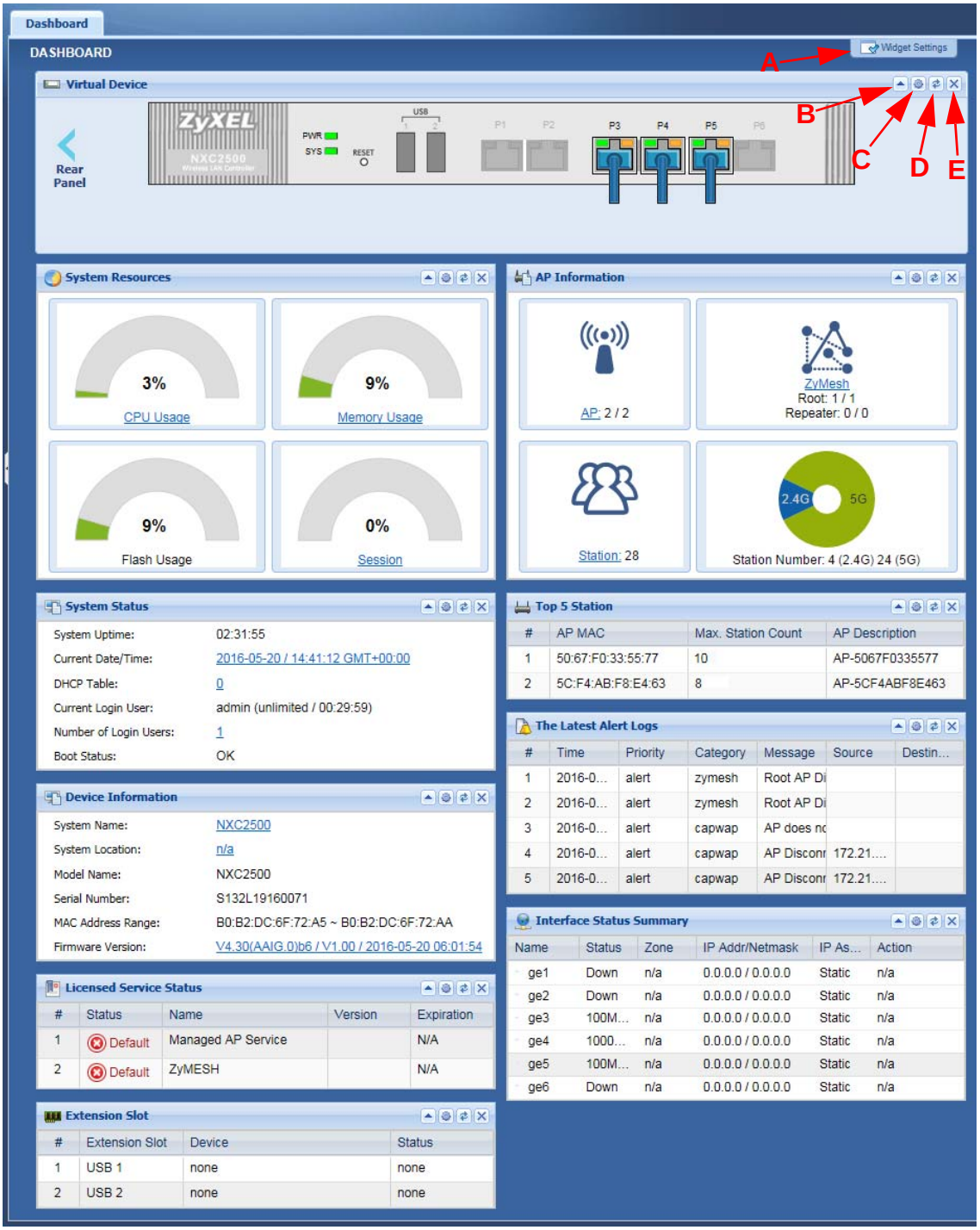
### 4.1.1 What You Can Do in this Chapter

- The main **Dashboard** screen (Section 4.2 on page 47) 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 4.2.4 on page 53) 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 4.2.5 on page 54) displays the users currently logged into the NXC.
- The **AP > Status** screen (Section 4.2.6 on page 55) displays how many wireless stations are connected to the managed AP(s) and data usage.
- The **Station > Traffic** screen (Section 4.2.7 on page 56) displays data usage of the connected wireless station(s).

# 4.2 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 18** Dashboard



The following table describes the labels in this screen.

Table 19 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 2.2.3 on page 25 for LED descriptions. An unconnected interface appears grayed out.<br>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.<br>**Inactive** - The Ethernet interface is disabled.<br>**Down** - The Ethernet interface is enabled but not connected.<br>**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 19 Dashboard (continued)

| LABEL | DESCRIPTION |
|---|---|
| Boot Status | This field displays details about the NXC's startup state.<br>**OK** - The NXC started up successfully.<br>**Firmware update OK** - A firmware update was successful.<br>**Problematic configuration after firmware update** - The application of the configuration failed after a firmware upgrade.<br>**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.<br>**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.<br>**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).<br>**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.<br>**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. |

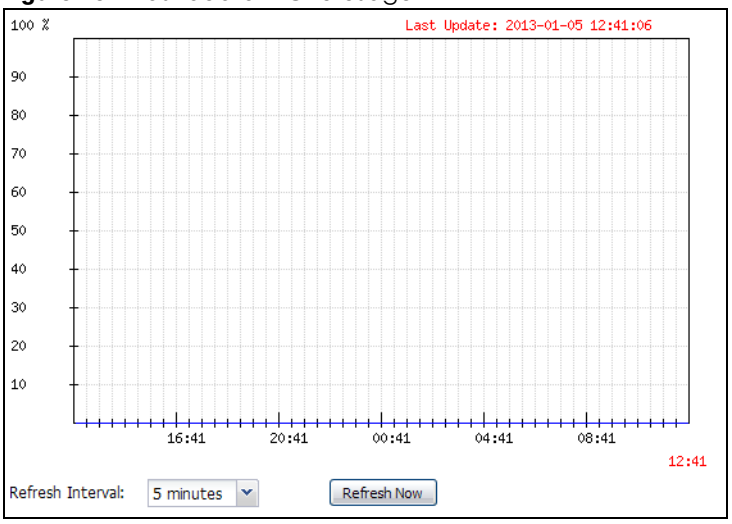
Table 19 Dashboard (continued)

| 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/WDS. 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. |
| Station Number | 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.<br>**Inactive** - The Ethernet interface is disabled.<br>**Down** - The Ethernet interface is enabled but not connected.<br>**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.<br>**Static** - This interface has a static IP address.<br>**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.<br>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. |

## 4.2.1 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 19** Dashboard > CPU Usage




The following table describes the labels in this screen.

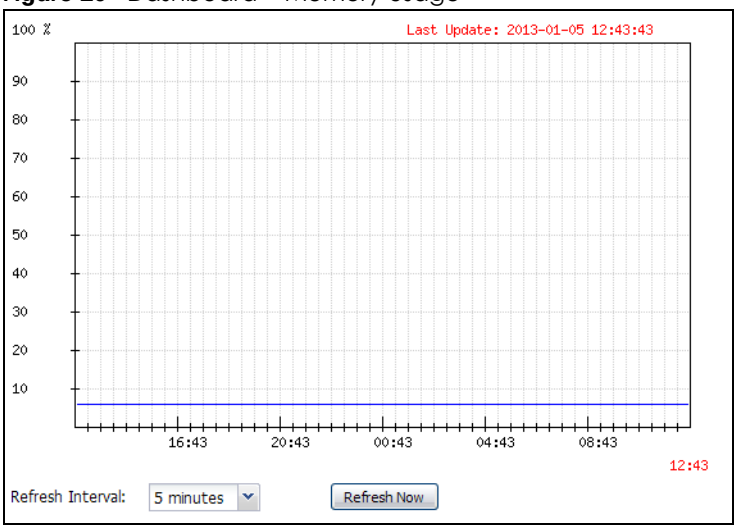
Table 20 Dashboard > CPU Usage

| 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. |

## 4.2.2 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 20** Dashboard > Memory Usage




The following table describes the labels in this screen.

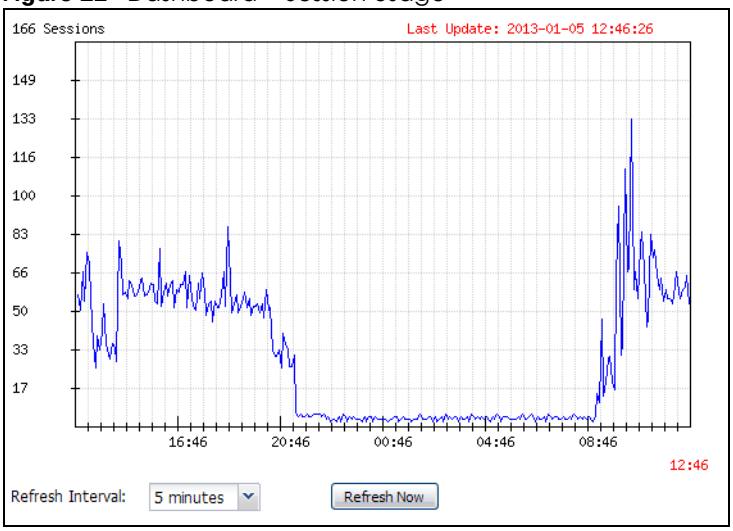
Table 21 Dashboard > Memory Usage

| 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. |

## 4.2.3 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 21** Dashboard > Session Usage



The following table describes the labels in this screen.

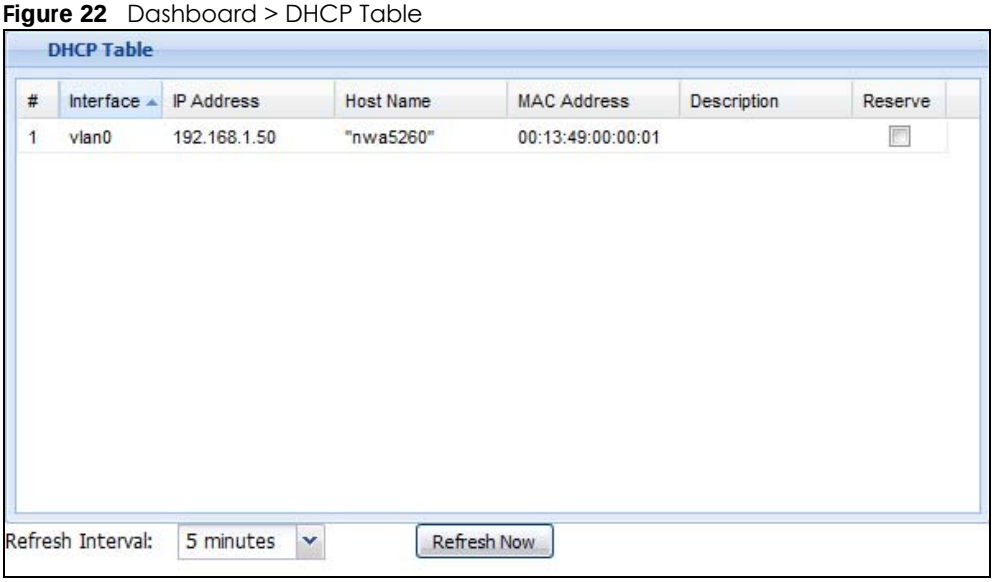
Table 22 Dashboard > Session Usage

| 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. |

## 4.2.4 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 22** Dashboard > DHCP Table




The following table describes the labels in this screen.

Table 23 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. |

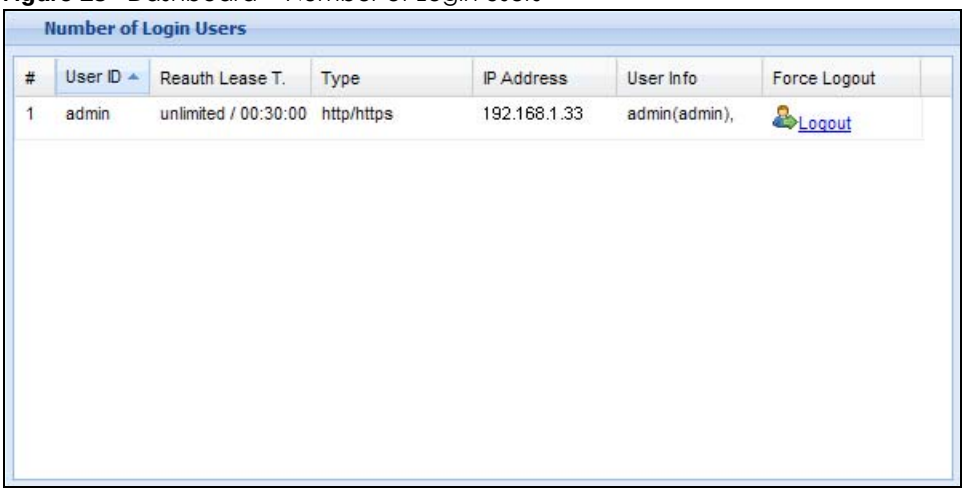
Table 23 Dashboard > DHCP Table (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>If this field is clear, this entry is a dynamic DHCP entry. The IP address is assigned to a DHCP client.<br>To create a static DHCP entry using an existing dynamic DHCP entry, select this field.<br>To remove a static DHCP entry, clear this field. |

## 4.2.5 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 23** Dashboard > Number of Login Users




The following table describes the labels in this screen.

Table 24 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 T. | 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.<br>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. |

## 4.2.6 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.

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.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 24 hours, the NXC also updates the station count chart for these APs, and vice versa.

**Figure 24** Dashboard > AP > Status: Top N APs

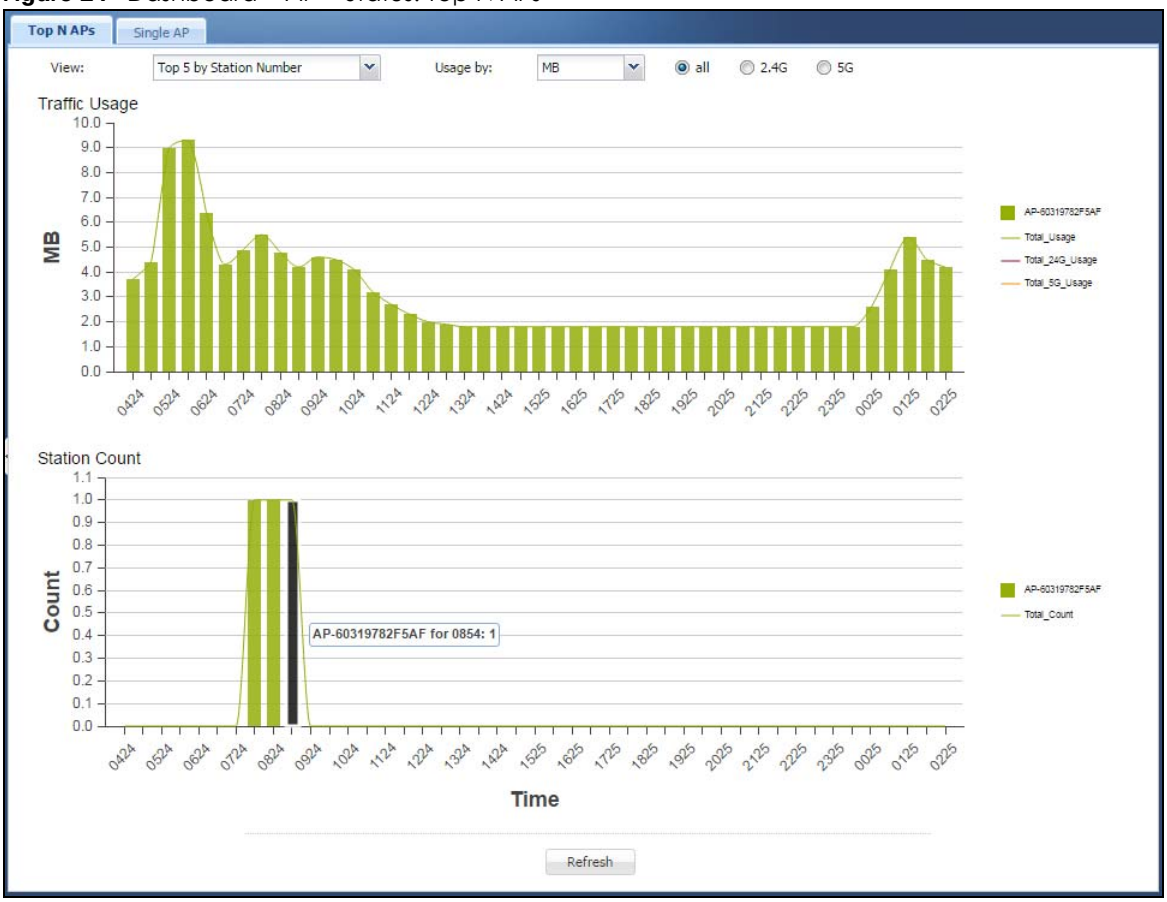
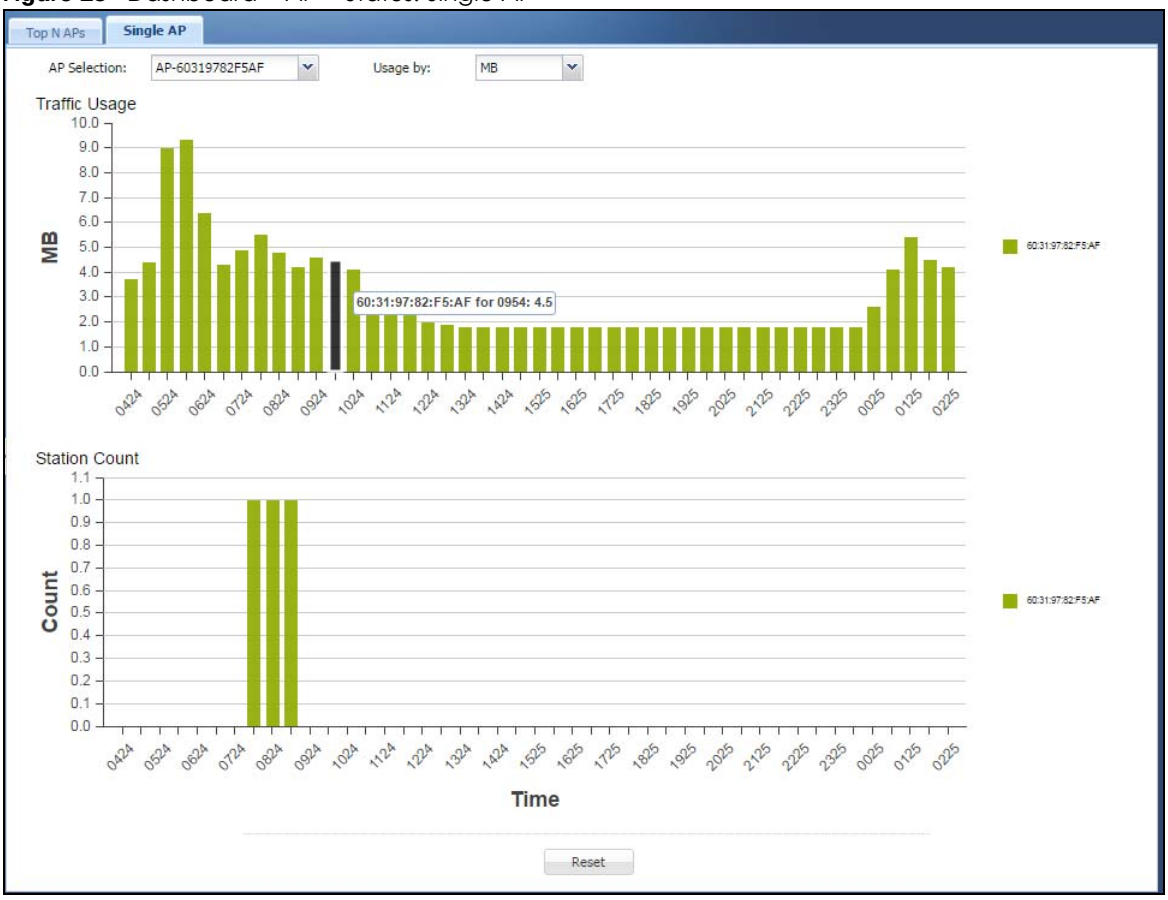


**Figure 25** Dashboard > AP > Status: Single AP




## 4.2.7 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.

Move the cursor over a bar to see usage details over a specific time period.

**Figure 26** Dashboard > Station > Traffic: Top N Stations

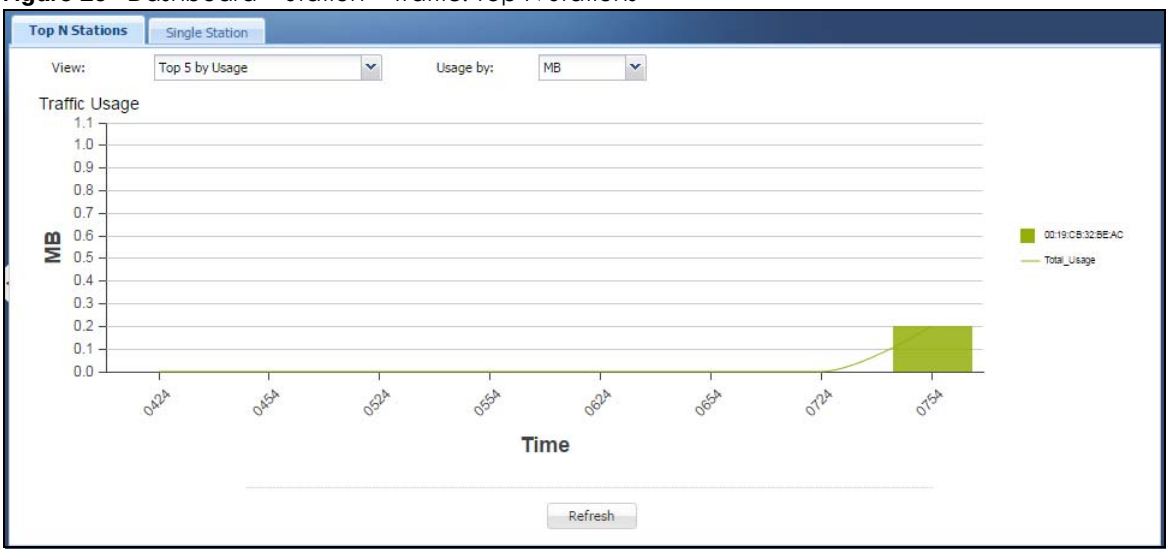
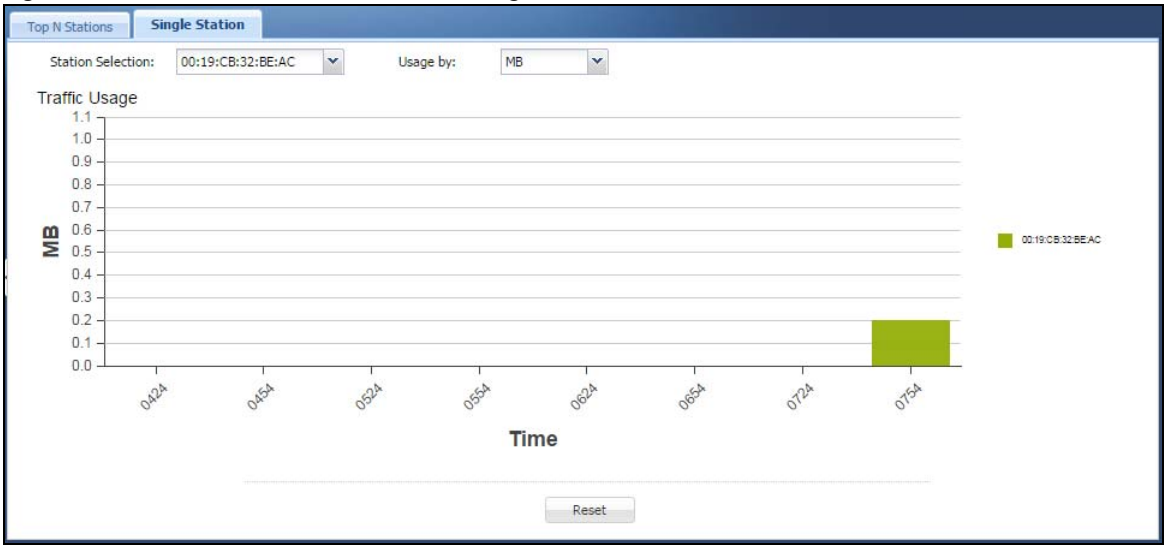



**Figure 27** Dashboard > Station > Traffic: Single Station



# CHAPTER 5
# Monitor

## 5.1 Overview

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

### 5.1.1 What You Can Do in this Chapter

- The **Port Statistics** screen (Section 5.3 on page 59) displays packet statistics for each physical port.
- The **Port Statistics Graph** screen (Section 5.3.1 on page 60) displays a line graph of packet statistics for each physical port.
- The **Interface Status** screen (Section 5.4 on page 61) displays all of the NXC's interfaces and their packet statistics.
- The **Traffic Statistics** screen (Section 5.5 on page 64) allows you to start or stop data collection and view statistics.
- The **Session Monitor** screen (Section 5.6 on page 67) displays sessions by user or service.
- The **IP/MAC Binding** screen (Section 5.7 on page 69) displays lists of the devices that have received an IP address from NXC interfaces with IP/MAC binding enabled.
- The **Login Users** screen (Section 5.8 on page 70) displays a list of the users currently logged into the NXC.
- The **Login Users > Dynamic Guest** screen (Section 5.8.1 on page 71) 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 5.8.2 on page 72) displays a list of MAC addresses, which are authenticated and allowed to access the network.
- The **USB Storage** screen (Section 5.9 on page 73) displays information about a connected USB storage device.
- The **Ethernet Neighbor** screen (Section 5.10 on page 74) displays the NXC's neighboring devices in one place.
- The **AP List** screen (Section 5.11 on page 75) displays which APs are currently connected to the NXC.
- The **Radio List** screen (Section 5.12 on page 83) displays statistics about the wireless radio transmitters in each of the APs connected to the NXC.
- The **ZyMesh Link Info** screen (Section 5.13 on page 86) displays statistics about the ZyMesh/WDS connections between the managed APs.
- The **SSID Info** screen (Section 5.14 on page 87) displays the number of wireless clients that are currently connected to an SSID and the SSID's security mode.
- The **Station List** screen (Section 5.15 on page 88) displays statistics pertaining to the connected stations (or "wireless clients").
- The **Detected Device** screen (Section 5.16 on page 89) displays the wireless devices passively detected by the NXC.

- The **View Log** screen (Section 5.17 on page 90) 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 5.18 on page 92) displays the NXC's current wireless AP log messages.

# 5.2 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 19 on page 242 for details.

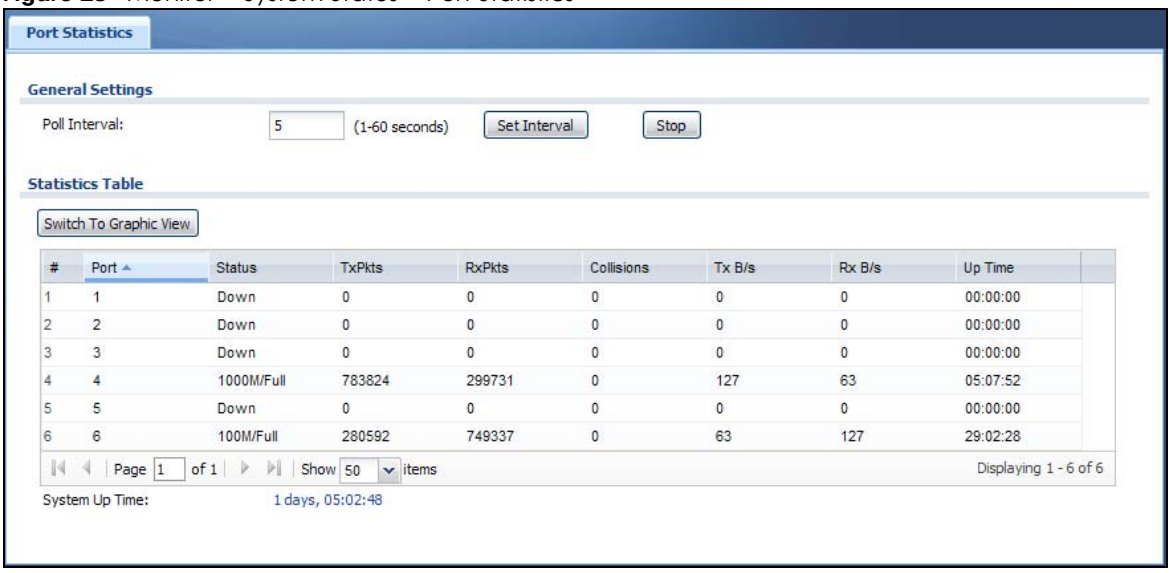
**Friendly AP**

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 19 on page 242 for details.

# 5.3 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 28** Monitor > System Status > Port Statistics



The following table describes the labels in this screen.

Table 25 Monitor > System Status > Port Statistics

| LABEL | DESCRIPTION |
|---|---|
| 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**. |
| 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.<br>**Down** - The physical port is not connected.<br>**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. |
| 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. |

## 5.3.1 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 29** Monitor > System Status > Port Statistics > Switch to Graphic View


The following table describes the labels in this screen.

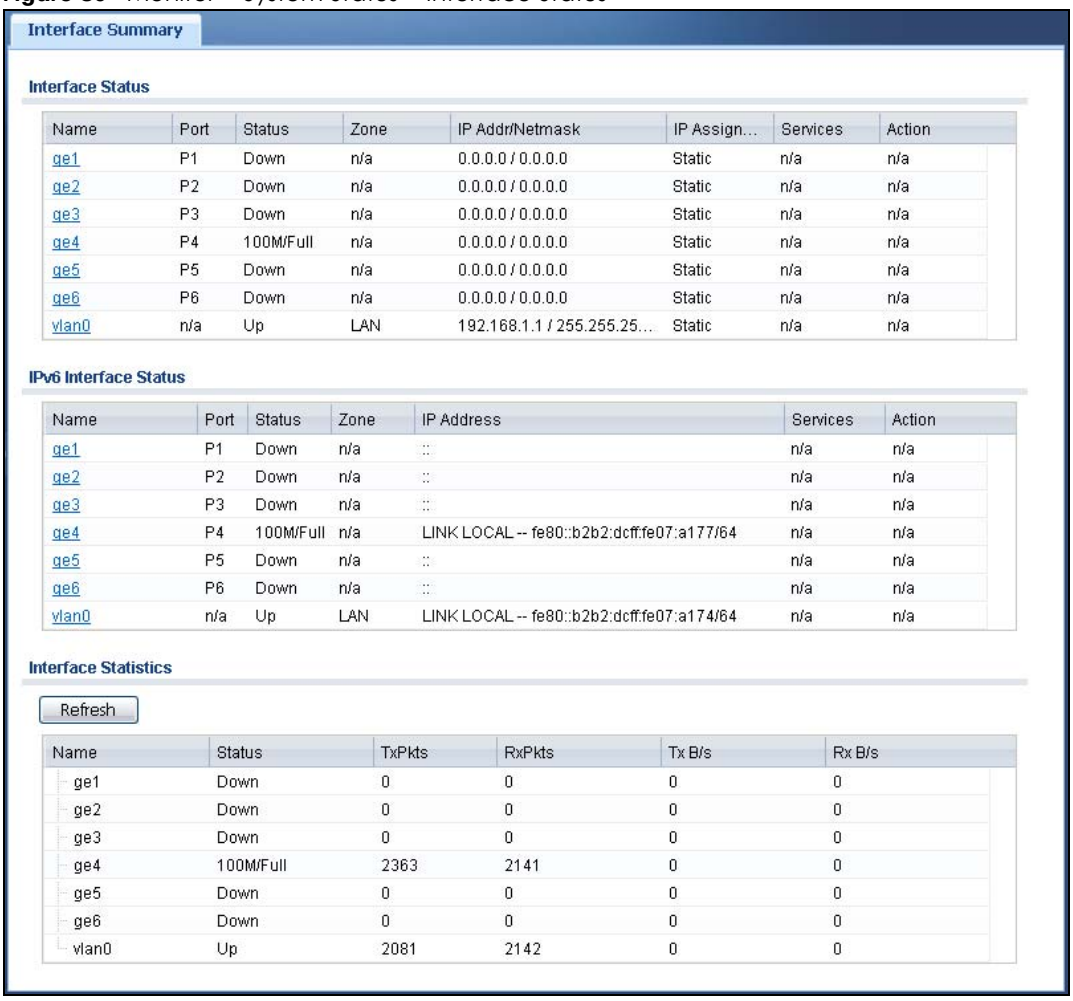
Table 26 Monitor > System Status > Port Statistics > Switch to Graphic View

| LABEL | DESCRIPTION |
|---|---|
| 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 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 | 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 |
| 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. |

# 5.4 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 30** Monitor > System Status > Interface Status




Each field is described in the following table.

Table 27 Monitor > System Status > Interface Status

| LABEL | DESCRIPTION |
|---|---|
| Interface Status<br><br>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. |

Table 27 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.<br><br>For Ethernet interfaces:<br><br>**Inactive** - The Ethernet interface is disabled.<br><br>**Down** - The Ethernet interface is enabled but not connected.<br><br>**Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**).<br><br>For VLAN interfaces:<br><br>**Up** - The VLAN interface is enabled and one of its member Ethernet interfaces is connected.<br><br>**Down** - The VLAN interface is enabled but none of its member Ethernet interfaces is connected.<br><br>**Inactive** - The VLAN interface is disabled. |
| Zone | This field displays the zone to which the interface is assigned. |
| IP Addr/Netmask<br><br>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.<br><br>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 447 for more information about IPv6. |
| IP Assignment | This field displays how the interface gets its IP address.<br><br>**Static** - This interface has a static IP address.<br><br>**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. |
| Status | This field displays the current status of each interface. The possible values depend on what type of interface it is.<br><br>For Ethernet interfaces:<br><br>**Inactive** - The Ethernet interface is disabled.<br><br>**Down** - The Ethernet interface is enabled but not connected.<br><br>**Speed / Duplex** - The Ethernet interface is enabled and connected. This field displays the port speed and duplex setting (**Full** or **Half**).<br><br>For VLAN interfaces:<br><br>**Up** - The VLAN interface is enabled and one of its member Ethernet interfaces is connected.<br><br>**Down** - The VLAN interface is enabled but none of its member Ethernet interfaces is connected.<br><br>**Inactive** - The VLAN interface is disabled. |

Table 27 Monitor > System Status > Interface Status (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |

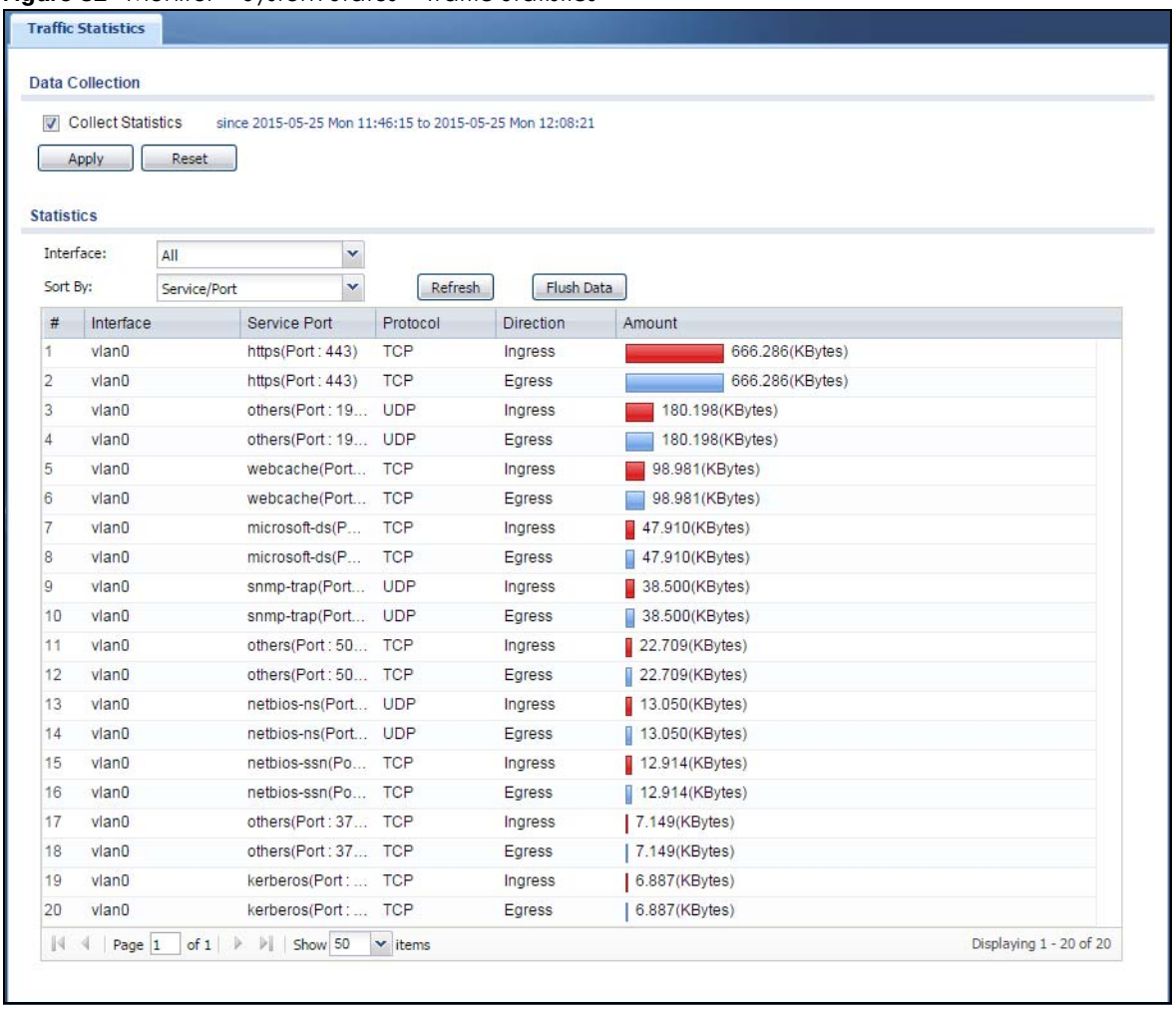
# 5.5 Traffic Statistics

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 31** Monitor > System Status > Traffic Statistics




There is a limit on the number of records shown in the report. See Table 29 on page 67 for more information. The following table describes the labels in this screen.

Table 28 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 28 Monitor > System Status > Traffic Statistics (continued)

| LABEL | DESCRIPTION |
|---|---|
| Sort By | Select the type of report to display. Choices are:<br>**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.<br>**Service/Port** - displays the most-used protocols or service ports and the amount of traffic for each one.<br>**Web Site Hits** - displays the most-visited Web sites and how many times each one has been visited.<br>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.<br>**Rx From**- traffic is coming from the IP address or user to the NXC.<br>**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 29 on page 67. |
| 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 29 on page 67. |
| | 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 29 on page 67. |
| 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.<br>**Ingress** - traffic is coming into the NXC through the interface.<br>**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 29 on page 67. |
| | 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 28 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 29 on page 67. |
| 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 29 on page 67. |

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

Table 29 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 $1.8 \times 10^{19}$ hits. |

# 5.6 Session Monitor

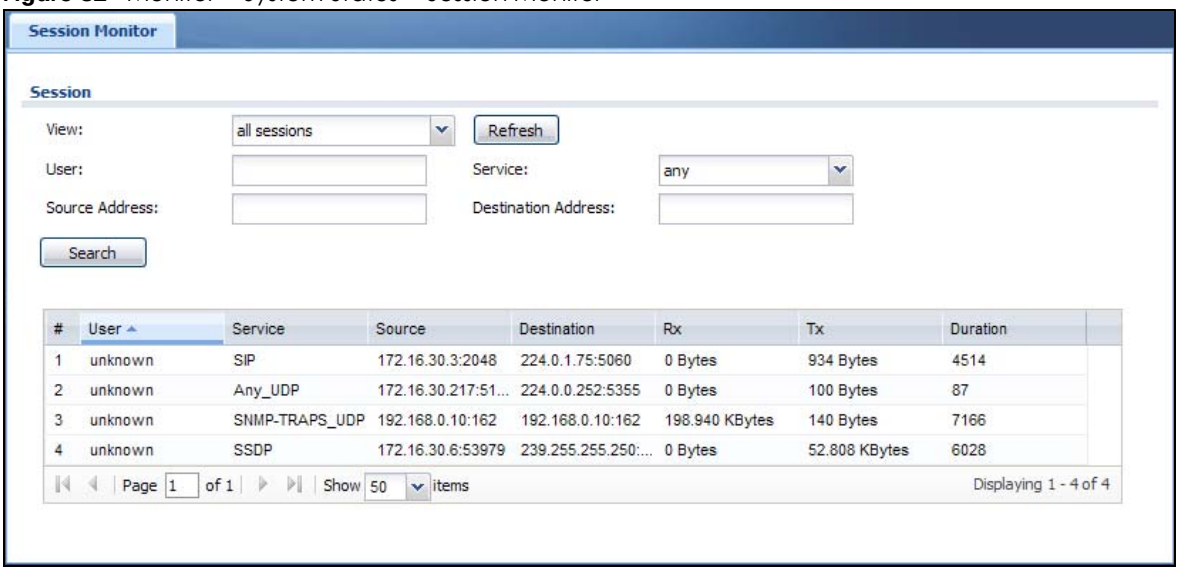
This screen displays information about active sessions for debugging or statistical analysis. It is not possible to manage sessions in this screen. The following information is displayed.

- 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 32** Monitor > System Status > Session Monitor




The following table describes the labels in this screen.

Table 30 Monitor > System Status > Session Monitor

| LABEL | DESCRIPTION |
|---|---|
| View | Select how you want the information to be displayed. Choices are:<br>**sessions by users** - display all active sessions grouped by user<br>**sessions by services** - display all active sessions grouped by service or protocol<br>**sessions by source IP** - display all active sessions grouped by source IP address<br>**sessions by destination IP** - display all active sessions grouped by destination IP address<br>**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 22 on page 256 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. |

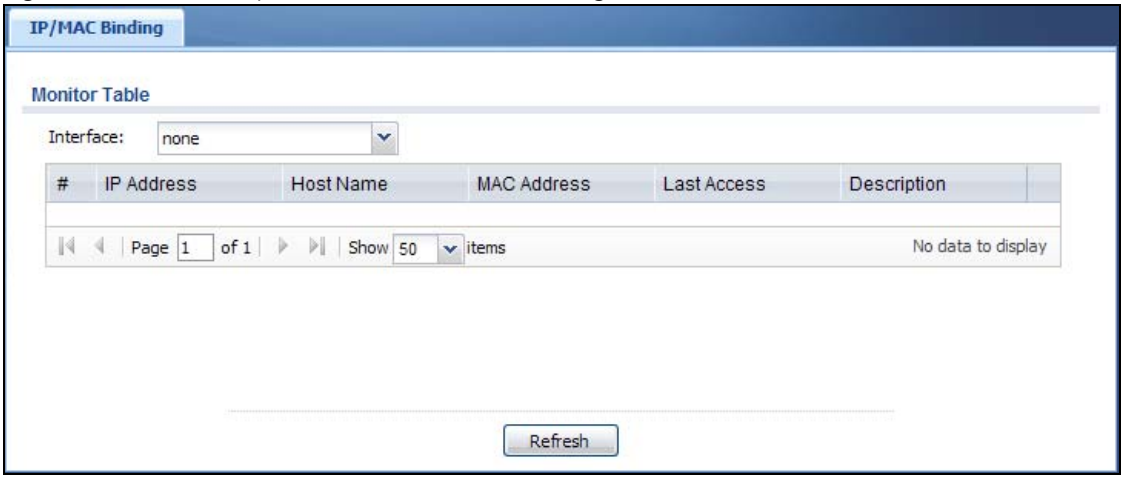
Table 30 Monitor > System Status > Session Monitor (continued)

| LABEL | DESCRIPTION |
|---|---|
| User | This field displays the user in each active session.<br>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.<br>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.<br>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.<br>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. |

# 5.7 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 33** Monitor > System Status > IP/MAC Binding



The following table describes the labels in this screen.

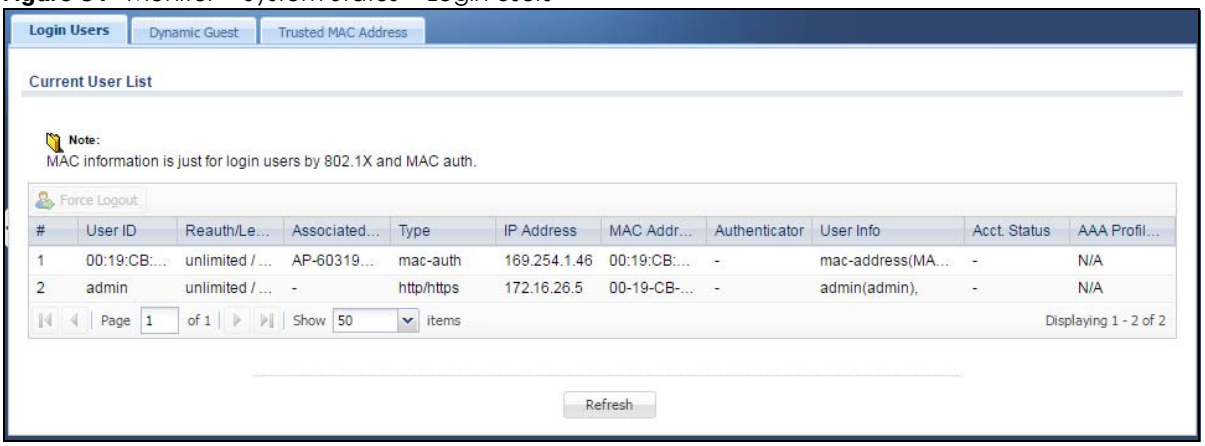
Table 31 Monitor > System Status > IP/MAC Binding

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

# 5.8 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 34** Monitor > System Status > Login Users




The following table describes the labels in this screen.

Table 32 Monitor > System Status > Login Users

| LABEL | DESCRIPTION |
|---|---|
| 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.<br><br>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 17 on page 203. |

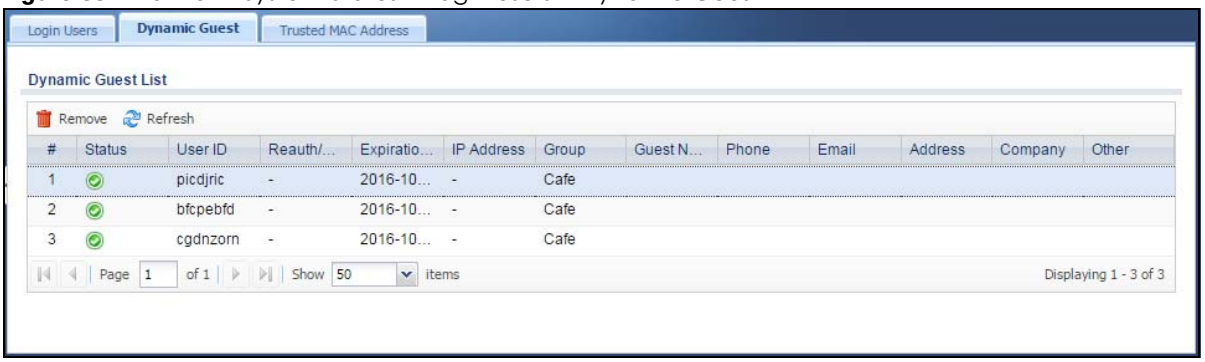
Table 32 Monitor > System Status > Login Users

| LABEL | DESCRIPTION |
|---|---|
| Associated AP | This field displays the description of the managed AP through which the user logs into the NXC.<br>The default description is "AP-" followed by the AP's MAC address. A "**-**" displays if the user is not connecting to the NXC wirelesly. |
| 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 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.<br>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.<br>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.<br>**Accounting-on** means accounting is being performed for the user login.<br>**Accounting-off** means accounting has stopped for this user login.<br>A "**-**" displays if accounting is not enabled for this login. |
| RADIUSAAA 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. |

## 5.8.1 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 35** Monitor > System Status > Login Users > Dynamic Guest



The following table describes the labels in this screen.

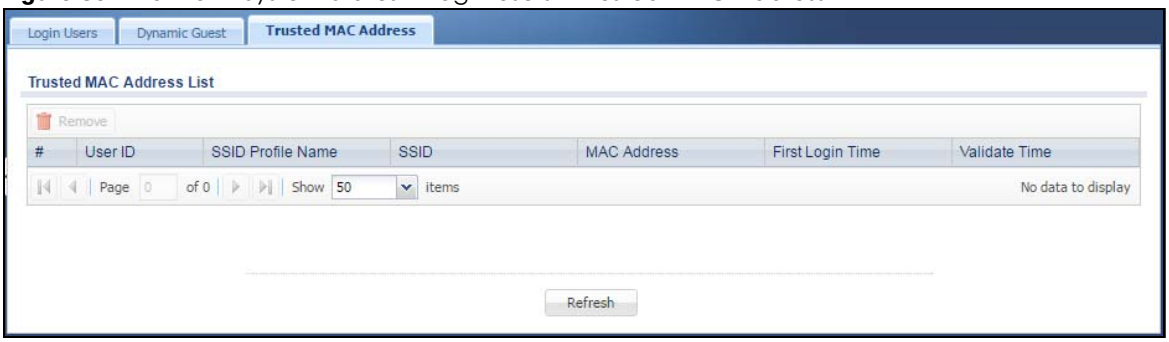
Table 33 Monitor > System Status > Login Users > Dynamic Guest

| LABEL | DESCRIPTION |
|---|---|
| Remove | Select an entry and click this button to remove it from the list.<br><br>Note: If you delete a valid user account which is in use, the NXC ends the user session. |
| Refresh | Click this button to update the information in the screen. |
| # | 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 17 on page 203. |
| 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. |

## 5.8.2 Trusted MAC Address

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 36** Monitor > System Status > Login Users > Trusted MAC Address



The following table describes the labels in this screen.

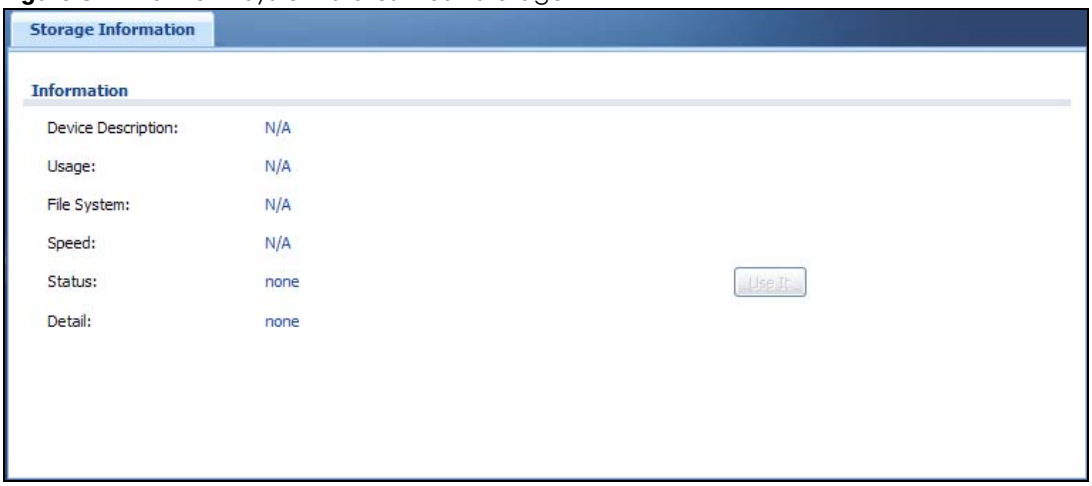
Table 34 Monitor > System Status > Login Users > Trusted MAC Address

| LABEL | DESCRIPTION |
|---|---|
| Remove | Select an entry and click this button to remove it from the list.<br><br>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. |

# 5.9 USB Storage

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

**Figure 37** Monitor > System Status > USB Storage




The following table describes the labels in this screen.

Table 35 Monitor > System Status > USB Storage

| LABEL | DESCRIPTION |
|---|---|
| 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 35 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.<br>Click **Remove Now** to stop the NXC from using the USB storage device so you can remove it.<br>**Unused** - the connected USB storage device was manually unmounted by using the **Remove Now** button or for some reason the NXC cannot mount it.<br>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.<br>**none** - no USB storage device is connected. |
| Detail | This field displays any other information the NXC retrieves from the USB storage device.<br>**Deactivated** - the use of a USB storage device is disabled (turned off) on the NXC.<br>**OutofSpace** - the available disk space is less than the disk space full threshold (see Section 28.3 on page 300 for how to configure this threshold).<br>**Mounting** - the NXC is mounting the USB storage device.<br>**Removing** - the NXC is unmounting the USB storage device.<br>**none** - the USB device is operating normally or not connected. |

# 5.10 Ethernet Neighbor

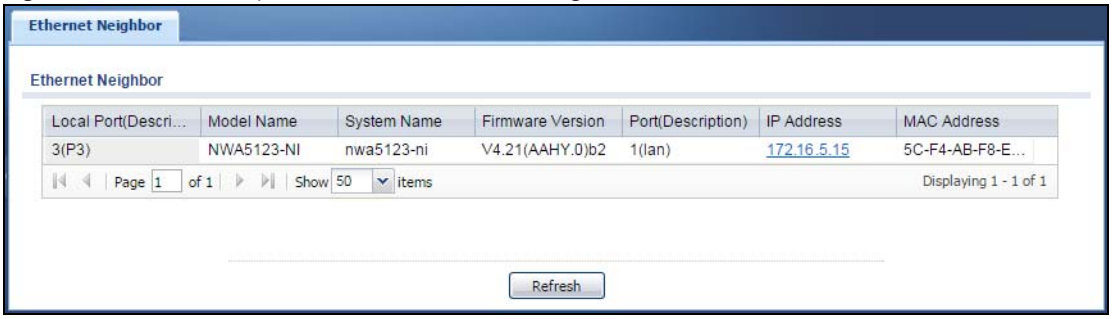
The NXC uses Smart Connect, that is Link Layer Discovery Protocol (LLDP) for discovering and configuring LLDP-aware devices in the same broadcast domain as the NXC that you're logged into using the web configurator.

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 38** Monitor > System Status > Ethernet Neighbor



The following table describes the labels in this screen.

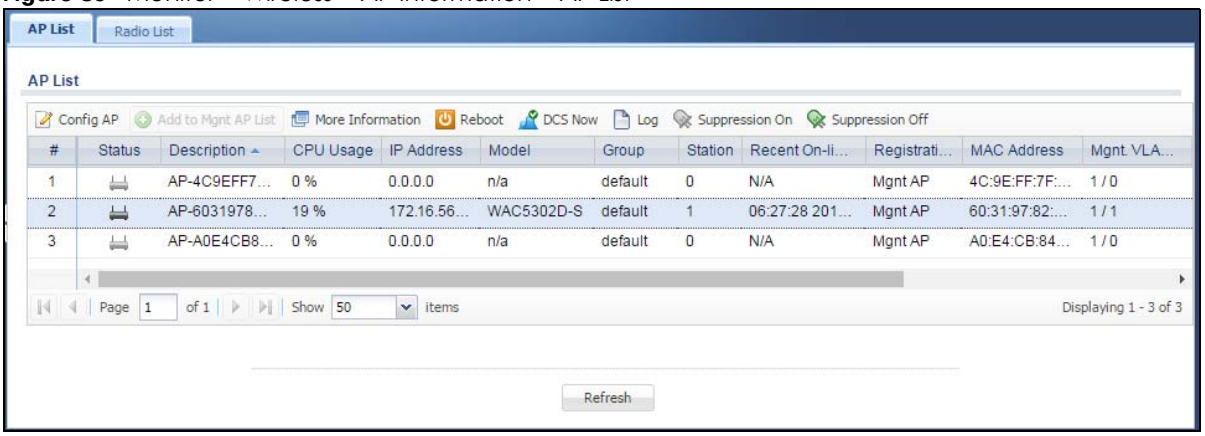
Table 36 Monitor > System Status > Ethernet Neighbor

| 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. |
| Refresh | Click this button to update the information in the screen. |

# 5.11 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 39** Monitor > Wireless > AP Information > AP List




The following table describes the labels in this screen.

Table 37 Monitor > Wireless > AP Information > AP List

| LABEL | DESCRIPTION |
|---|---|
| Config AP | Select an AP and click this to change the selected AP's group, radio, VLAN and port settings. |
| Add to Mgnt AP List | Select an AP and click this to add the selected AP to the managed AP list. |
| 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. |
| Reboot | Select one or multiple APs and click this button to force the AP(s) to restart. |

Table 37 Monitor > Wireless > AP Information > 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.<br><br>Note: You should have enabled DCS in the applied AP radio profile berfore the APs can use DCS.<br><br>Note: DCS is not supported on the radio which is working in repeater AP mode. |
| Log | Select an AP and click this button to go to the **Monitor > Log > View AP Log** screen to view the selected AP's current log messages. |
| 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. |
| # | 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. |
| 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.<br><br>This field displays **n/a** if the NXC cannot get model information from the AP. |
| Group | This displays the name of the AP group to which the AP belongs. |
| Station | This displays the number of stations (aka wireless clients) associated with the AP. |
| 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. |
| Registration | This indicates whether the AP is on the managed AP list (**Mgnt AP**) or not (**Un-Mgnt AP**). |
| MAC Address | This displays the AP's MAC address. |
| Mgnt. 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.<br><br>**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.<br><br>**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.<br><br>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.<br><br>A green LED icon signifies that the AP LED suppression mode is disabled and the AP LEDs stay lit after the AP is ready.<br><br>A sun icon signifies that the AP's locator LED is blinking.<br><br>A circle signifies that the AP's locator LED is extinguished. |

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

| LABEL | DESCRIPTION |
|---|---|
| Power Mode | This displays the AP's power status.<br><br>**Full** - the AP receives power using a power adapter and/or through a PoE switch/injector using IEEE 802.3at PoE plus. The PoE device that supports IEEE 802.3at PoE Plus can supply power of up to 30W per Ethernet port.<br><br>**Limited** - the AP receives power through a PoE switch/injector using IEEE 802.3af PoE even when it is also connected to a power source using a power adaptor. The PoE device that supports IEEE 802.3af PoE can supply power of up to 15.4W per Ethernet port.<br><br>When the AP is in limited power mode, the AP throughput decreases and has just one transmitting radio chain.<br><br>It always shows **Full** if the AP does not support power detection. At the time of writing, only the WAC6500 series APs support the power detection feature. |
| Refresh | Click this button to update the information in the screen. |

The following table describes the icons in this screen.

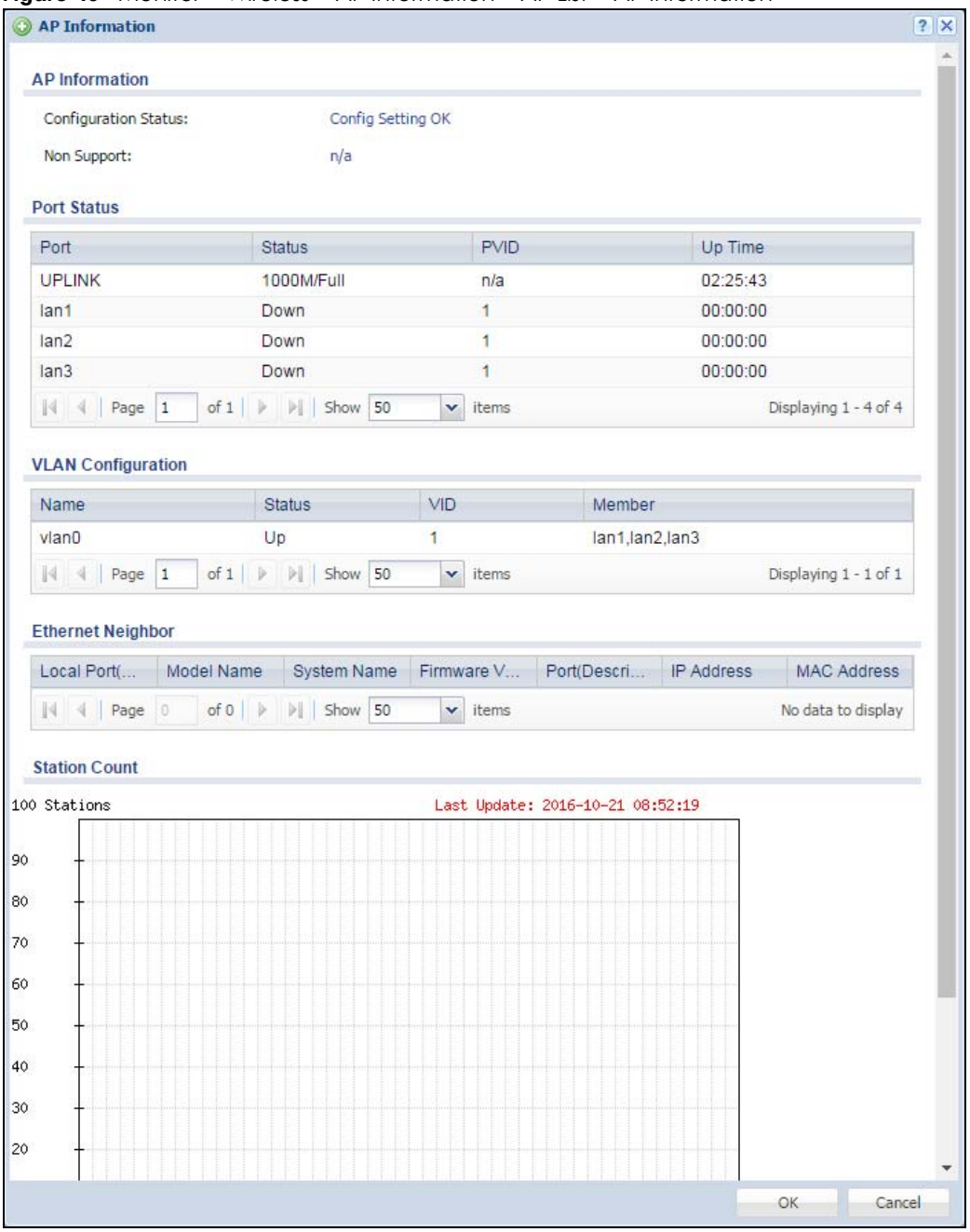
Table 38 Monitor > Wireless > AP Information > AP List Icons

| 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:<br>• This AP has a runtime management VLAN ID setting that conflicts with the VLAN ID setting on the Access Controller (the NXC).<br>• A setting the NXC assigns to this AP does not match the AP's capability.<br>• 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. |

## 5.11.1 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 40** Monitor > Wireless > AP Information > AP List > AP Information




The following table describes the labels in this screen.

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

| LABEL | DESCRIPTION |
|---|---|
| Configuration Status | This displays whether or not any of the AP's configuration is in conflict with the NXC's settings for the AP. |
| Non Support | 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. |
| Port Status | |

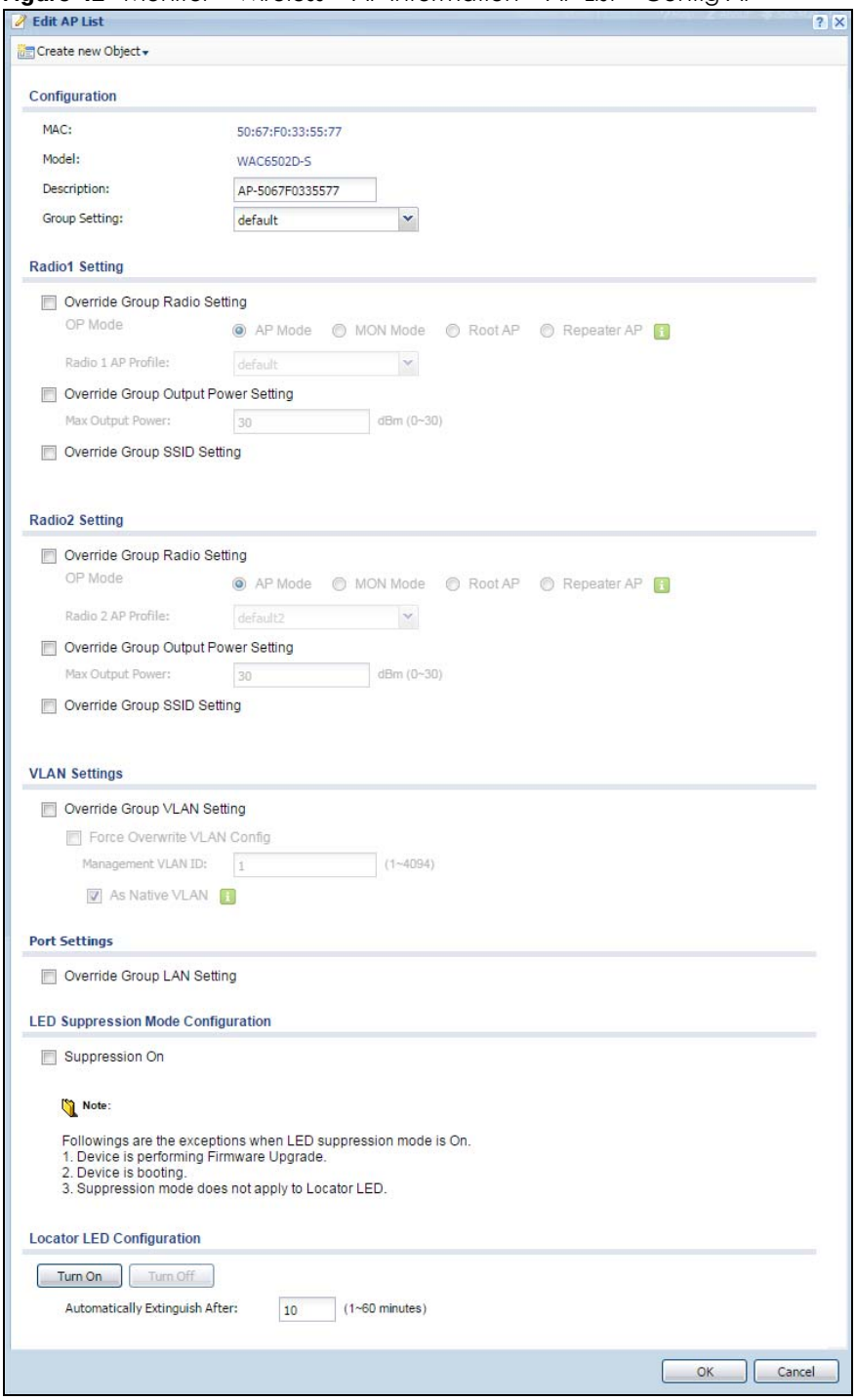
Table 39 Monitor > Wireless > AP Information > AP List > AP Information (continued)

| LABEL | DESCRIPTION |
|---|---|
| Port | This shows the name of the physical Ethernet port on the NXC. |
| Status | This field displays the current status of each physical port on the AP.<br>**Down** - The port is not connected.<br>**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.<br>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. |
| 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.<br>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. |

## 5.11.2 Config AP

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 **Config AP** button in the **AP List** screen.

**Figure 41** Monitor > Wireless > AP Information > AP List > Config AP




The following table describes the labels in this screen.

Table 40 Monitor > Wireless > AP Information > AP List > Config AP

| 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. |
| MAC | This displays the MAC address of the selected AP. |

Table 40 Monitor > Wireless > AP Information > AP List > Config AP (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| Description | Enter a description for this AP. You can use up to 31 characters, spaces and underscores allowed.<br>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. |
| Radio 1/2 Setting | |
| Override Group Radio Setting | Select this option to overwrite the AP radio settings with the settings you configure here. |
| OP Mode | Select the operating mode for radio 1 or radio 2.<br>**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).<br>**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.<br>**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/WDS to extend its wireless network.<br>**Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode).<br>Note: To prevent bidge loops, do NOT set both radios on a managed AP to **Repeater AP** mode.<br>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.<br>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 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.<br>Select the ZyMesh profile the radio uses to connect to a root AP or repeater. |
| Override Group Output Power Setting | Select this option to overwrite the AP output power setting with the setting you configure here. |
| Output Power | Enter the 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.<br>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. |
| VLAN Settings | |

Table 40 Monitor > Wireless > AP Information > AP List > Config AP (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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.<br>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 | This section displays only when you select **Override Group LAN Setting**. |
| 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. |
| LED Supression Mode Configuration<br>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.<br>If the check box is unchecked, it means the LEDs will stay lit after the AP is ready. |
| Locator LED Configuration<br>This section is available only when the AP has a locator LED. | |

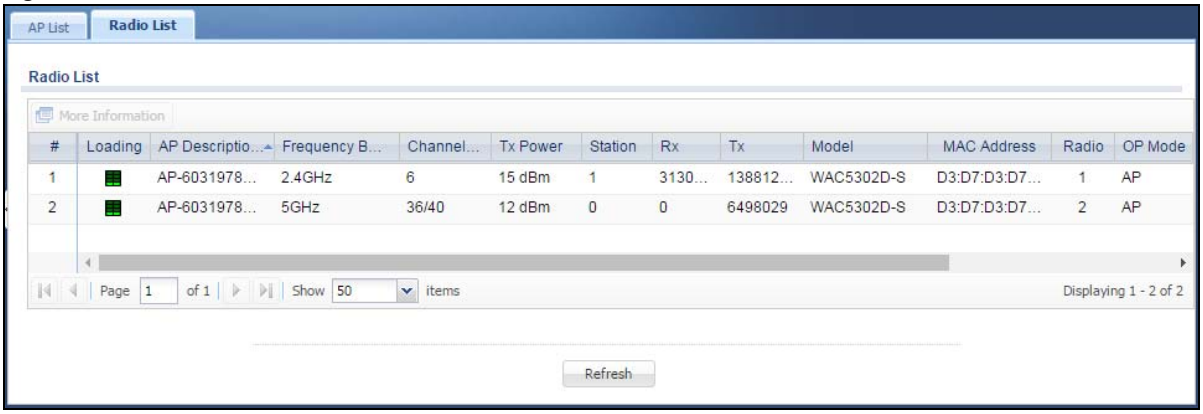
Table 40 Monitor > Wireless > AP Information > AP List > Config AP (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>If the locator LED is blinking, click the **Turn Off** button to stop the locator LED from blinking immediately. |
| 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.<br>If you make changes to the time default setting, it will be stored as the default when the AP restarts. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to close the window with changes unsaved. |

# 5.12 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 42** Monitor > Wireless > AP Information > Radio List




The following table describes the labels in this screen.

Table 41 Monitor > Wireless > AP Information > Radio List

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| # | This is the radio's index number in this list. |
| Loading | This indicates the AP's load balance status (**UnderLoad** or **OverLoad**) 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.<br>This shows **-** when the radio is in monitor mode. |
| Channel ID | This indicates the radio's channel ID. |
| Tx Power | This shows the radio's output power (in dBm). |

Table 41 Monitor > Wireless > AP Information > Radio List (continued)

| LABEL | DESCRIPTION |
|---|---|
| Station | This displays the number of stations (aka wireless clients) associated with the radio. |
| Rx | This displays the total number of bytes received by the radio. |
| Tx | 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**).<br>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. |
| Refresh | Click this button to update the information in the screen. |

The following table describes the icons in this screen.

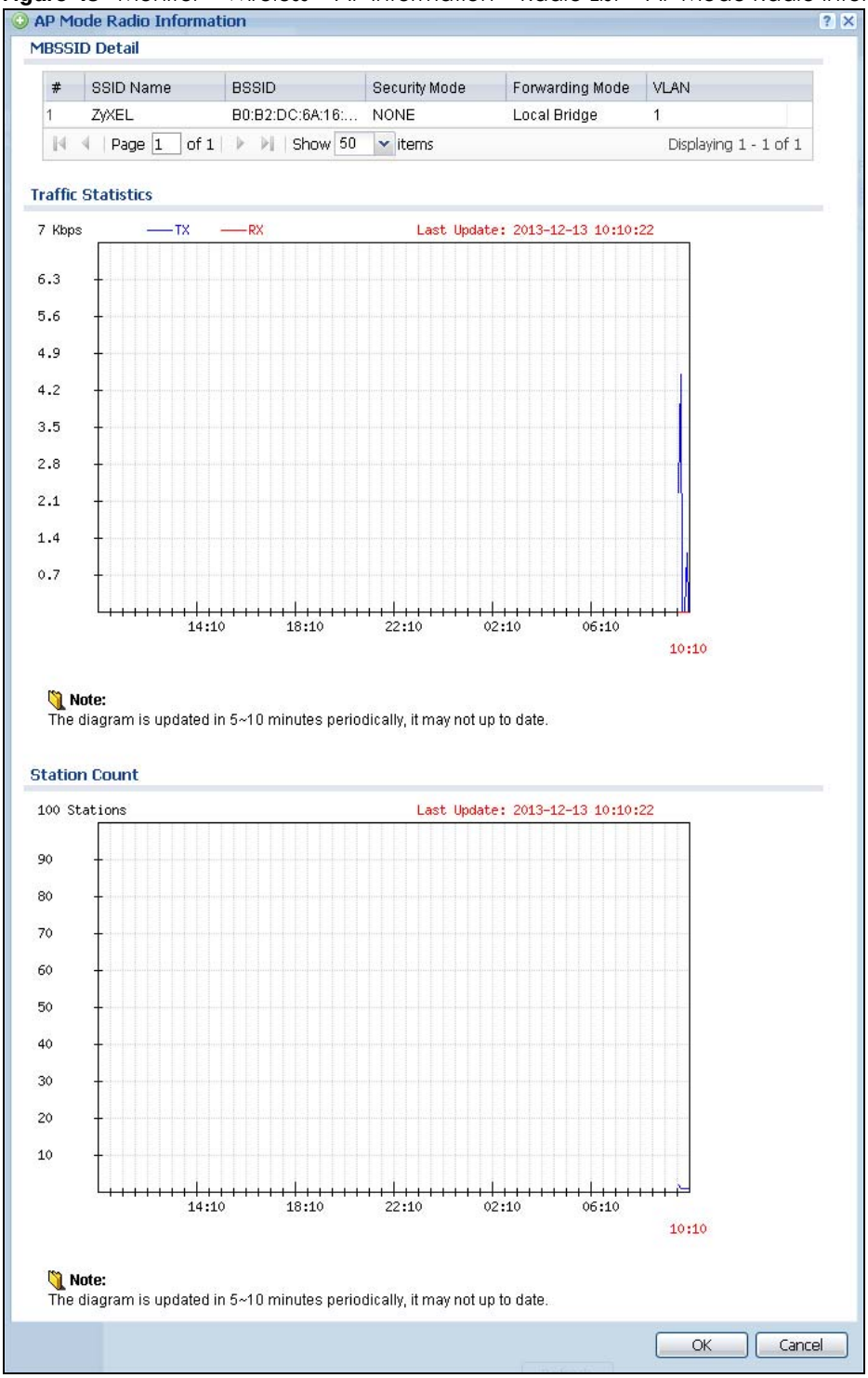
Table 42 Monitor > Wireless > AP Information > Radio List Icons

| 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. |

## 5.12.1 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 43** Monitor > Wireless > AP Information > Radio List > AP Mode Radio Information



The following table describes the labels in this screen.

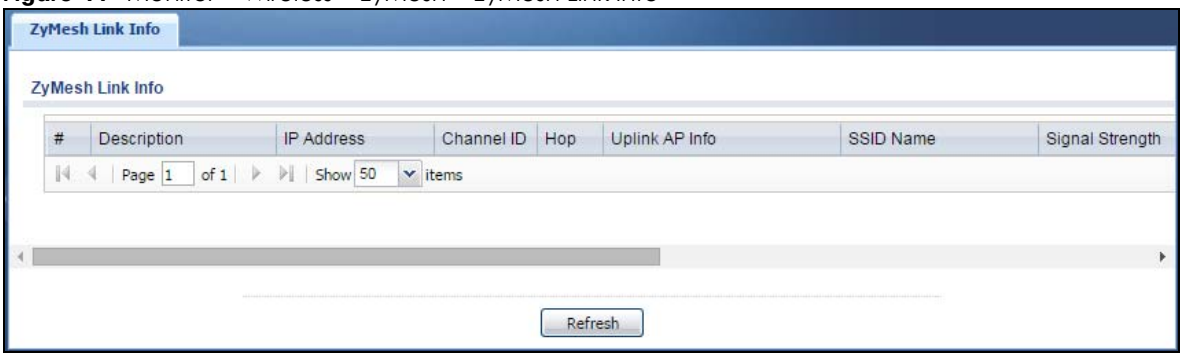
Table 43 Monitor > Wireless > AP Info > Radio List > AP Mode Radio Information

| 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. |

# 5.13 ZyMesh Link Info

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

**Figure 44** Monitor > Wireless > ZyMesh > ZyMesh Link Info



The following table describes the labels in this screen.

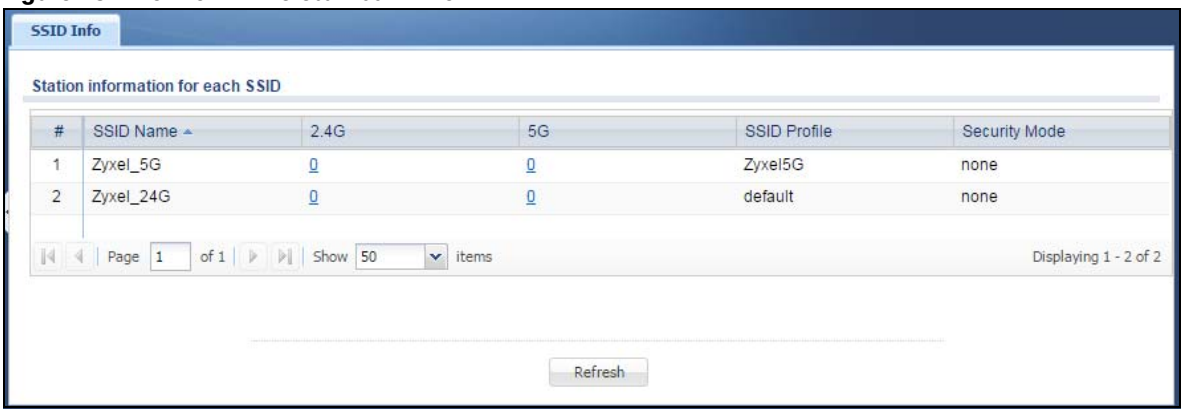
Table 44 Monitor > Wireless > ZyMesh > ZyMesh Link Info

| LABEL | DESCRIPTION |
|---|---|
| # | 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).<br>Afer 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 first associated with the root AP or repeater. |
| MAC Address | This is the MAC address of the managed AP (in repeater mode). |
| Tx 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. |
| Tx Rate | This is the maximum transmission rate of the root AP or repeater to which the managed AP is connected. |
| Rx Rate | This is the maximum reception 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. |

# 5.14 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 45** Monitor > Wireless > SSID Info



The following table describes the labels in this screen.

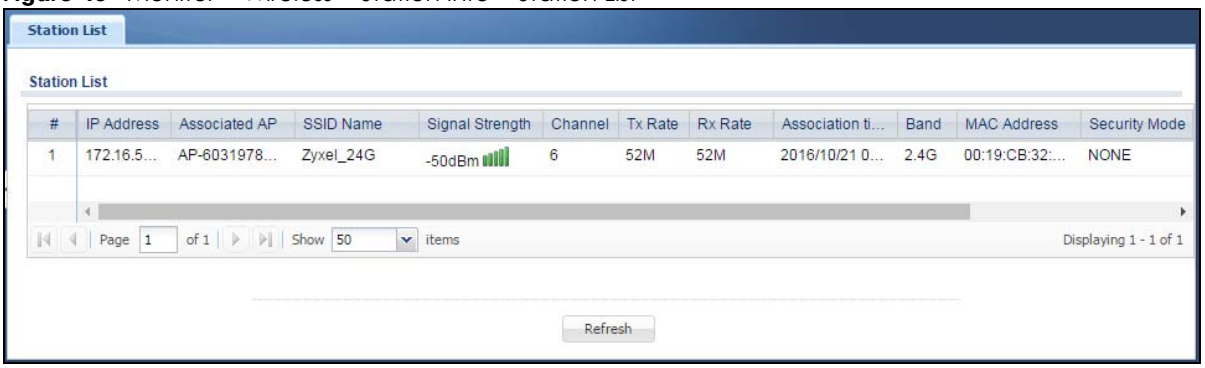
Table 45 Monitor > Wireless > SSID Info

| LABEL | DESCRIPTION |
|---|---|
| # | This is the SSID's index number in this list. |
| SSID Name | This indicates the name of the wireless network to which the client is connected. A single AP can have multiple SSIDs or networks. |
| 2.4G | 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 5.15 on page 88. |
| 5G | 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 5.15 on page 88. |
| SSID Profile | 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. |

# 5.15 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 46** Monitor > Wireless > Station Info > Station List




The following table describes the labels in this screen.

Table 46 Monitor > Wireless > Station Info > Station List

| LABEL | DESCRIPTION |
|---|---|
| # | This is the station's index number in this list. |
| 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. |
| 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. |
| Tx Rate | This indicates the current data transmission rate of the station. |

Table 46 Monitor > Wireless > Station Info > Station List (continued)

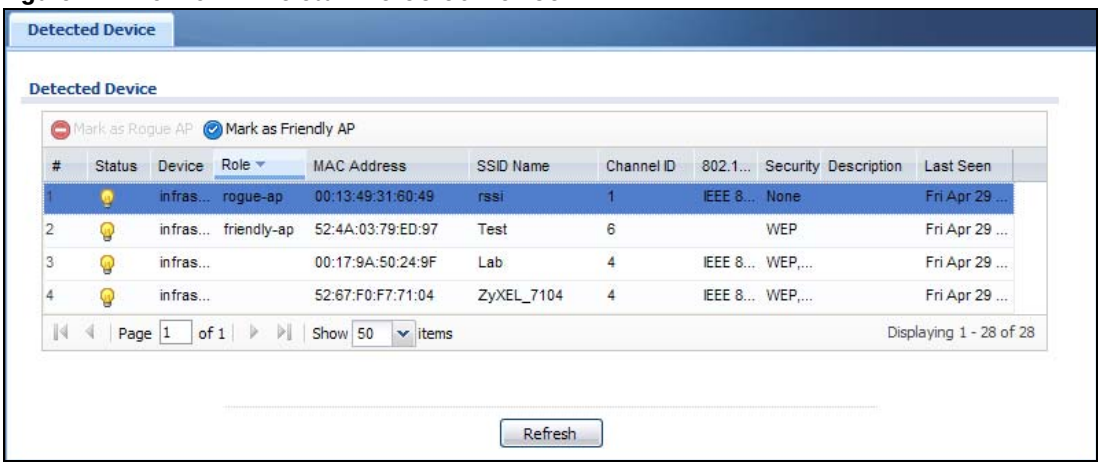
| LABEL | DESCRIPTION |
|---|---|
| Rx Rate | This indicates the current data receiving rate of the station. |
| Association Time | This displays the time a wireless station first associated with the AP. |
| Band | This indicates the frequency band which is currently being used by the station. |
| MAC Address | This is the station's MAC address. |
| Security Mode | This indicates which secure encryption methods is being used by the station to connect to the network. |
| Tx | This field displays the number of bytes transmitted from the station. |
| Rx | This field displays the number of bytes received by the station. |
| Refresh | Click this to refresh the items displayed on this page. |

# 5.16 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: At least one radio of the APs connected to the NXC must be set to monitor mode (in the **Configuration > Wireless > AP Management** screen) in order to detect other wireless devices in its vicinity.

**Figure 47** Monitor > Wireless > Detected Device




The following table describes the labels in this screen.

Table 47 Monitor > Wireless > Rogue AP > Detected Device

| LABEL | DESCRIPTION |
|---|---|
| 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 > MON Mode** screen (Chapter 7 on page 98). |
| 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 > MON Mode** screen (Chapter 7 on page 98). |
| # | This is the station's index number in this list. |
| Status | This indicates the detected device's status. |
| Device | This indicates the detected device's network type (such as **infrastructure** or **ad-hoc**). |

Table 47 Monitor > Wireless > Rogue AP > Detected Device (continued)

| LABEL | DESCRIPTION |
|---|---|
| Role | This indicates the detected device's role (such as friendly or rogue). |
| 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) transmitted by the detected device. |
| Security | This indicates the encryption method (if any) used by the detected device. |
| Description | This displays the detected device's description. For more on managing friendly and rogue APs, see the **Configuration > Wireless > MON Mode** screen (Chapter 7 on page 98). |
| Last Seen | This indicates the last time the device was detected by the NXC. |
| Refresh | Click this to refresh the items displayed on this page. |

# 5.17 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.

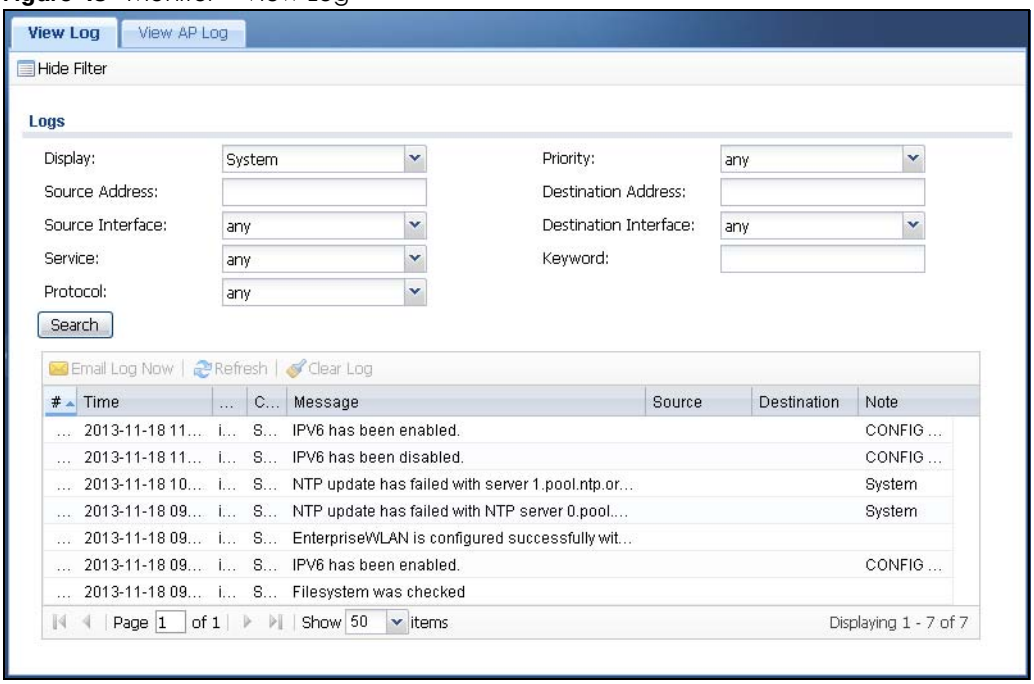
To access this screen, click **Monitor > Log**. The log is displayed in the following screen.

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 392.
- 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 48** Monitor > View Log




The following table describes the labels in this screen.

Table 48 Monitor > View Log

| LABEL | DESCRIPTION |
|---|---|
| Show Filter / Hide Filter | Click this button to show or hide the filter settings.<br>If the filter settings are hidden, the **Display**, **Email Log Now**, **Refresh**, and **Clear Log** fields are available.<br>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. |

Table 48 Monitor > View Log (continued)

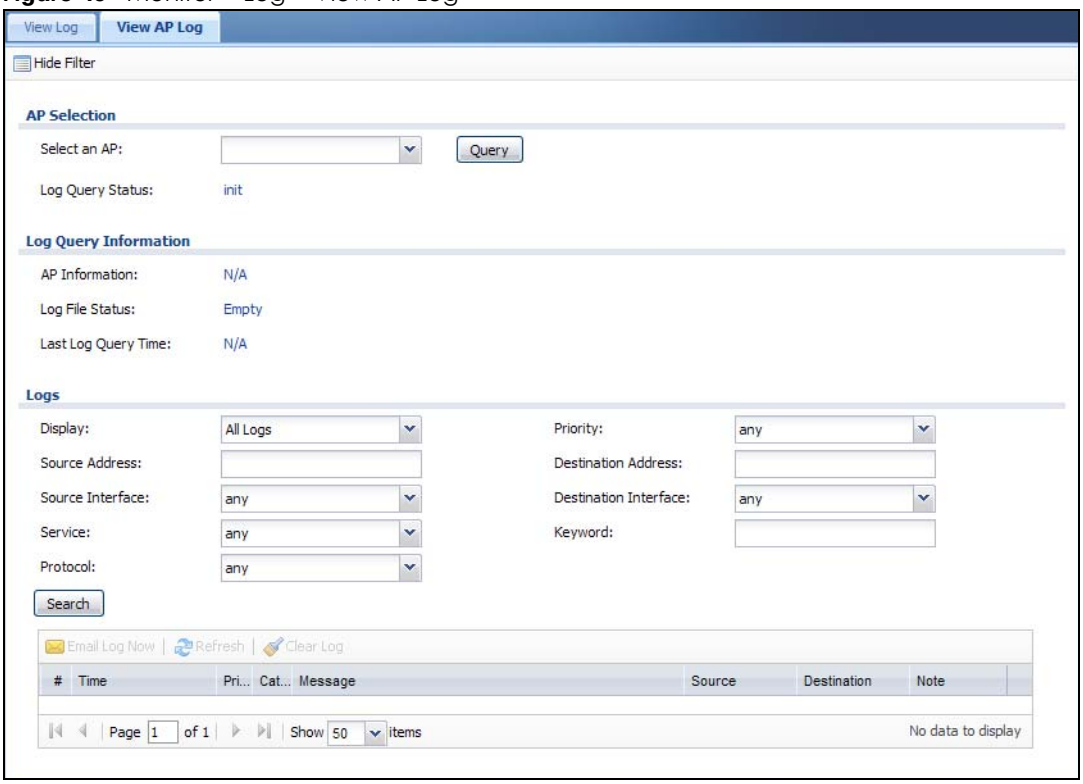
| LABEL | DESCRIPTION |
|---|---|
| Protocol | This displays when you show the filter. Select a service protocol whose log messages you would like to see. |
| Search | This displays when you show the filter. Click this button to update the log using the current filter settings. |
| Email Log Now | Click 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. |
| 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.

# 5.18 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 49** Monitor > Log > View AP Log




The following table describes the labels in this screen.

Table 49 Monitor > Log > View AP Log

| LABEL | DESCRIPTION |
|---|---|
| Show/Hide Filter | Click this to show or hide the AP log filter. |
| Select an AP | Select an AP from the list and click **Query** to view its log messages. |
| Log Query Status | This indicates the current log query status.<br>**init** - Indicates the query has not been initialized.<br>**querying** - Indicates the query is in process.<br>**fail** - Indicates the query failed.<br>**success** - Indicates the query succeeded. |
| 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. |
| Display | Select the log file from the specified AP that you want displayed.<br>Note: This criterion only appears when you **Show Filter**. |
| Priority | Select a priority level to use for filtering displayed log messages.<br>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.<br>Note: This criterion only appears when you **Show Filter**. |

Table 49 Monitor > Log > View AP Log

| LABEL | DESCRIPTION |
|---|---|
| Destination Address | Enter a destination IP address to display only the log messages that include it.<br>Note: This criterion only appears when you **Show Filter**. |
| Source Interface | Enter a source interface to display only the log messages that include it.<br>Note: This criterion only appears when you **Show Filter**. |
| Destination Interface | Enter a destination interface to display only the log messages that include it.<br>Note: This criterion only appears when you **Show Filter**. |
| Service | Select a service type to display only the log messages related to it.<br>Note: This criterion only appears when you **Show Filter**. |
| Keyword | Enter a keyword to display only the log messages that include it.<br>Note: This criterion only appears when you **Show Filter**. |
| Protocol | Select a protocol to display only the log messages that include it.<br>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. |
| 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 6
# Registration

## 6.1 Overview

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

### 6.1.1 What You Can Do in this Chapter

- The **Registration** screen (Section 6.2 on page 96) registers your NXC with myZyxel.com.
- The **Service** screen (Section 6.3 on page 96) displays the status of your service registrations and upgrade licenses.

### 6.1.2 What you Need to Know

This section introduces the topics covered in this chapter.

#### myZyxel.com

myZyxel.com is Zyxel's online services 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 a NXC, you need to access myZyxel.com via that NXC.

#### Maximum Number of Managed APs

The NXC2500 is initially configured to support up to 8 managed APs (such as the NWA5123-NI). You can increase this by subscribing to additional licenses. As of this writing, each license upgrade allows an additional 8 managed APs while the maximum number of APs a single NXC can support is 64.

The NXC5500 is initially configured to support up to 64 managed APs (such as the NWA512x series or NWA5301-NJ). You can increase this by subscribing to additional licenses. As of this writing, a license upgrade allows an additional 8 or 64 managed APs while the maximum number of APs a single NXC can support is 512.

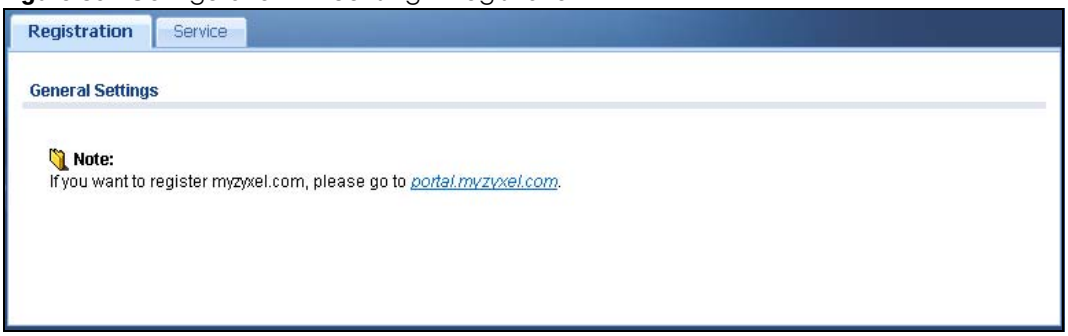
### Maximum Number of ZyMesh Root APs

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. You can remove the limit by subscribing to the ZyMesh license.

## 6.2 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 50** Configuration > Licensing > Registration




## 6.3 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 51** Configuration > Licensing > Registration > Service

The following table describes the labels in this screen.

Table 50 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**). |
| 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 7
# Wireless

## 7.1 Overview

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

### 7.1.1 What You Can Do in this Chapter

- The **Controller** screen (Section 7.2 on page 99) sets how the NXC allows new APs to connect to the network.
- The **AP Management** screen (Section 7.3 on page 99) manages all of the APs connected to the NXC.
- The **MON Mode** screen (Section 7.4 on page 114) allows you to assign APs either to the rogue AP list or the friendly AP list.
- The **Auto Healing** screen (Section 7.5 on page 116) turns on the auto healing feature to extend the wireless service coverage area of the managed APs when one of the APs fails.

### 7.1.2 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.

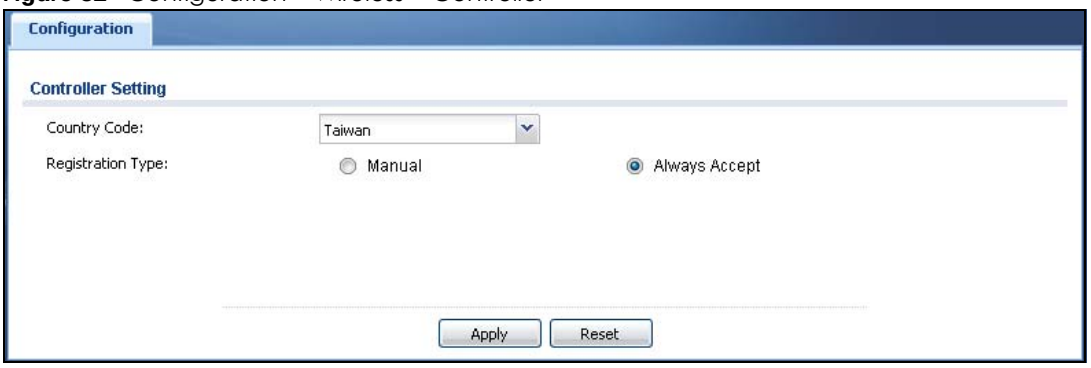
#### Load Balancing (Wireless)

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.

# 7.2 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 52** Configuration > Wireless > Controller




Each field is described in the following table.

Table 51 Configuration > Wireless > Controller

| LABEL | DESCRIPTION |
|---|---|
| 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.<br><br>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 5.16 on page 89.<br><br>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. |

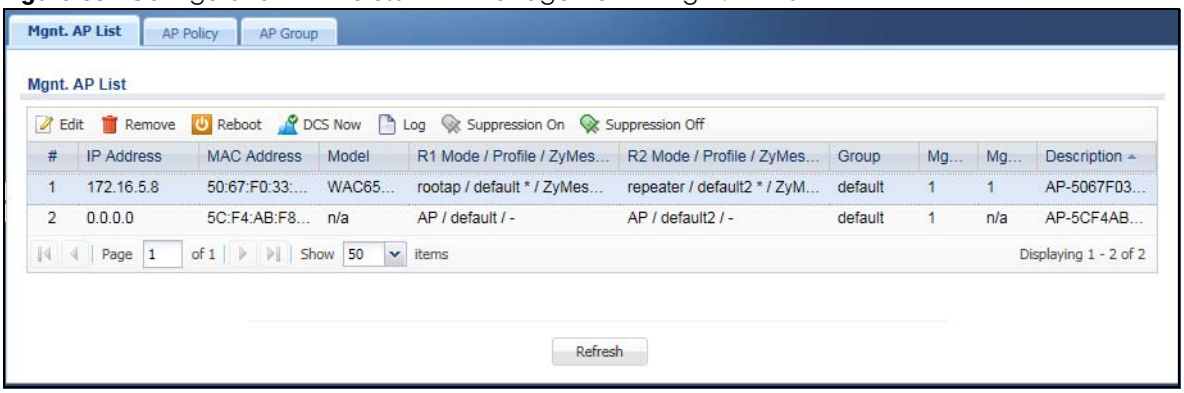
# 7.3 AP Management

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

## 7.3.1 Mgnt. 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 53** Configuration > Wireless > AP Management > Mgnt. AP List




Each field is described in the following table.

Table 52 Configuration > Wireless > AP Management > Mgnt. AP List

| LABEL | DESCRIPTION |
|---|---|
| Edit | Select an AP and click this button to edit its properties. |
| Remove | Select one or multiple APs and click this button to remove the AP(s) from the list.<br><br>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. |
| Reboot | Select one or multiple APs and click this button to force the AP(s) to restart. |
| 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.<br><br>Note: You should have enabled DCS in the applied AP radio profile before the APs can use DCS.<br><br>Note: DCS is not supported on the radio which is working in repeater AP mode. |
| Log | Select an AP and click this button to go to the **Monitor > Log > View AP Log** screen to view the selected AP's current log messages. |
| 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. |
| # | This field is a sequential value, and it is not associated with any interface. |
| 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. |

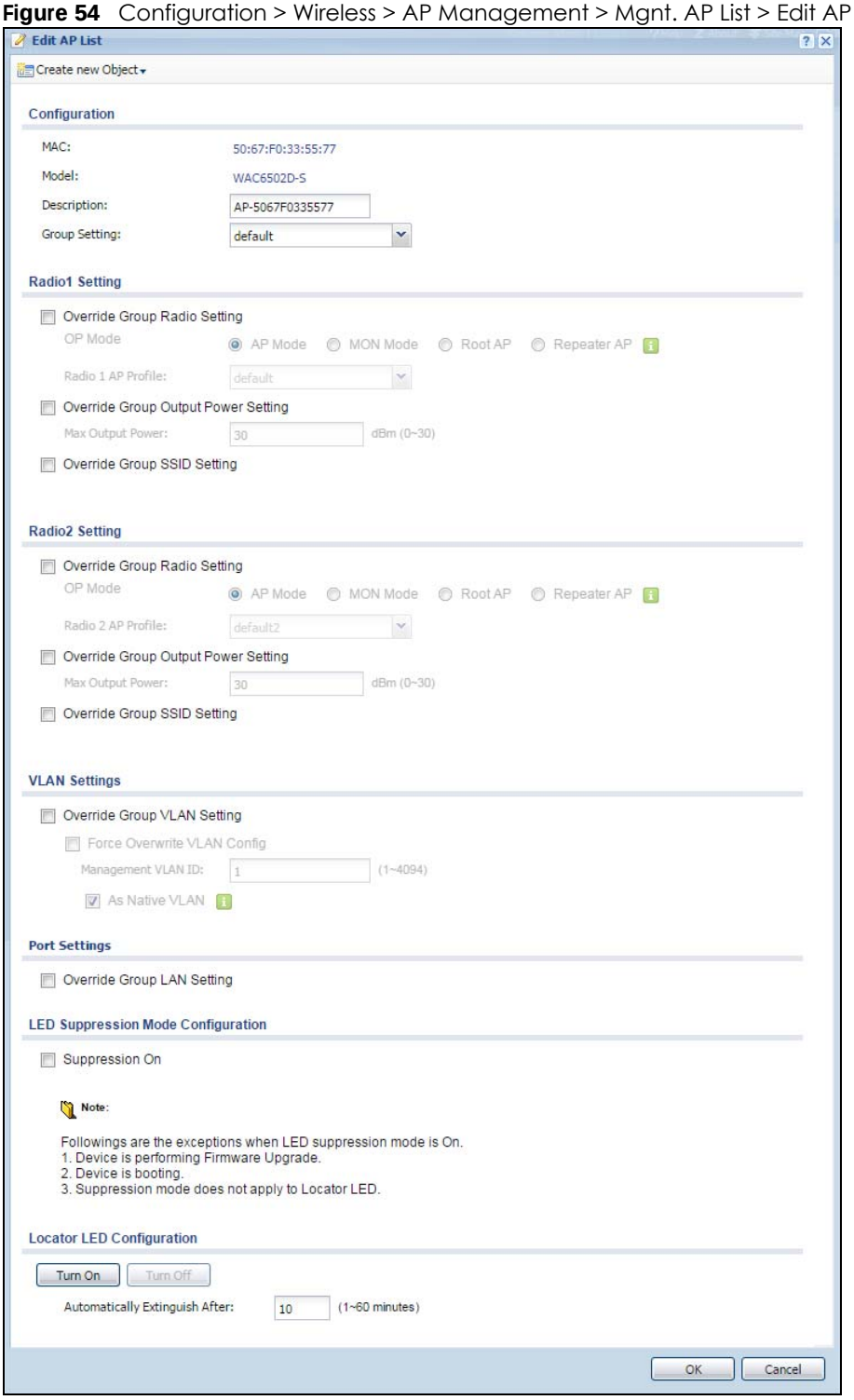
Table 52 Configuration > Wireless > AP Management > Mgnt. AP List (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| Group | This field displays the name of the AP group to which the AP belongs.<br>The group becomes editable immediately upon clicking. |
| Mgnt. VLAN ID(AC) | This displays the Access Controller (the NXC) management VLAN ID setting for the AP. |
| Mgnt. VLAN ID(AP) | This displays the runtime management VLAN ID setting on the AP. **VLAN Conflict** displays if the AP's management VLAN ID does not match the **Mgnt. VLAN ID(AC)**. This field displays **n/a** if the NXC cannot get VLAN information from the AP. |
| Description | This field displays the AP's description, which you can configure by selecting the AP's entry and clicking the **Edit** button. |
| Refresh | Click **Refresh** to update the information in this screen. |

### 7.3.1.1 Edit AP List

Select an AP and click the **Edit** button in the **Configuration > Wireless > AP Management > Mgnt. AP List** table to display this screen.

**Figure 54** Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List



Each field is described in the following table.

Table 53 Configuration > Wireless > AP Management > Mgnt. 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. |
| 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. |
| Description | Enter a description for this AP. You can use up to 31 characters, spaces and underscores allowed.<br><br>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. |
| Radio 1/2 Setting | |
| Override Group Radio Setting | Select this option to overwrite the AP radio settings with the settings you configure here. |
| OP Mode | Select the operating mode for radio 1 or radio 2.<br><br>**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).<br><br>**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.<br><br>**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/WDS to extend its wireless network.<br><br>**Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode).<br><br>Note: To prevent bidge loops, do NOT set both radios on a managed AP to **Repeater AP** mode.<br><br>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.<br><br>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.<br><br>Select the ZyMesh profile the radio uses to connect to a root AP or repeater. |

Table 53 Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List (continued)

| LABEL | DESCRIPTION |
|---|---|
| Enable Wireless Bridging | This field is available only when the radio is in **Repeater AP** mode.<br>Select this option to enable wireless bridging on the radio.<br>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/WDS link is up. Be careful to avoid bridge loops.<br>The managed APs in the same ZyMesh/WDS 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. |
| Output Power | Set the 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.<br>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. |
| 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. |
| 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.<br>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 | This section displays only when you select **Override Group LAN Setting**. |
| 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 53 Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List (continued)

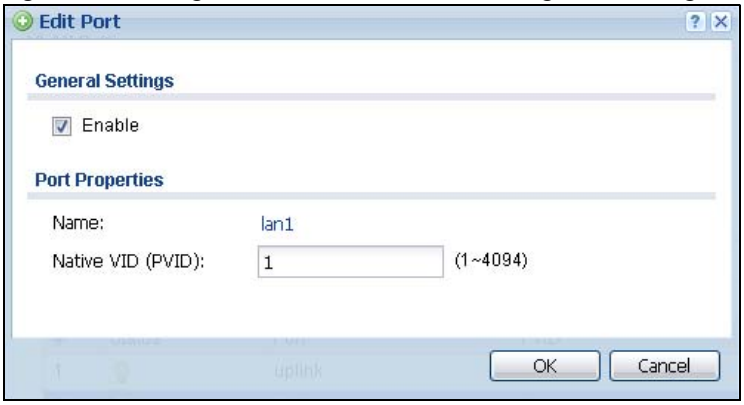
| LABEL | DESCRIPTION |
|---|---|
| Remove | To remove an entry, select it and click **Remove**. The NXC confirms you want to remove it before doing so. |
| Activate/Inactivate | To turn on an entry, select it and click **Activate**. To turn off an entry, select it and click **Inactivate**. |
| # | This 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. |
| LED Supression Mode Configuration<br>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.<br>If the check box is unchecked, it means the LEDs will stay lit after the AP is ready. |
| Locator LED Configuration<br>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.<br>If the locator LED is blinking, click the **Turn Off** button to stop the locator LED from blinking immediately. |
| 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.<br>If you make changes to the time default setting, it will be stored as the default when the AP restarts. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to close the window with changes unsaved. |

### 7.3.1.2 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 **Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List** screen.

**Figure 55** Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List > Edit Port



Each field is described in the following table.

Table 54 Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List > Edit Port

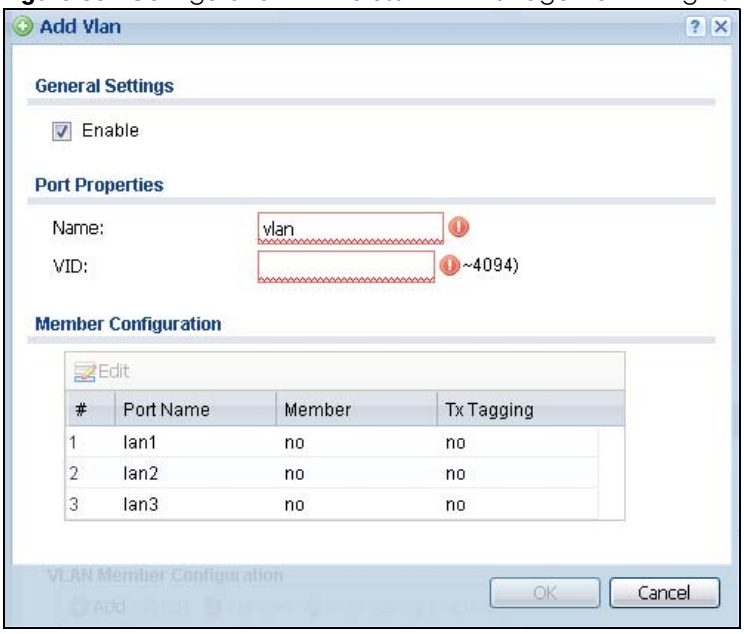
| LABEL | DESCRIPTION |
|---|---|
| Enable | Select this option to activate the port. Otherwise, deselect it. |
| Name | This shows the name of the port. |
| Native VID (PVID) | A PVID (Port VLAN ID) is a tag that adds to incoming untagged frames received on a port so that the frames are forwarded to the VLAN group that the tag defines.<br>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. |

### 7.3.1.3 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 Member Configuration** table of the **Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List** screen.

**Figure 56** Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List > Edit VLAN




Each field is described in the following table.

Table 55 Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List > Edit VLAN

| LABEL | DESCRIPTION |
|---|---|
| Enable | Select this option to activate the VLAN. Otherwise, deselect it. |
| Name | This field is read-only if you are editing an existing VLAN.<br>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.) |

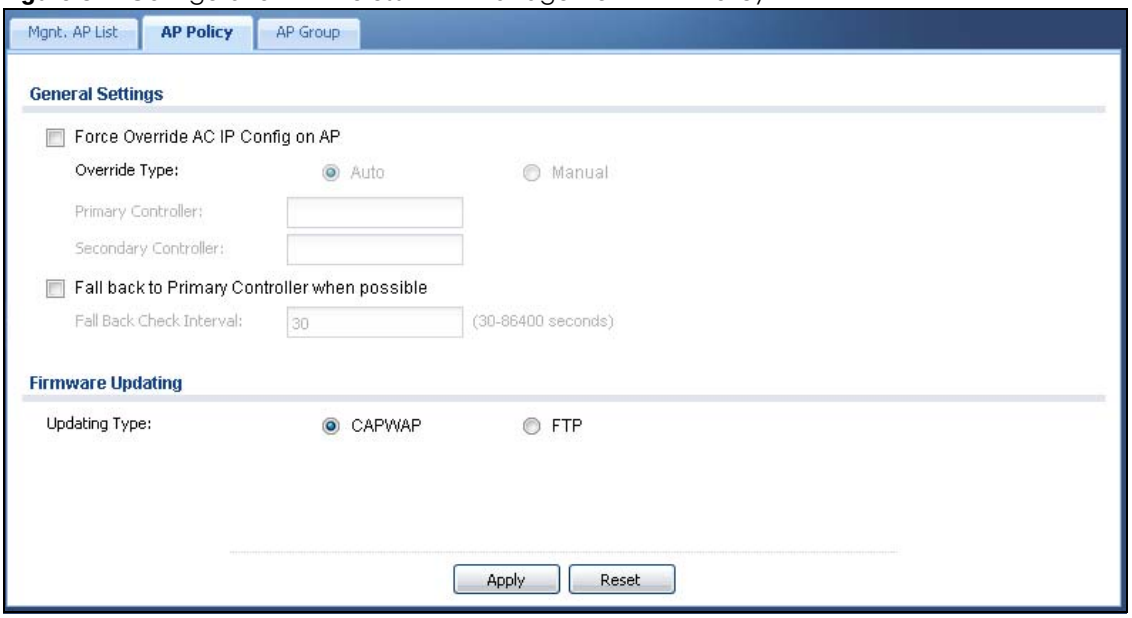
Table 55 Configuration > Wireless > AP Management > Mgnt. AP List > Edit AP List > Edit VLAN

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>Click this field to edit the value. |
| Tx Tagging | This indicates whether the selected port tags outbound traffic with this VLAN's ID .<br>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. |

## 7.3.2 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 57** Configuration > Wireless > AP Management > AP Policy



Each field is described in the following table.

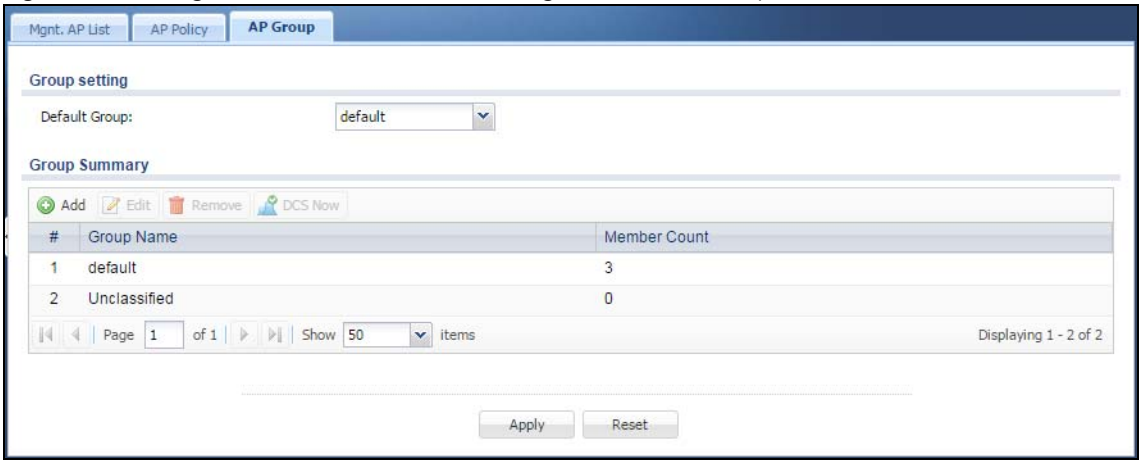
Table 56 Configuration > Wireless > AP Management > AP Policy

| LABEL | DESCRIPTION |
|---|---|
| Force Override AC 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.<br>Select **Manual** to replace the AP controller's IP address configured on the managed AP(s) with the one(s) you specified below. |
| 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 Type | Specify how you want the NXC to upgrade AP firmware.<br>Select **CAPWAP** to have the NXC use CAPWAP to automatically update firmware on the managed APs.<br>Select **FTP** to allow the managed APs to download the latest firmware from the NXC using FTP. |
| Apply | Click **Apply** to save your changes back to the NXC. |
| Reset | Click **Reset** to return the screen to its last-saved settings. |

## 7.3.3 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 58** Configuration > Wireless > AP Management > AP Group



Each field is described in the following table.

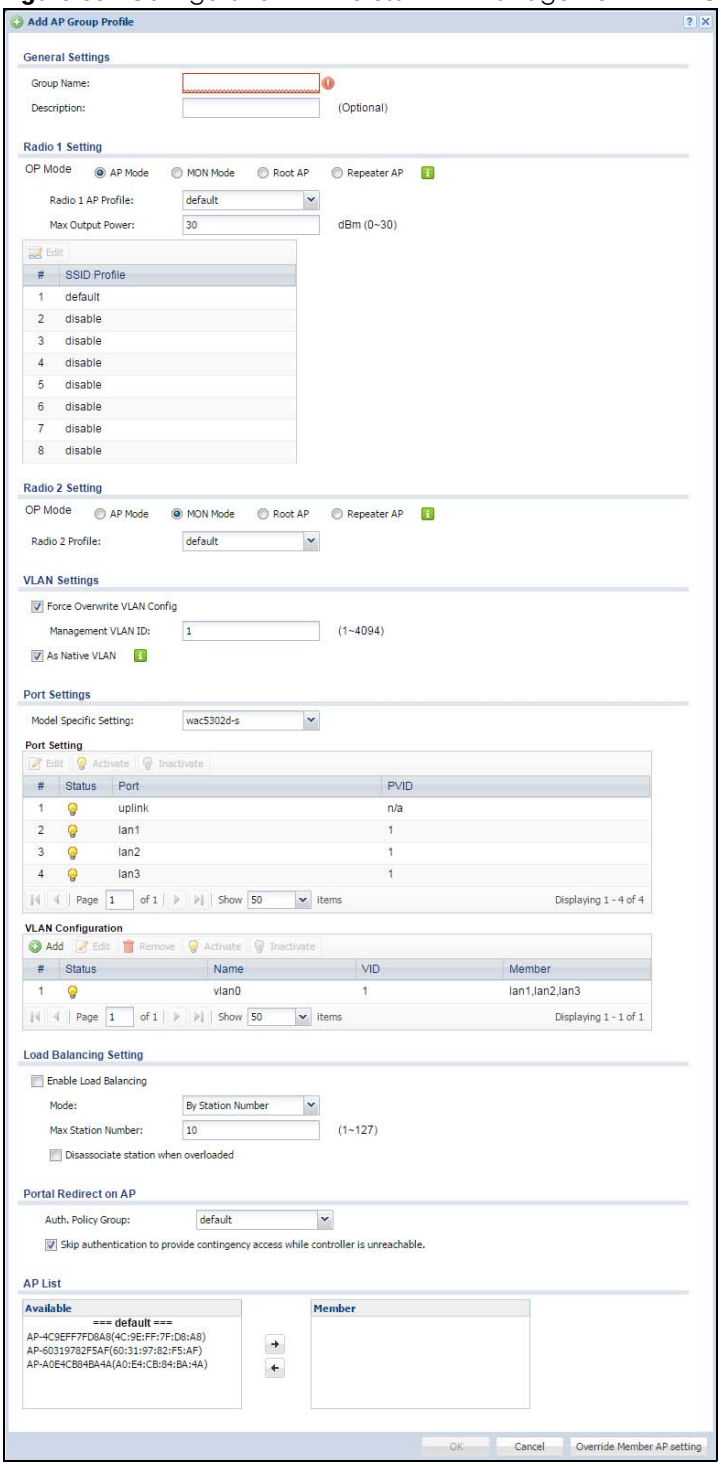
Table 57 Configuration > Wireless > AP Management > AP Group

| LABEL | DESCRIPTION |
|---|---|
| Group Setting | |
| Default Group | Select a group that is used as the default group.<br><br>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 entry and click this button to edit its properties. |
| Remove | Select an entry and click this button to remove it from the list.<br><br>Note: You cannot remove a group with which an AP is associated. |
| 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.<br><br>Note: You should have enabled DCS in the applied AP radio profile berfore the APs can use DCS.<br><br>Note: DCS is not supported on the radio which is working in repeater AP mode. |
| # | 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. |

## 7.3.4 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 59** Configuration > Wireless > AP Management > AP Group > Add/Edit



Each field is described in the following table.

Table 58 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. |
| Radio 1/2 Setting | |
| OP Mode | Select the operating mode for radio 1 or radio 2.<br>**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).<br>**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.<br>**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/WDS to extend its wireless network.<br>Note: You can select **Root AP** in an AP group only when the ZyMesh license is activated.<br>**Repeater AP** means the radio can establish a wireless connection with other APs (in either root AP or repeater mode).<br>Note: To prevent bidge loops, do NOT set both radios on a managed AP to **Repeater AP** mode.<br>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 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.<br>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.<br>Select this option to enable wireless bridging on the radio.<br>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/WDS link is up. Be careful to avoid bridge loops.<br>The managed APs in the same ZyMesh/WDS must use the same static VLAN ID. |
| Max Output Power | Set the maximum output power of the AP.<br>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.<br>Note: Reducing the output power also reduces the NXC's effective broadcast radius. |

Table 58 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 radio. |
| SSID Profile | Indicates which SSID profile is associated with this radio profile. |
| VLAN Settings | |
| 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 | |
| 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.<br>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. |
| Enable Load Balancing | Select this to enable load balancing on the NXC.<br>Use this section to configure wireless network traffic load balancing between the managed APs in this group.<br>Note: Load balancing is not supported on the radio which is working in root AP or repeater AP mode. |

Table 58 Configuration > Wireless > AP Management > AP Group > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Mode | Select a mode by which load balancing is carried out.<br><br>Select **By Station Number** to balance network traffic based on the number of specified stations connected to an AP.<br><br>Select **By Traffic Level** to balance network traffic based on the volume generated by the stations connected to an AP.<br><br>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.<br><br>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. |
| Max Station Number | Enter the threshold number of stations at which an AP begins load balancing its connections. |
| Traffic Level | Select the threshold traffic level at which the AP begins load balancing its connections (**Low**, **Medium**, **High**).<br><br>The maximum bandwidth allowed for each level is:<br><br>• **Low** - 11 Mbps,<br>• **Medium** - 23 Mbps<br>• **High** - 35M bps |
| 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**.<br><br>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.<br><br>The disassociation priority is determined automatically by the NXC and is as follows:<br><br>• **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**.<br>• **Signal Strength** - Devices with the weakest signal strength will be disassociated first.<br><br>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. |
| Portal Redirect on AP | |
| 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 14.4 on page 178 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. |

Table 58 Configuration > Wireless > AP Management > AP Group > Add/Edit (continued)

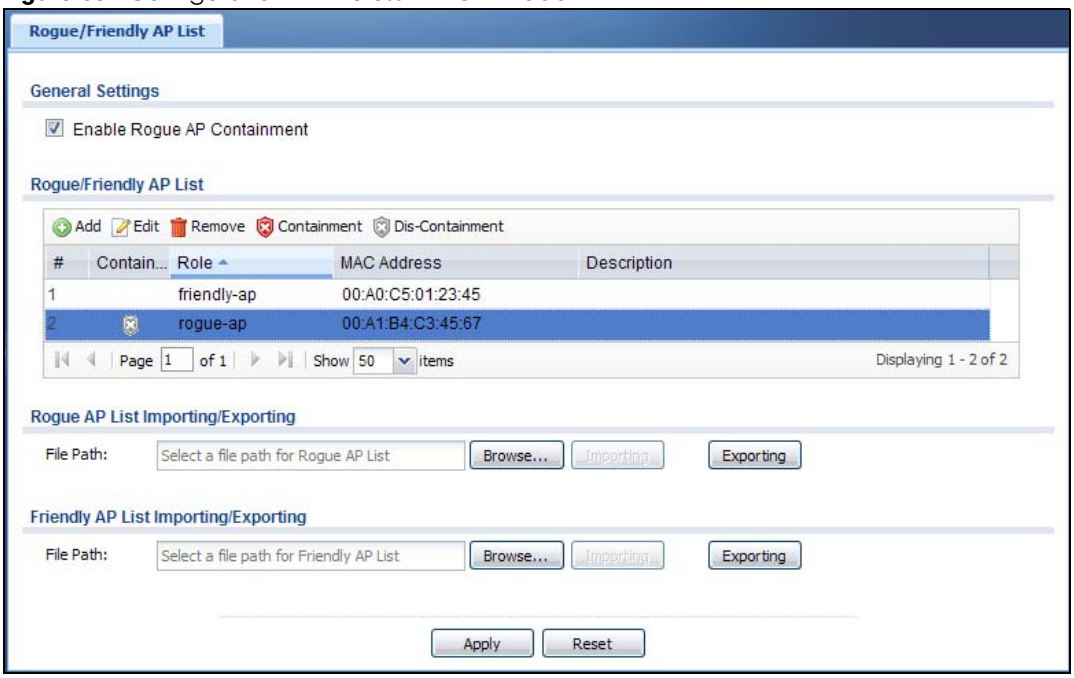
| LABEL | DESCRIPTION |
|---|---|
| Member | This lists the APs that belong to this group. Select any APs that you want to remove from the group, and click the left arrow button to remove them. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to close the window 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. |

# 7.4 MON Mode

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 > MON Mode** to access this screen.

**Figure 60** Configuration > Wireless > MON Mode




Each field is described in the following table.

Table 59 Configuration > Wireless > MON Mode

| LABEL | DESCRIPTION |
|---|---|
| General Settings | |
| Enable Rogue AP Containment | Select this to enable rogue AP containment. |
| Rogue/Friendly AP List | |
| Add | Click this button to add an AP to the list and assign it either friendly or rogue status. |

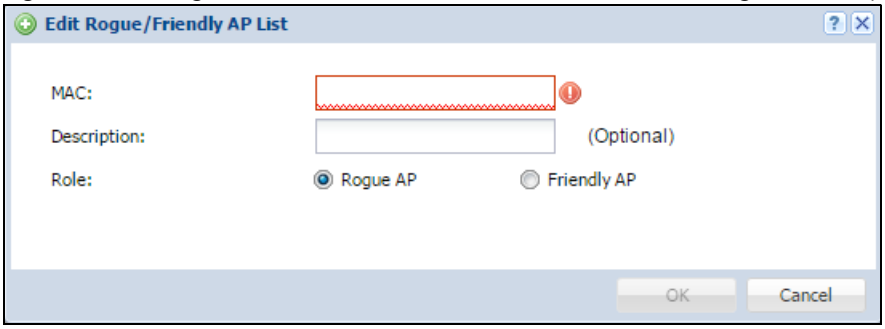
Table 59 Configuration > Wireless > MON Mode (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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.<br>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. |
| Apply | Click **Apply** to save your changes back to the NXC. |
| Reset | Click **Reset** to return the screen to its last-saved settings. |

## 7.4.1 Add/Edit Rogue/Friendly List

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

**Figure 61** Configuration > Wireless > MON Mode > Add/Edit Rogue/Friendly AP List




Each field is described in the following table.

Table 60 Configuration > Wireless > MON Mode > Add/Edit Rogue/Friendly

| 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. |

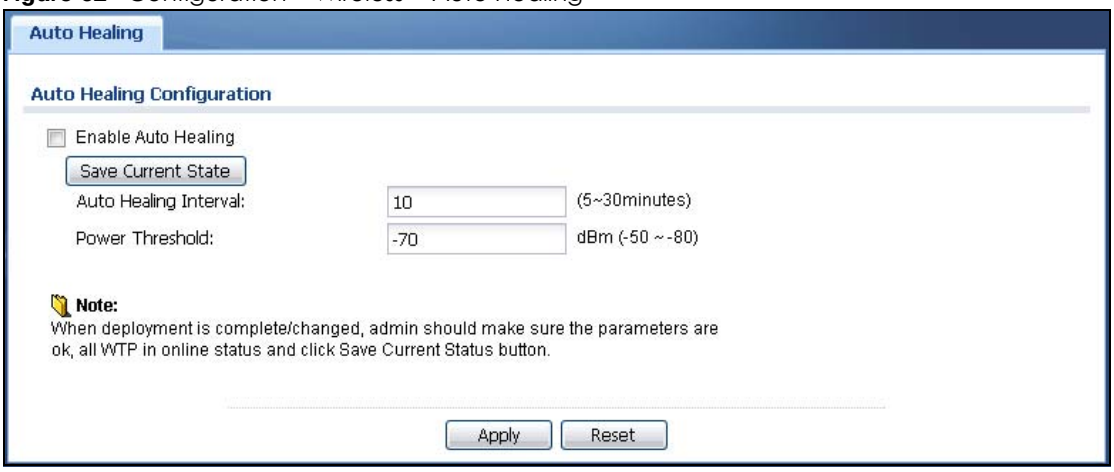
Table 60 Configuration > Wireless > MON Mode > Add/Edit Rogue/Friendly (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |

# 7.5 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 62** Configuration > Wireless > Auto Healing




Each field is described in the following table.

Table 61 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).<br>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.<br>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. |

# 7.6 Technical Reference

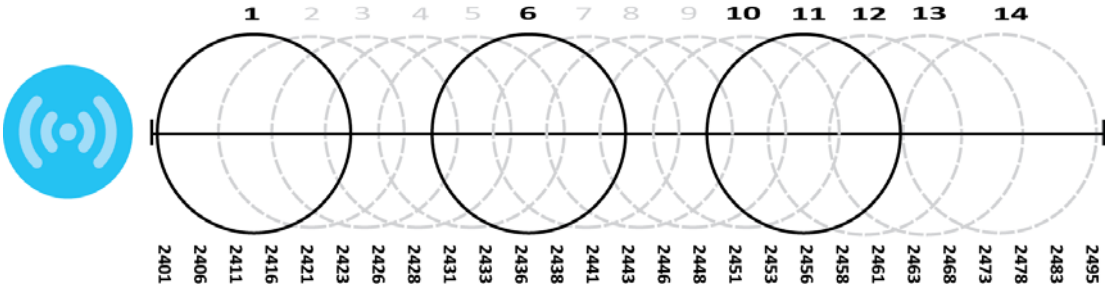
The following section contains additional technical information about the features described in this chapter.

## 7.6.1 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.

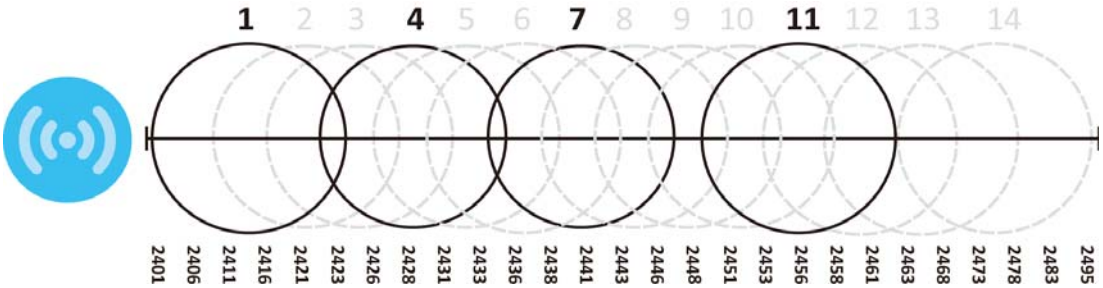
In the 2.4 GHz spectrum, each channel from 1 to 13 is broken up into discrete 22 MHz segments that are spaced 5 MHz apart. Channel 1 is centered on 2.412 GHz while channel 13 is centered on 2.472 GHz.

**Figure 63** 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.

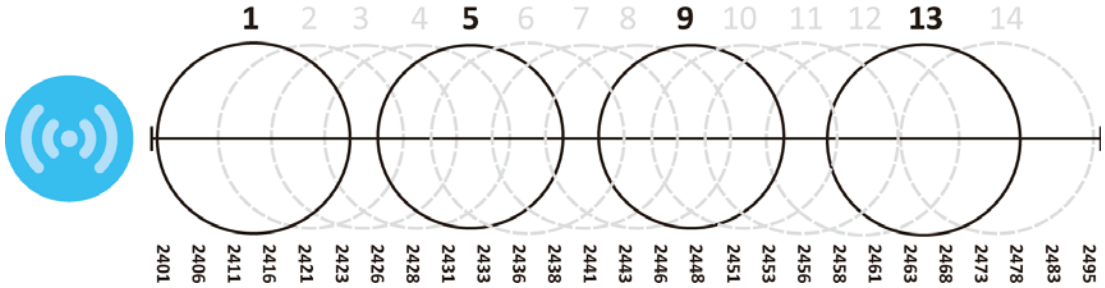
**Figure 64** An Example Four-Channel Deployment




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 65** An Alternative Four-Channel Deployment




## 7.6.2 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 two 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.

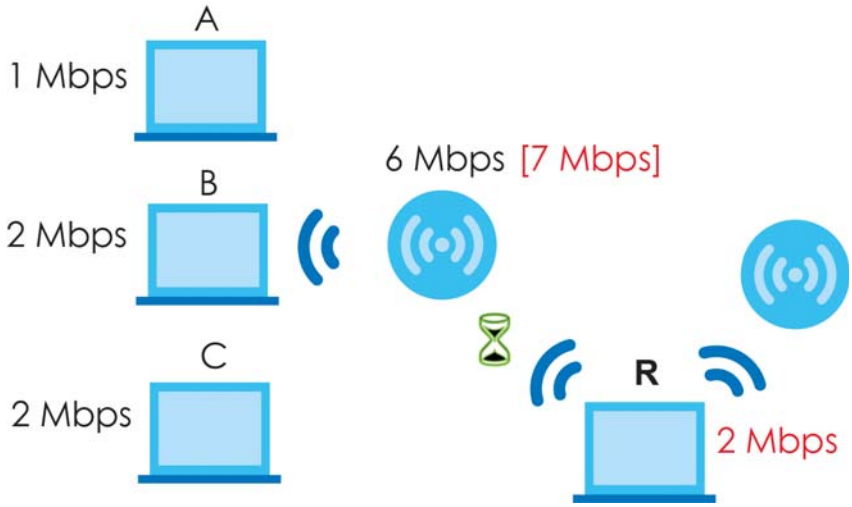
Imagine a coffee shop in a crowded business district that offers free wireless connectivity to its customers. The coffee shop owner can't possibly know how many connections his AP will have at any given moment. As such, he decides to put a limit on the bandwidth that is available to his customers but 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.

### 7.6.3 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.

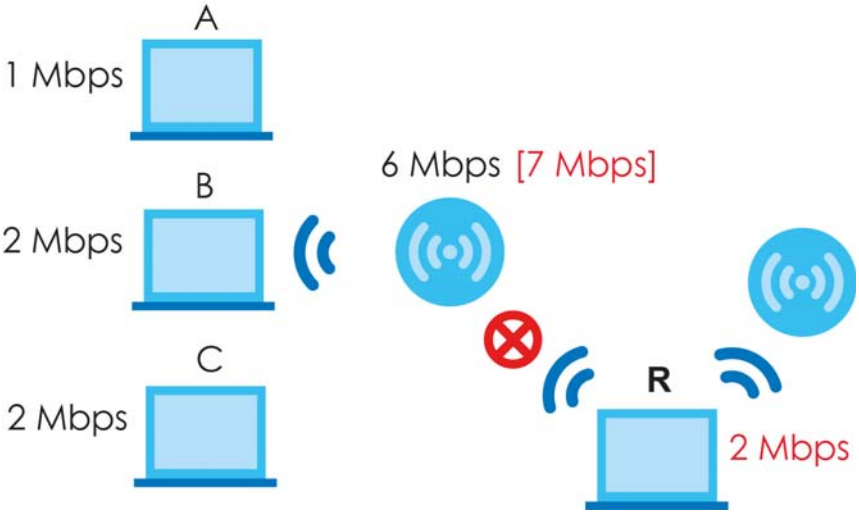
For example, here the AP has a balanced bandwidth allotment of 6 Mbps. If laptop **R** connects and it pushes the AP over its allotment, say to 7 Mbps, then the AP delays the red laptop's connection until it can afford the bandwidth or the laptop is picked up by a different AP with bandwidth to spare.

**Figure 66** 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 67** 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 8
# Interfaces

## 8.1 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.

### 8.1.1 What You Can Do in this Chapter

- The **Ethernet** screens (Section 8.2 on page 121) configure the Ethernet interfaces. Ethernet interfaces are the foundation for defining other interfaces and network policies.
- The **VLAN** screens (Section 8.3 on page 132) 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.

### 8.1.2 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.

# 8.2 Ethernet Summary

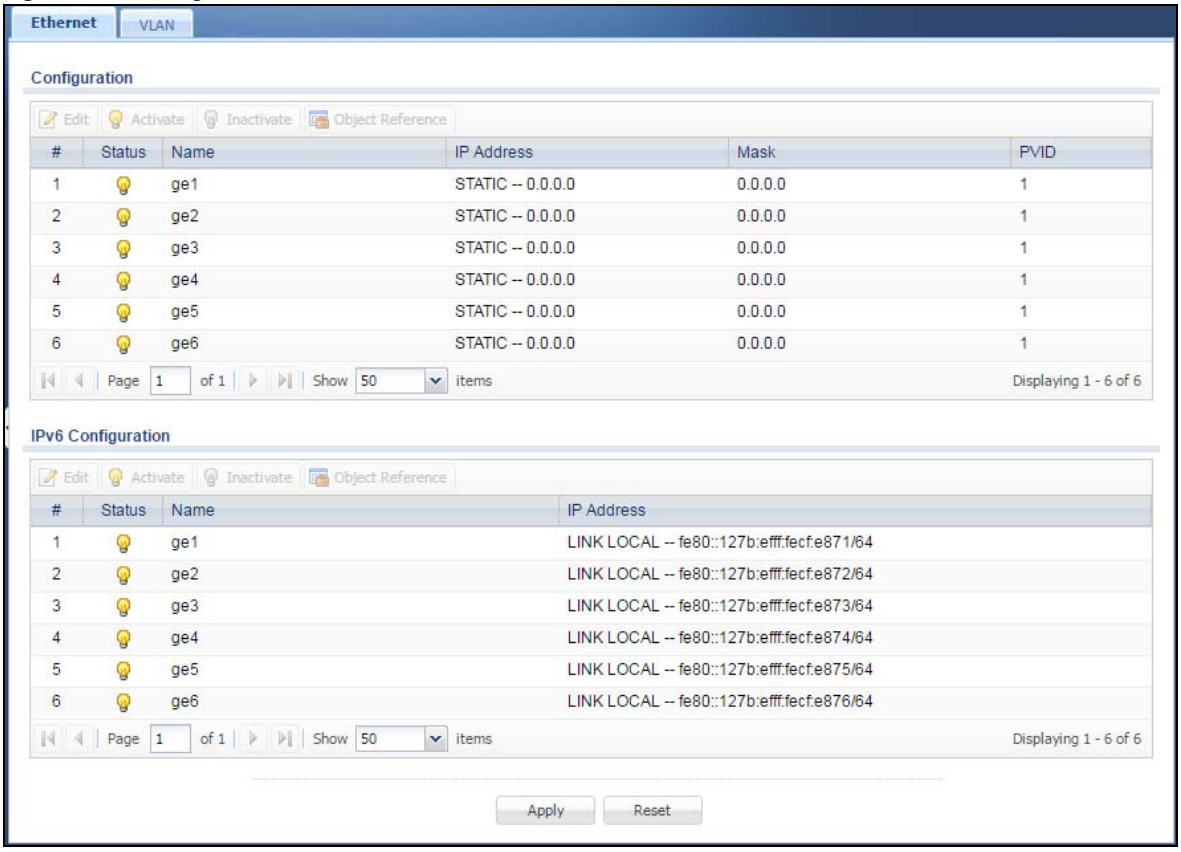
This screen lists every Ethernet interface. If you enabled IPv6 in the **Configuration > System > IPv6** screen, you can also configure VLAN interfaces used for your IPv6 networks on this screen. To access this screen, click **Configuration > Network** > **Interface**.

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 68** Configuration > Network > Interface > Ethernet



Each field is described in the following table.

Table 62 Configuration > Network > Interface > Ethernet

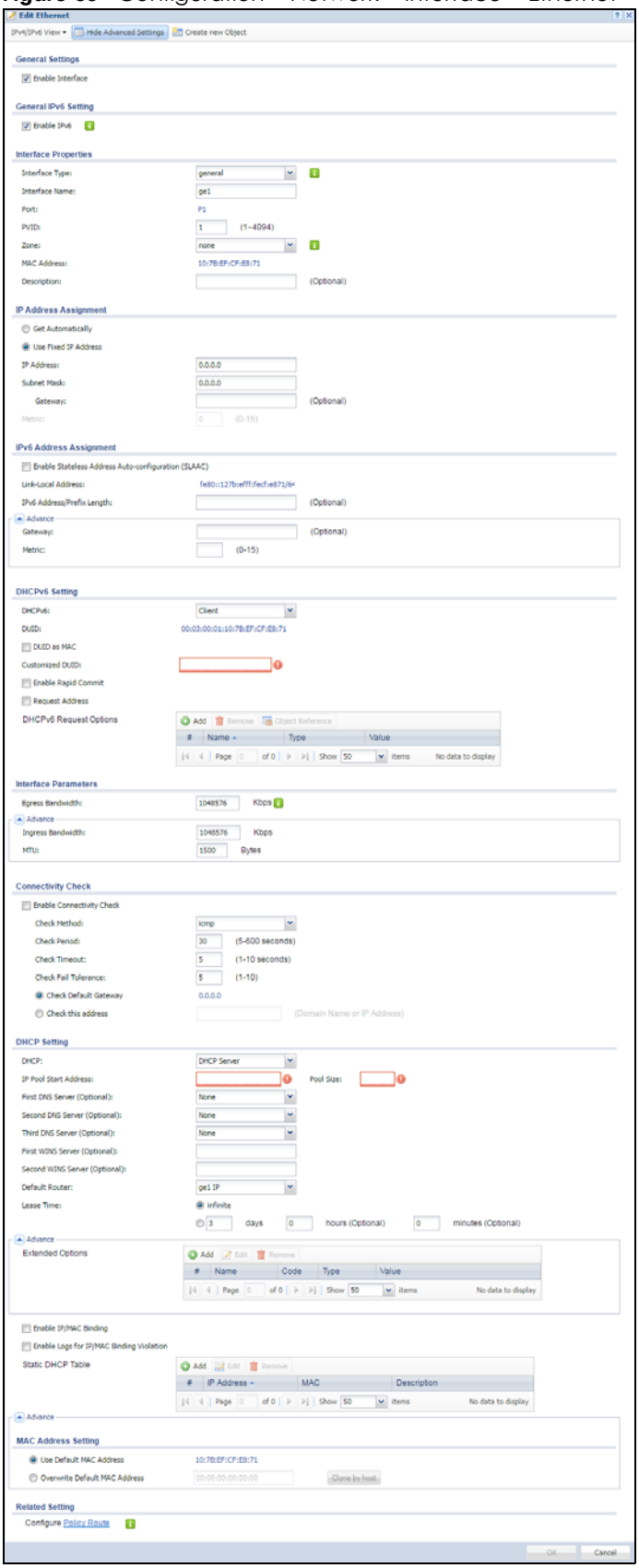
| LABEL | DESCRIPTION |
|---|---|
| Configuration/IPv6 Configuration | Use the **Configuration** section for IPv4 network settings. Use the **IPv6 Configuration** section for IPv6 network settings if you connect your NXC to an IPv6 network. Both sections have similar fields as described below. |
| Edit | 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.<br>In the IPv4 network, this screen also shows whether the IP address is a static IP address (**STATIC**) or dynamically assigned (**DHCP**).<br>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 447 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. |

## 8.2.1 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 69** Configuration > Network > Interface > Ethernet > Edit (general)



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

Table 63 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. |
| 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.<br>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.<br>Select **external** to connect to an external network (like the Internet).<br>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.<br>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**.<br>Enter the IP address for this interface. |
| Subnet Mask | This field is enabled if you set the **Interface Type** to **internal** or you select **Use Fixed IP Address**.<br>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. |

Table 63 Configuration > Network > Interface > Ethernet > Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Gateway | This field is enabled if you select **Use Fixed IP Address**.<br>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**.<br>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.<br>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.<br>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 447 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.<br>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 8.2.3 on page 129 for more information. |
| Remove | Select an entry and click this to delete it from this table. |
| Object Reference | Select an entry and click **Object Reference** to open a screen that shows which settings use the entry. See Section 8.2.2 on page 128 for an example. |
| # | This field is a sequential value, and it is not associated with any entry. |

Table 63 Configuration > Network > Interface > Ethernet > Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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 576 - 1500. Usually, this value is 1500. |
| Connectivity Check | These fields appear when you set the **Interface Type** to **External** or **General**.<br>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.<br>Select **icmp** to have the NXC regularly ping the gateway you specify to make sure it is still available.<br>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**. |
| DHCP | Select what type of DHCP service the NXC provides to the network. Choices are:<br>**None** - the NXC does not provide any DHCP services. There is already a DHCP server on the network.<br>**DHCP Relay** - the NXC routes DHCP requests to one or more DHCP servers you specify. The DHCP server(s) may be on another network.<br>**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. |

Table 63 Configuration > Network > Interface > Ethernet > Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| | 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**.<br><br>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.<br><br>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.<br><br>**Custom Defined** - enter a static IP address.<br><br>**From ISP** - select the DNS server that another interface received from its DHCP server.<br><br>**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.<br><br>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:<br><br>**infinite** - select this if IP addresses never expire.<br><br>**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**.<br><br>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 8.2.4 on page 130. |
| 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. |

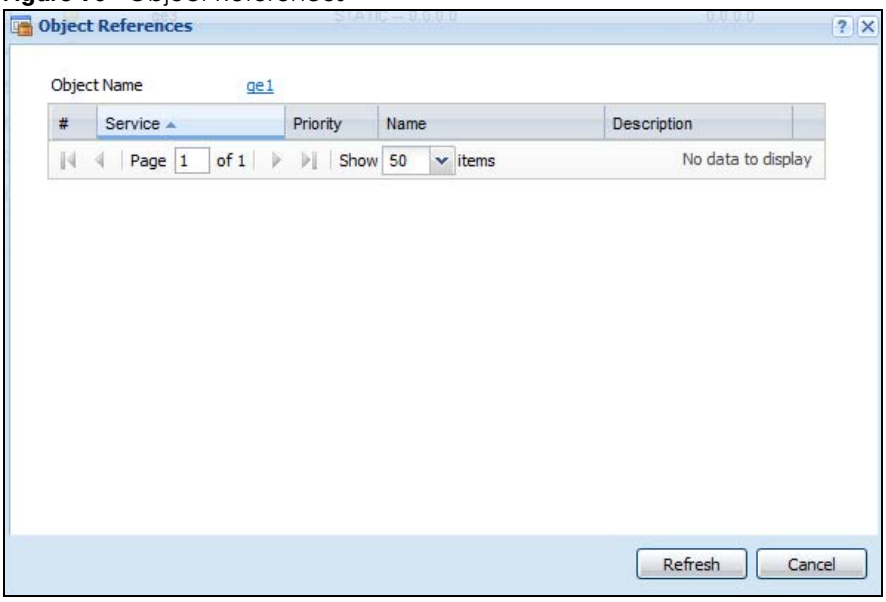
Table 63 Configuration > Network > Interface > Ethernet > Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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**.<br>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.<br>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. |

## 8.2.2 Object References

When a configuration screen includes an **Object Reference** icon, select a configuration object and click **Object Reference** 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 70** Object References




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

Table 64 Object References

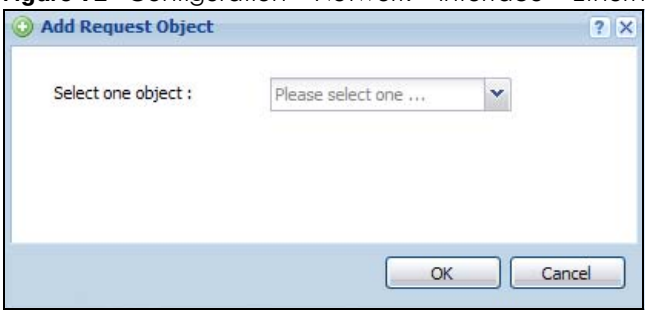
| LABEL | DESCRIPTION |
|---|---|
| Object Name | This identifies the object for which the configuration settings that use it are displayed. Click the object's name to display the object's configuration screen in the main window. |
| # | This field is a sequential value, and it is not associated with 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. |

## 8.2.3 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.

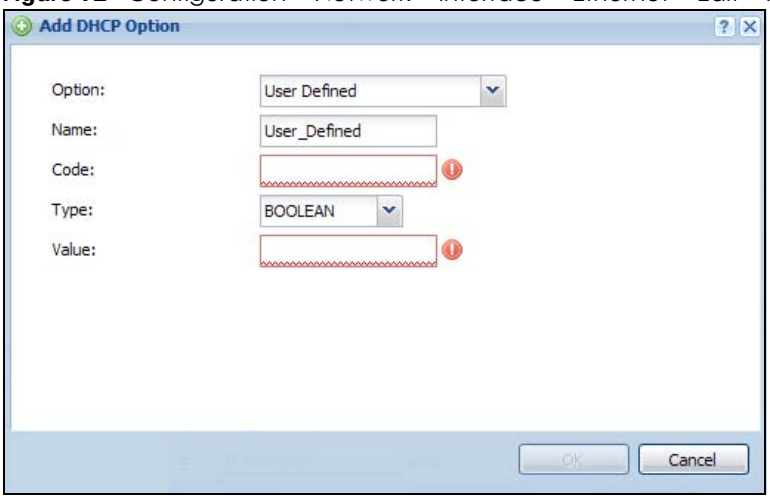
**Figure 71** Configuration > Network > Interface > Ethernet > Edit > Add DHCPv6 Request Options




## 8.2.4 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 72** Configuration > Network > Interface > Ethernet > Edit > Add/Edit Extended Options




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

Table 65 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 66 on page 131 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 65 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 66 DHCP Extended Options

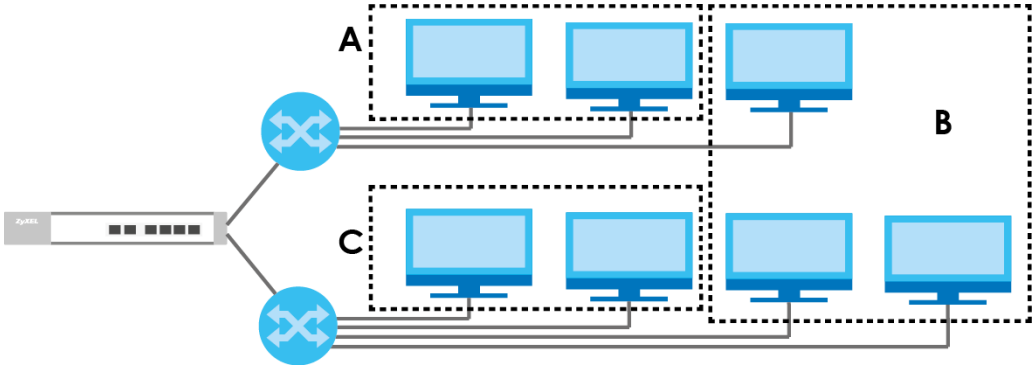
| OPTION NAME | CODE | DESCRIPTION |
|---|---|---|
| Time Offset | 2 | This option specifies the offset of the client's subnet in seconds from Coordinated Universal Time (UTC). |
| Time Server | 4 | This option specifies a list of Time servers available to the client. |
| NTP Server | 42 | This option 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<br>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<br>DHCP clients and servers may use this option to exchange vendor-specific information. |
| CAPWAP AC | 138 | CAPWAP Access Controller addresses option<br>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. |

# 8.3 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.

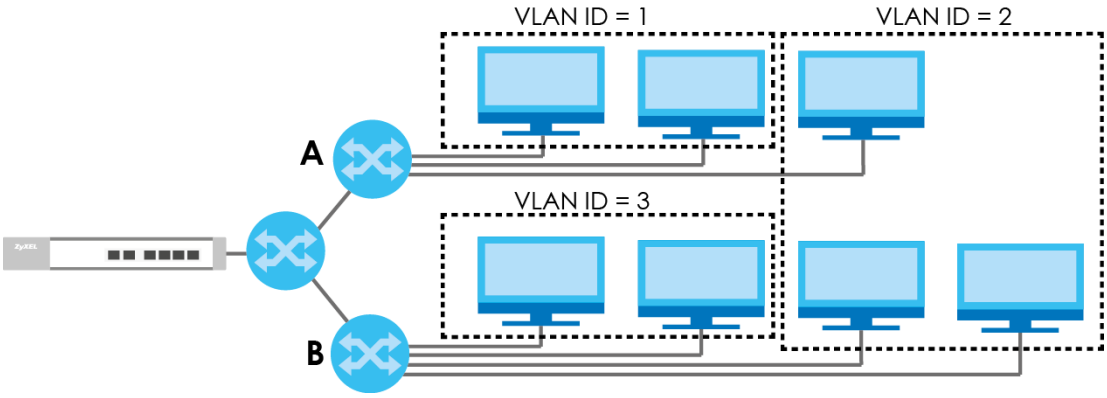
**Figure 73** Example: Before VLAN




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 74** 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.

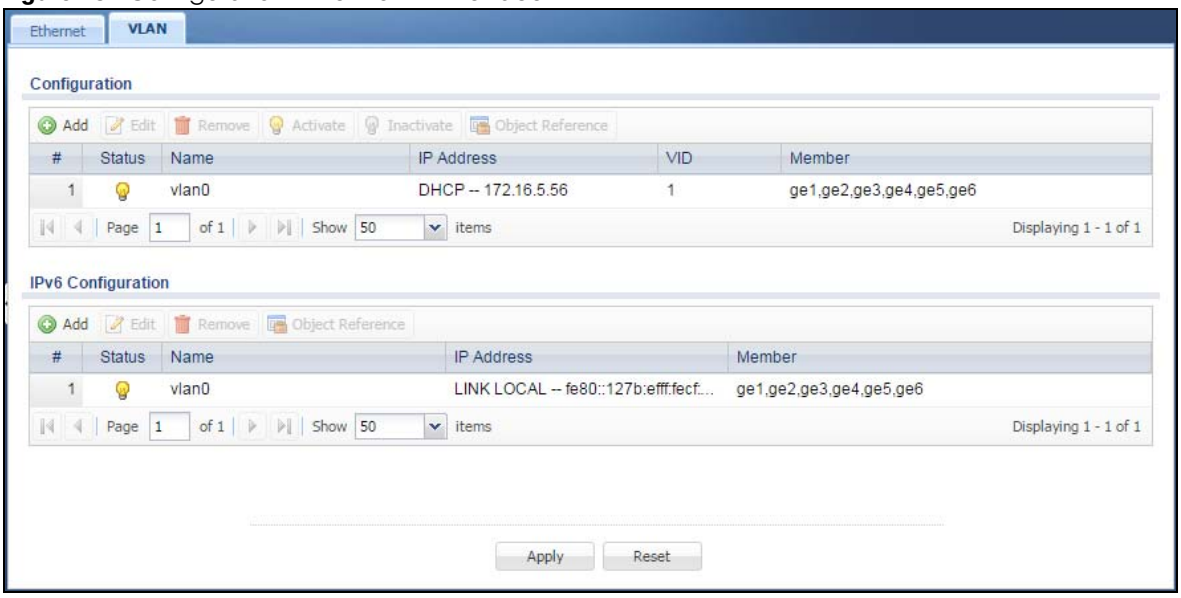
In this example, the new switch handles the following types of traffic:

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

## 8.3.1 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 75** Configuration > Network > Interface > VLAN




Each field is explained in the following table.

Table 67 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. |

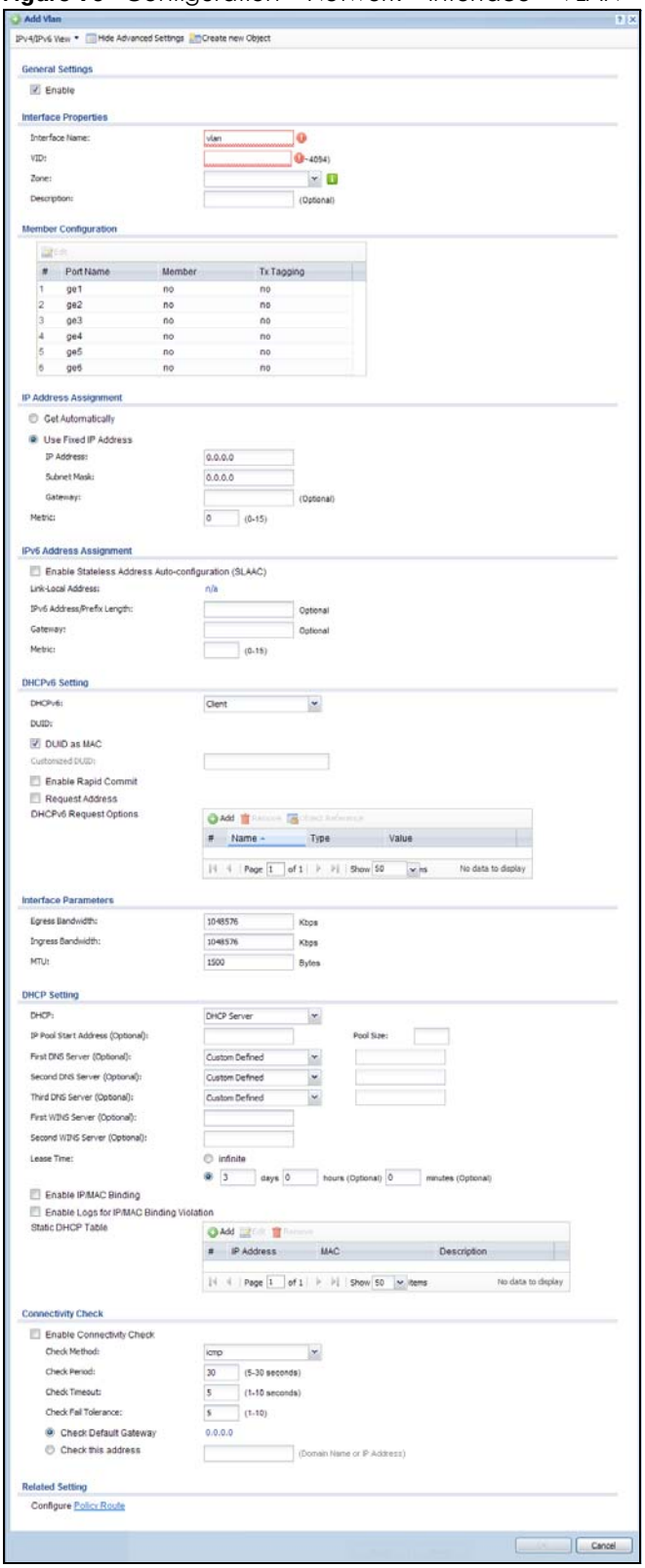
Table 67 Configuration > Network > Interface > VLAN (continued)

| 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 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.<br>In the IPv4 network, this screen also shows whether the IP address is a static IP address (**STATIC**) or dynamically assigned (**DHCP**).<br>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 447 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. |

## 8.3.2 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 76** Configuration > Network > Interface > VLAN > Add/Edit



Each field is explained in the following table.

Table 68 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.<br>Click this field to edit the value. |
| Tx Tagging | This indicates whether the selected interface tags outbound traffic with this VLAN's ID .<br>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**.<br>Enter the IP address for this interface. |
| Subnet Mask | This field is enabled if you select **Use Fixed IP Address**.<br>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**.<br>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 68 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.<br>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.<br>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 447 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.<br>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 8.2.3 on page 129 for more information. |
| Remove | Select an entry and click this to delete it from this table. |
| Object Reference | Select an entry and click **Object Reference** to open a screen that shows which settings use the entry. See Section 8.2.2 on page 128 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 68 Configuration > Network > Interface > VLAN > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Ingress Bandwidth | This is reserved for future use.<br>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 576 - 1500. Usually, this value is 1500. |
| DHCP Setting | |
| DHCP | Select what type of DHCP service the NXC provides to the network. Choices are:<br>**None** - the NXC does not provide any DHCP services. There is already a DHCP server on the network.<br>**DHCP Relay** - the NXC routes DHCP requests to one or more DHCP servers you specify. The DHCP server(s) may be on another network.<br>**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**.<br>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.<br>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<br>Second DNS Server<br>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.<br>**Custom Defined** - enter a static IP address.<br>**From ISP** - select the DNS server that another interface received from its DHCP server.<br>**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:<br>**infinite** - select this if IP addresses never expire<br>**days**, **hours**, and **minutes** - select this to enter how long IP addresses are valid. |

Table 68 Configuration > Network > Interface > VLAN > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>Select **icmp** to have the NXC regularly ping the gateway you specify to make sure it is still available.<br>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. |
| 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. |

# 8.4 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 69 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 70 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 9
# Policy and Static Routes

## 9.1 Overview

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

### 9.1.1 What You Can Do in this Chapter

- The **Policy Route** screens (Section 9.2 on page 144) list and configure policy routes.
- The **Static Route** screens (Section 9.3 on page 149) list and configure static routes.

### 9.1.2 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.

## 9.2 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.

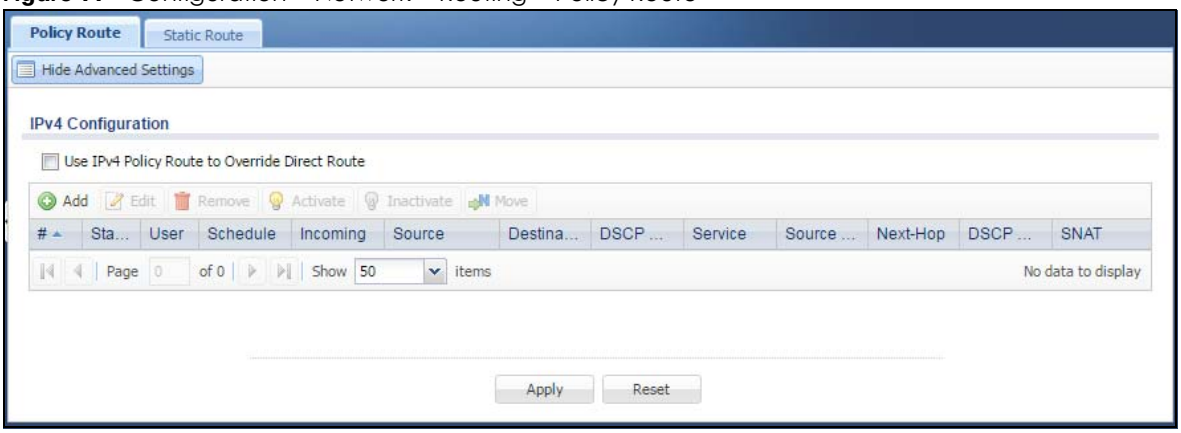
A policy route defines the matching criteria and the action to take when a packet meets the criteria. The action is taken only when all the criteria are met. The criteria can include the user name, source address and incoming interface, destination address, schedule, IP protocol (ICMP, UDP, TCP, etc.) 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 77** Configuration > Network > Routing > Policy Route




The following table describes the labels in this screen.

Table 71 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.<br>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. |

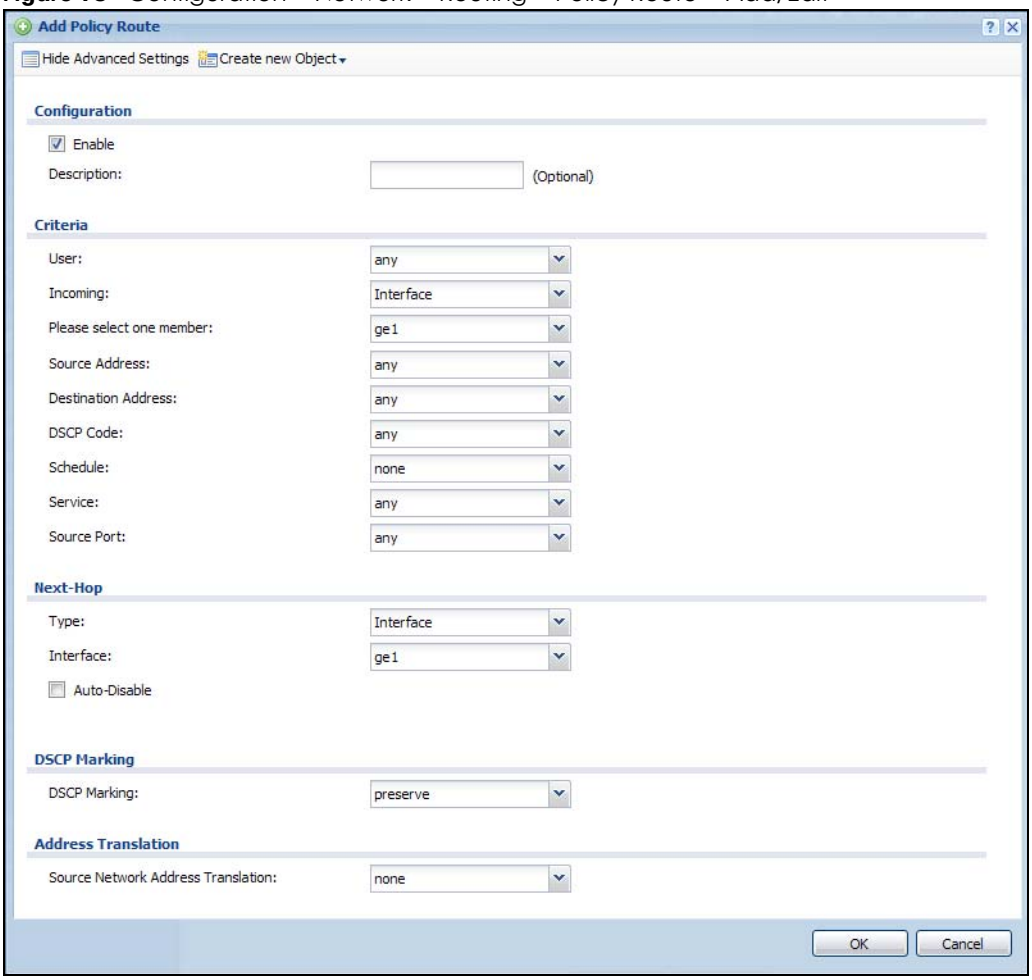
Table 71 Configuration > Network > Routing > Policy Route (continued)

| LABEL | DESCRIPTION |
|---|---|
| DSCP Code | This is the DSCP value of incoming packets to which this policy route applies.<br>**any** means all DSCP values or no DSCP marker.<br>**default** means traffic with a DSCP value of 0. This is usually best effort traffic<br>The "**af**" entries stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences.<br>The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 151. |
| 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.<br>**preserve** means the NXC does not modify the DSCP value of the route's outgoing packets.<br>**default** means the NXC sets the DSCP value of the route's outgoing packets to 0.<br>The "**af**" choices stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences.<br>The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 151. |
| SNAT | This is the source IP address that the route uses.<br>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. |

## 9.2.1 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 78** Configuration > Network > Routing > Policy Route > Add/Edit




The following table describes the labels in this screen.

Table 72 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. |

Table 72 Configuration > Network > Routing > Policy Route > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Destination Address | Select a destination IP address object to which the traffic is being sent. |
| 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.<br>**any** means all DSCP value or no DSCP marker.<br>**default** means traffic with a DSCP value of 0. This is usually best effort traffic<br>The "**af**" choices stand for Assured Forwarding. The number following the "**af**" identifies one of four classes and one of three drop preferences.<br>The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 151. |
| 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.<br>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.<br>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.<br>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.<br>Select **default** to have the NXC set the DSCP value of the packets to 0.<br>The "**wmm**" entries are for QoS. For more information on QoS and WMM categories, see WMM on page 151. |
| 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. |

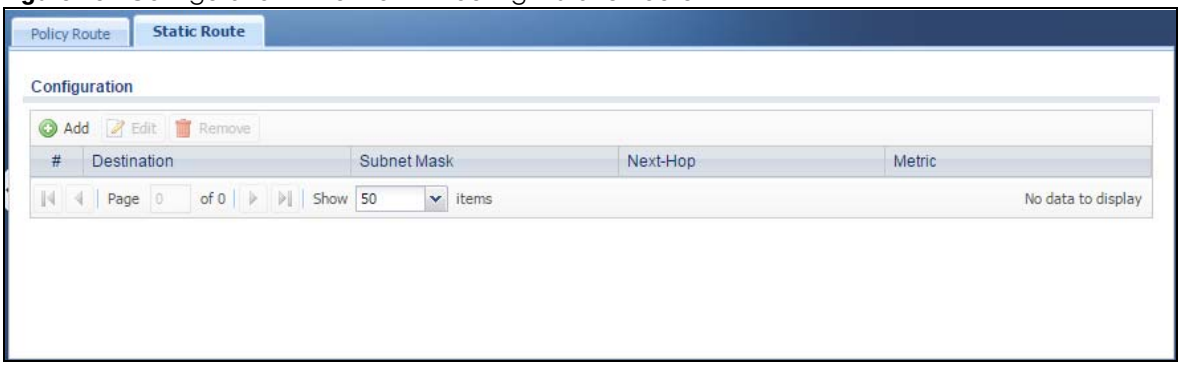
Table 72 Configuration > Network > Routing > Policy Route > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Source Network Address Translation | Select **none** to not use NAT for the route.<br>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.<br>Otherwise, select a pre-defined address (group) to use as the source IP address(es) of the packets that match this route.<br>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. |

# 9.3 Static Route

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

**Figure 79** Configuration > Network > Routing > Static Route




The following table describes the labels in this screen.

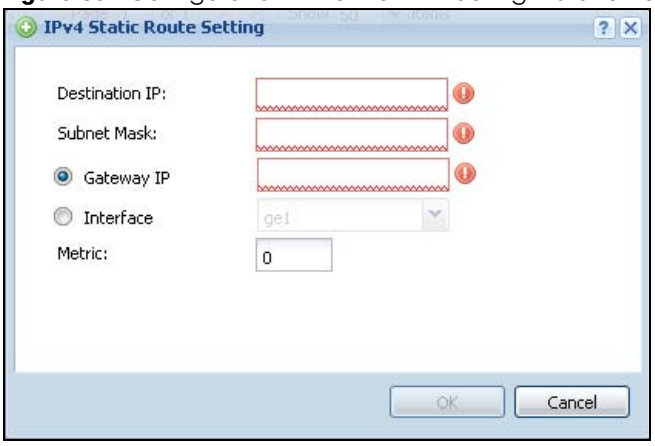
Table 73 Configuration > Network > Routing > Static Route

| 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. |

### 9.3.1 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 80** Configuration > Network > Routing > Static Route > Add/Edit




The following table describes the labels in this screen.

Table 74 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. |

## 9.4 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 75 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

Wi-Fi 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 76 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 10
# Zones

## 10.1 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.

### 10.1.1 What You Can Do in this Chapter

The **Zone** screens (see Section 10.2 on page 154) manage the NXC's zones.

### 10.1.2 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.

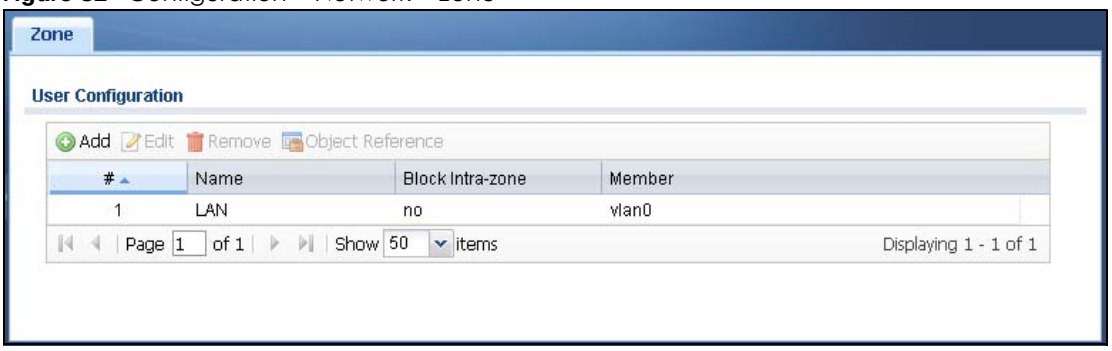
#### Extra-zone Traffic

- 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.

# 10.2 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 81** Configuration > Network > Zone




The following table describes the labels in this screen.

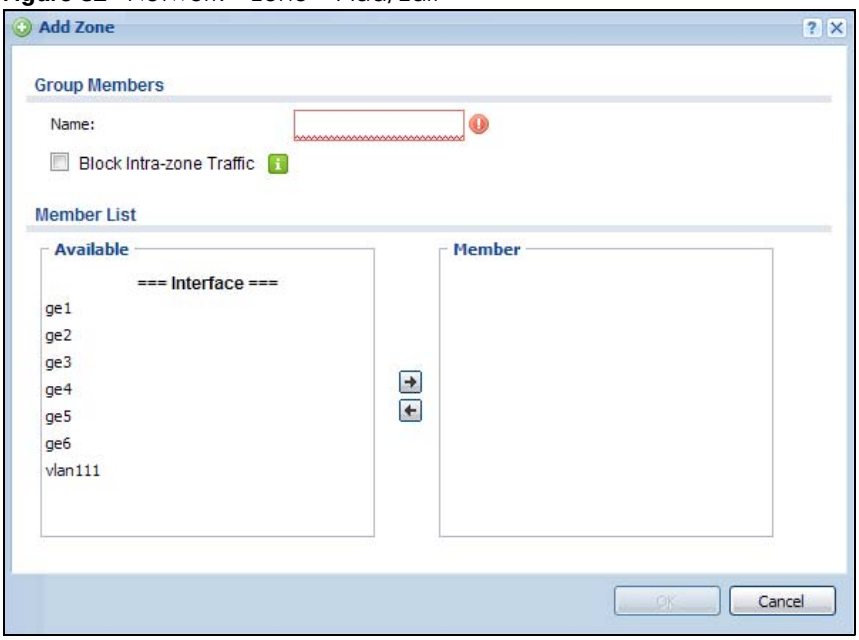
Table 77 Configuration > Network > Zone

| 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 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. |
| 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. |

## 10.2.1 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 82** Network > Zone > Add/Edit




The following table describes the labels in this screen.

Table 78 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.<br>**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. |

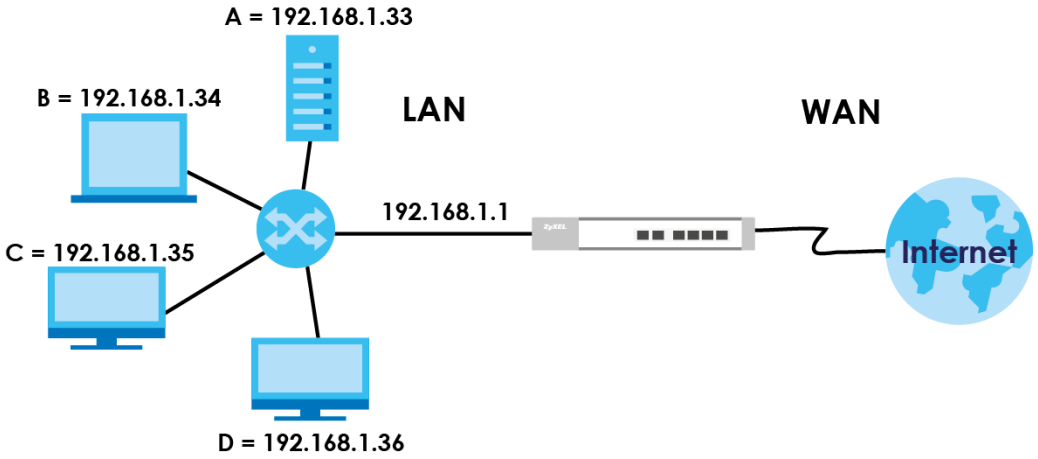
# CHAPTER 11
# NAT

## 11.1 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 83** Multiple Servers Behind NAT Example



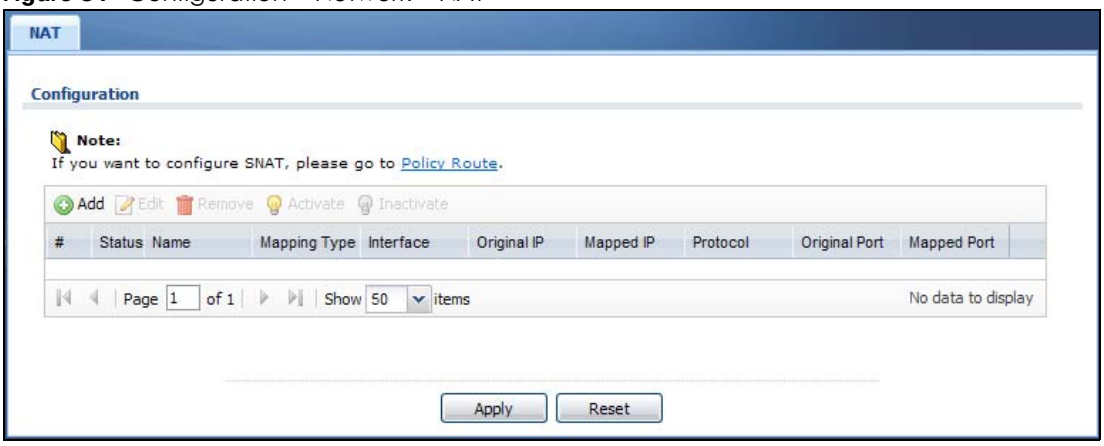

### 11.1.1 What You Can Do in this Chapter

The **NAT** screens (see Section 11.2 on page 156) 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.

## 11.2 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 84** Configuration > Network > NAT




The following table describes the labels in this screen.

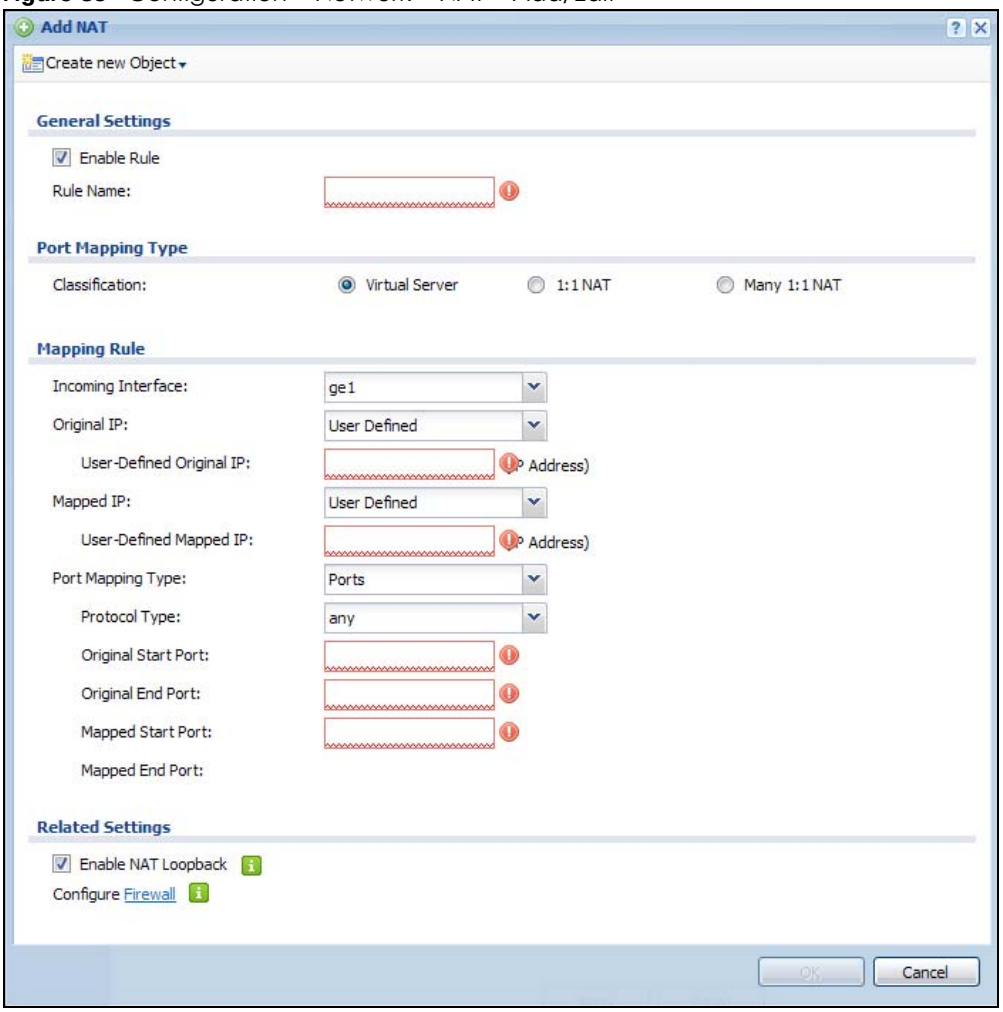
Table 79 Configuration > Network > NAT

| 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. |

## 11.2.1 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 85** Configuration > Network > NAT > Add/Edit




The following table describes the labels in this screen.

Table 80 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. |
| 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. |

Table 80 Configuration > Network > NAT > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| Classification | Select what kind of NAT this rule is to perform.<br><br>**Virtual Server** - This makes computers on a private network behind the NXC available to a public network outside the NXC (like the Internet).<br><br>**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.<br><br>**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.<br><br>One many 1:1 NAT rule works like multiple 1:1 NAT rules, but it eases configuration effort since you only create one 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.<br><br>**any** - Select this to use all of the incoming interface's IP addresses including dynamic addresses.<br><br>**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.<br><br>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.<br><br>**User Defined** - this NAT rule supports a specific IP address, specified in the **User Defined** field.<br><br>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 Original 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:<br><br>**Any** - this NAT rule supports all the destination ports.<br><br>**Service** - this NAT rule supports the destination port(s) used by the specified service(s).<br><br>**Port** - this NAT rule supports one destination port.<br><br>**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.<br><br>This field is read-only and displays **any** for **Many 1:1 NAT**. |

Table 80 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. |
| 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.<br><br>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.<br><br>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). |

# 11.3 Technical Reference

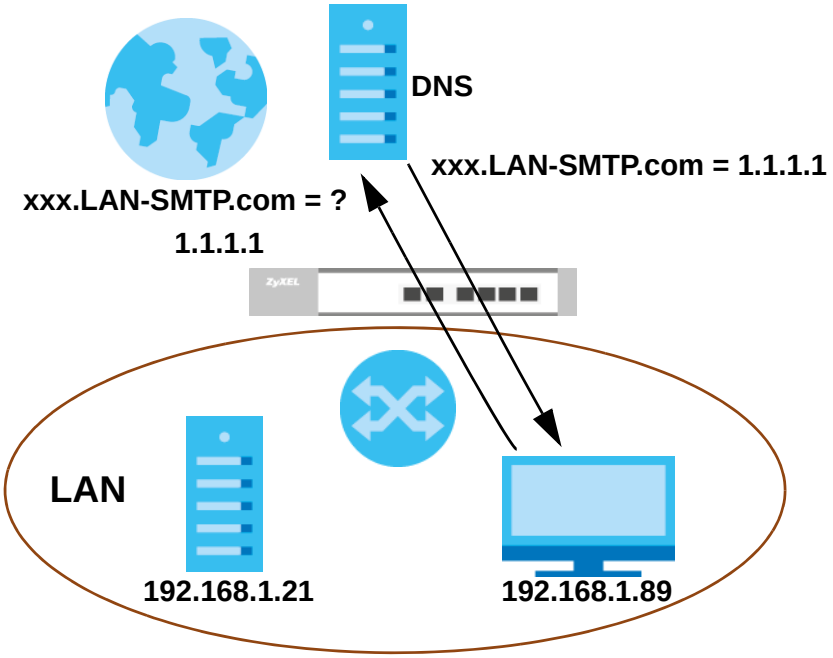
The following section contains additional technical information about the features described in this chapter.

## 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.

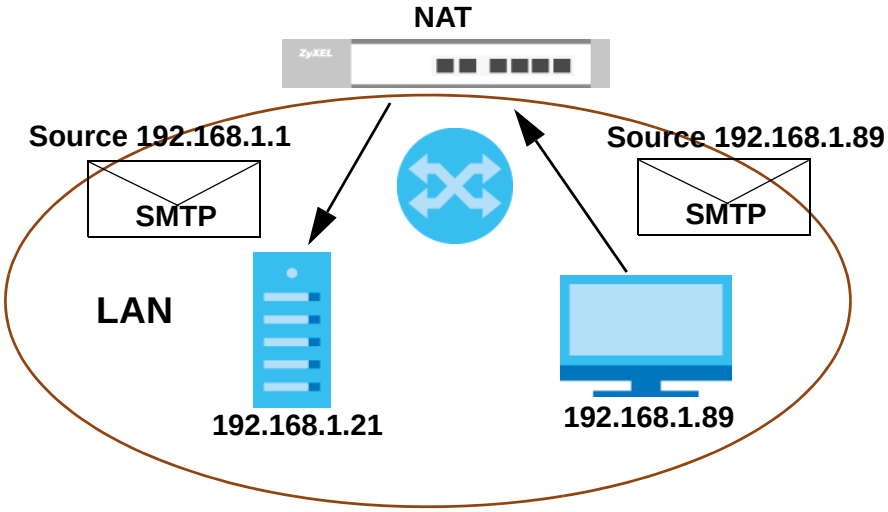
For example, a LAN user's computer at IP address 192.168.1.89 queries a public DNS server to resolve the SMTP server's domain name (xxx.LAN-SMTP.com in this example) and gets the SMTP server's mapped public IP address of 1.1.1.1.

**Figure 86** LAN Computer Queries a Public DNS Server



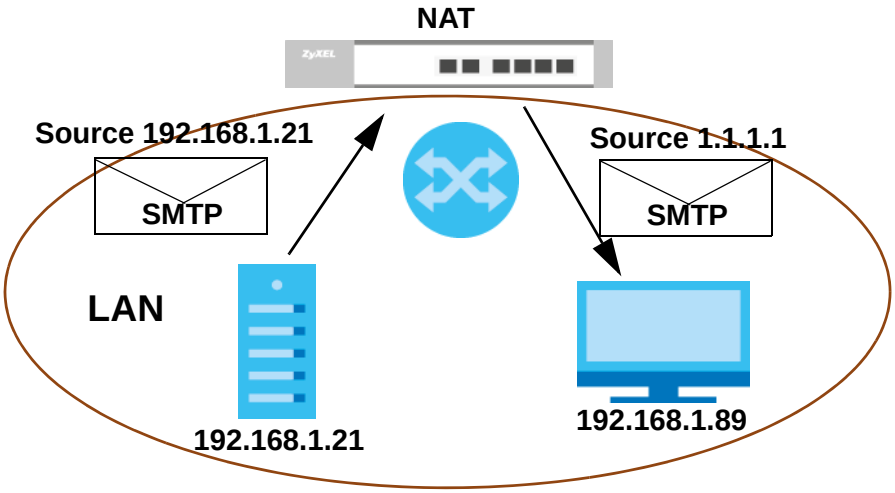

The LAN user's computer then sends traffic to IP address 1.1.1.1. NAT loopback uses the IP address of the NXC's LAN interface (192.168.1.1) as the source address of the traffic going from the LAN users to the LAN SMTP server.

**Figure 87** 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 88** LAN to LAN Return Traffic



# CHAPTER 12
# ALG

## 12.1 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.

### 12.1.1 What You Can Do in this Chapter

The **ALG** screen (Section 12.2 on page 163) configures the FTP ALG settings.

### 12.1.2 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 un-friendly 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.

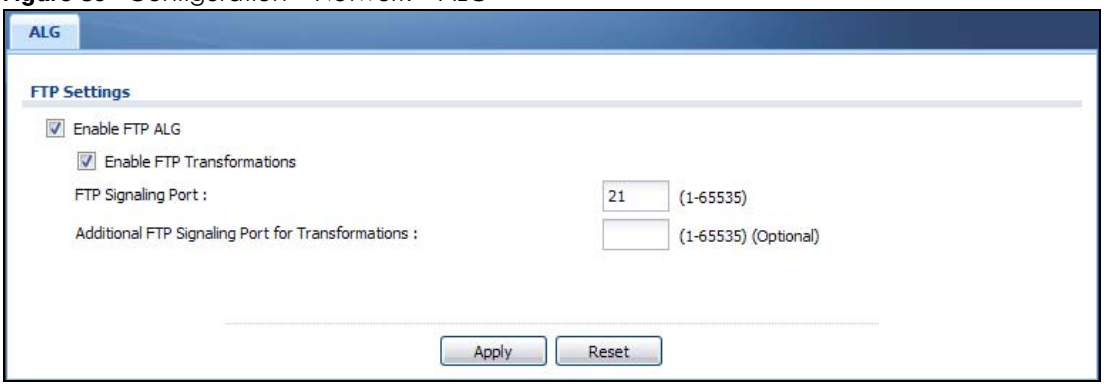
### 12.1.3 Before You Begin

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

## 12.2 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 89** Configuration > Network > ALG




The following table describes the labels in this screen.

Table 81 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.<br>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. |

# 12.3 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.

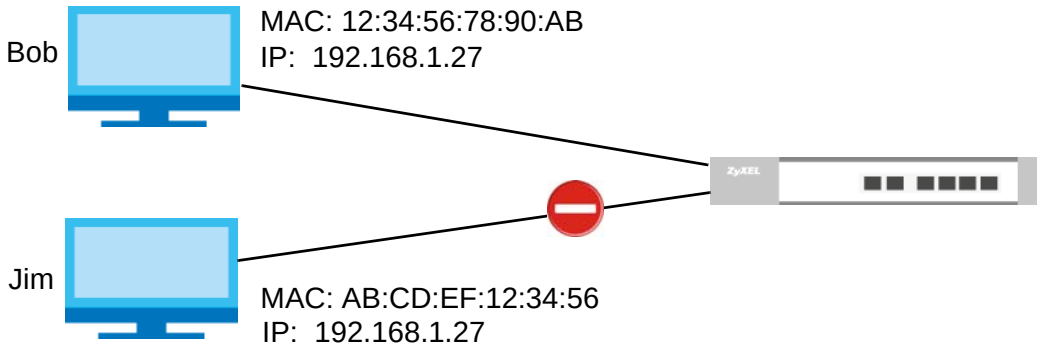
# CHAPTER 13
# IP/MAC Binding

## 13.1 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 90** IP/MAC Binding Example




### 13.1.1 What You Can Do in this Chapter

- The **Summary** and **Edit** screens (Section 13.2 on page 166) bind IP addresses to MAC addresses.
- The **Exempt List** screen (Section 13.3 on page 168) configures ranges of IP addresses to which the NXC does not apply IP/MAC binding.

### 13.1.2 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.

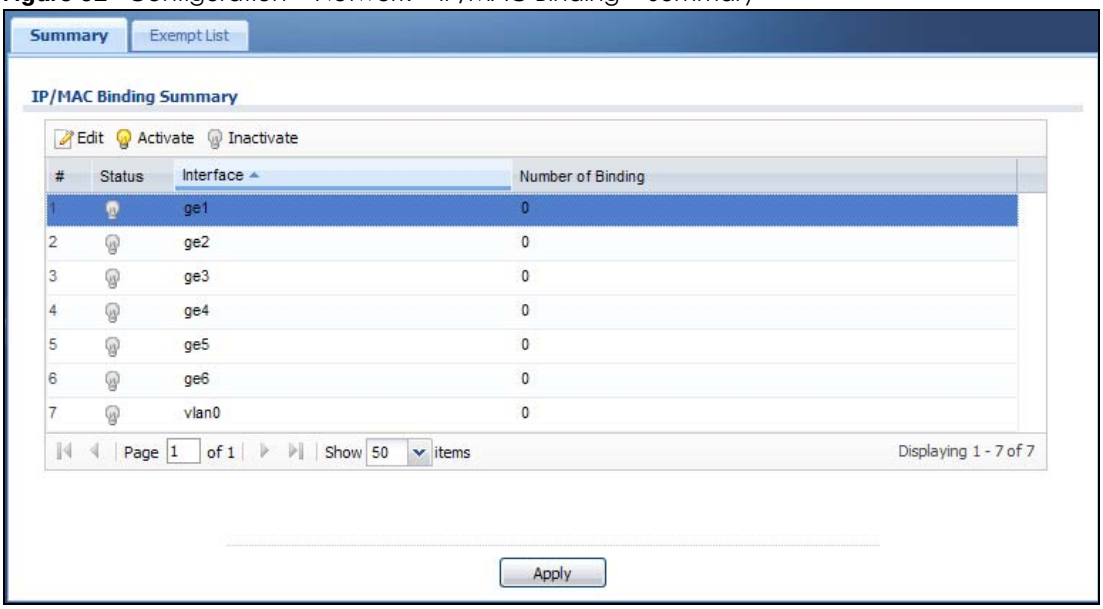
### Interfaces Used With IP/MAC Binding

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.

## 13.2 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 91** Configuration > Network > IP/MAC Binding > Summary




The following table describes the labels in this screen.

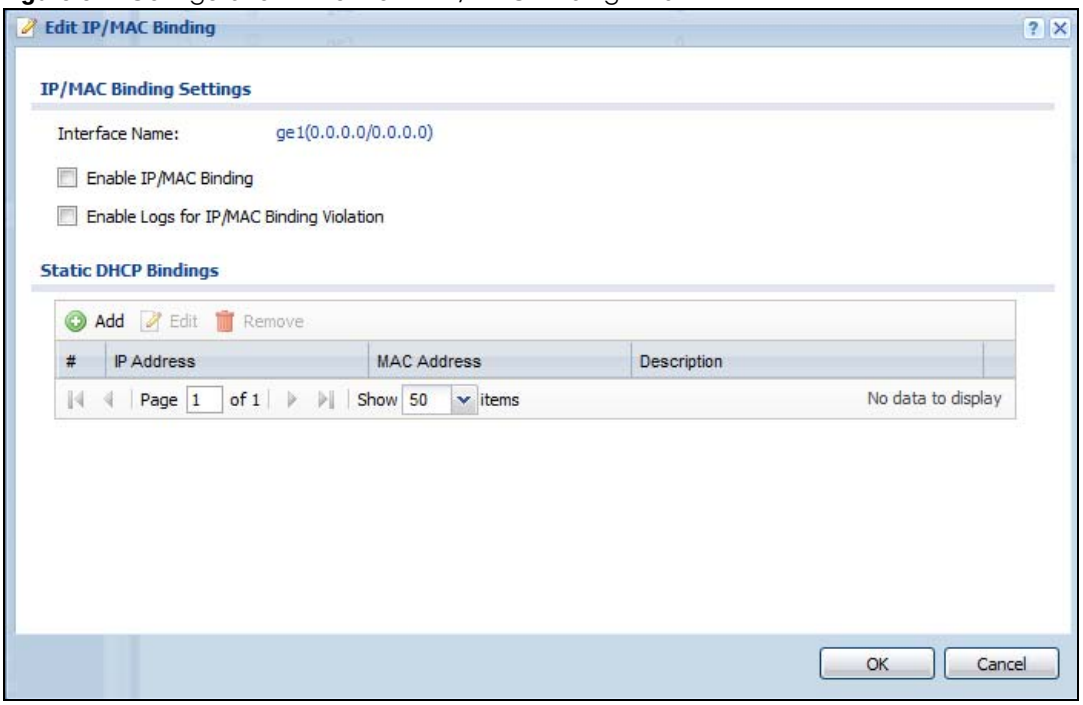
Table 82 Configuration > Network > IP/MAC Binding > Summary

| 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. |

## 13.2.1 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 92** Configuration > Network > IP/MAC Binding > Edit




The following table describes the labels in this screen.

Table 83 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. |

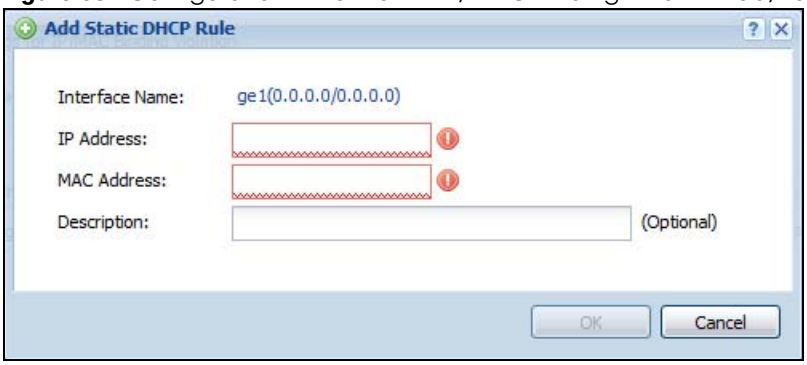
Table 83 Configuration > Network > IP/MAC Binding > Edit (continued)

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

## 13.2.2 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 93** Configuration > Network > IP/MAC Binding > Edit > Add/Edit




The following table describes the labels in this screen.

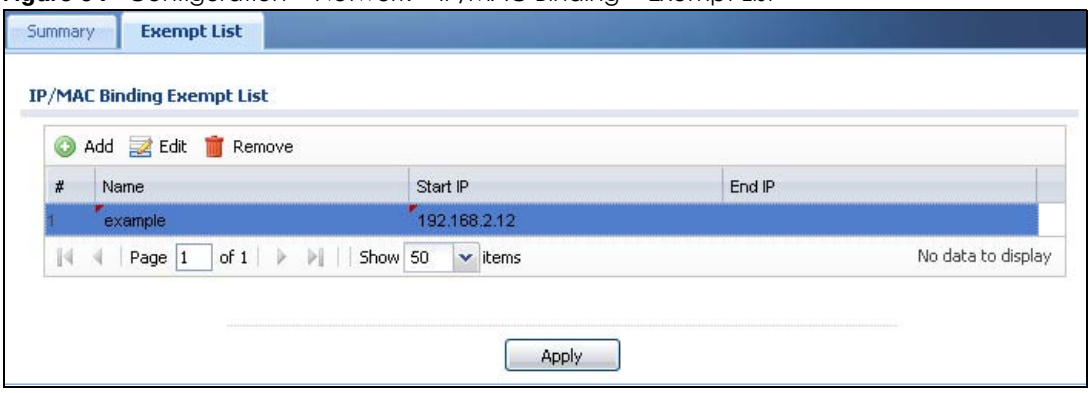
Table 84 Configuration > Network > IP/MAC Binding > Edit > Add/Edit

| 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. |

# 13.3 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 94** Configuration > Network > IP/MAC Binding > Exempt List




The following table describes the labels in this screen.

Table 85 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 14
# Captive Portal

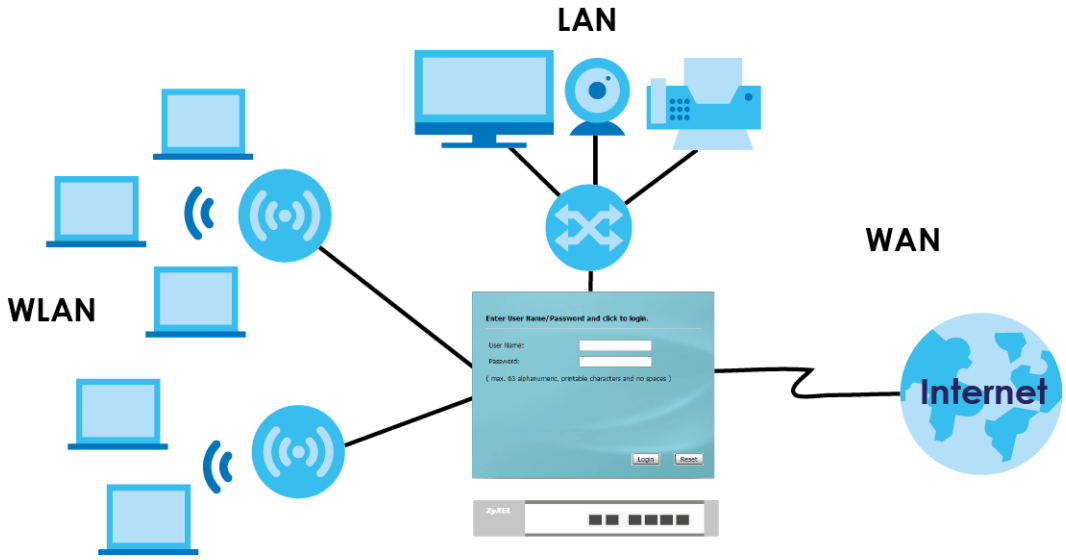
## 14.1 Overview

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

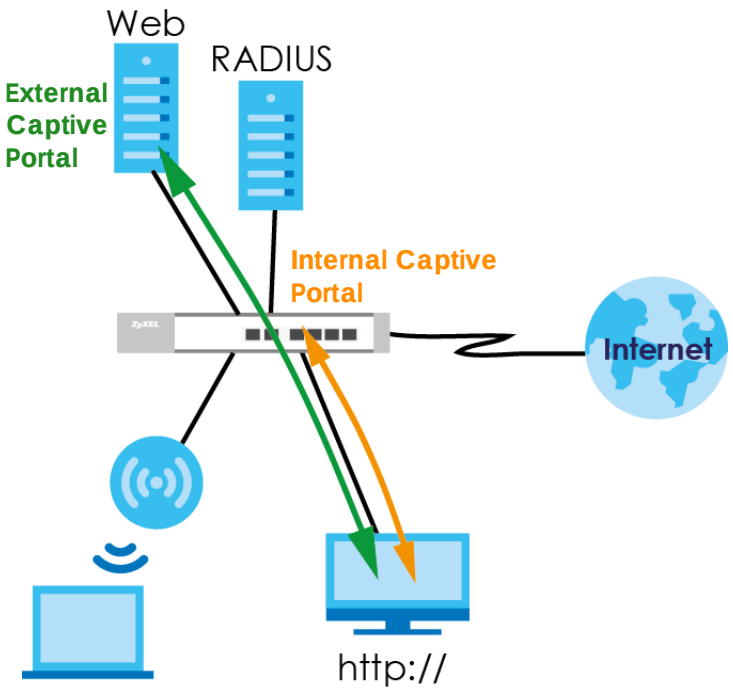
**Figure 95** Captive Portal Example




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.

### 14.1.1 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 14.5.1 on page 184 and Section 14.5.2 on page 186 for portal pages details.




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

Table 86 Captive Portal Options

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

### 14.1.2 What You Can Do in this Chapter

- The **Captive Portal** screen (Section 14.2 on page 171) enables captive portal and specifies the captive portal page that displays when a client makes an initial network connection.
- The **Redirect on Controller** screen (Section 14.3 on page 175) allows clients to use a QR code for authentication with the NXC, and configures the authentication policy rules for the NXC.
- The **Redirect on AP** screen (Section 14.4 on page 178) configures the authentication policy rules for the managed APs.
- The **Login Page** screen (Section 14.5 on page 182) assigns or creates a customized login page built into the NXC for captive portal.

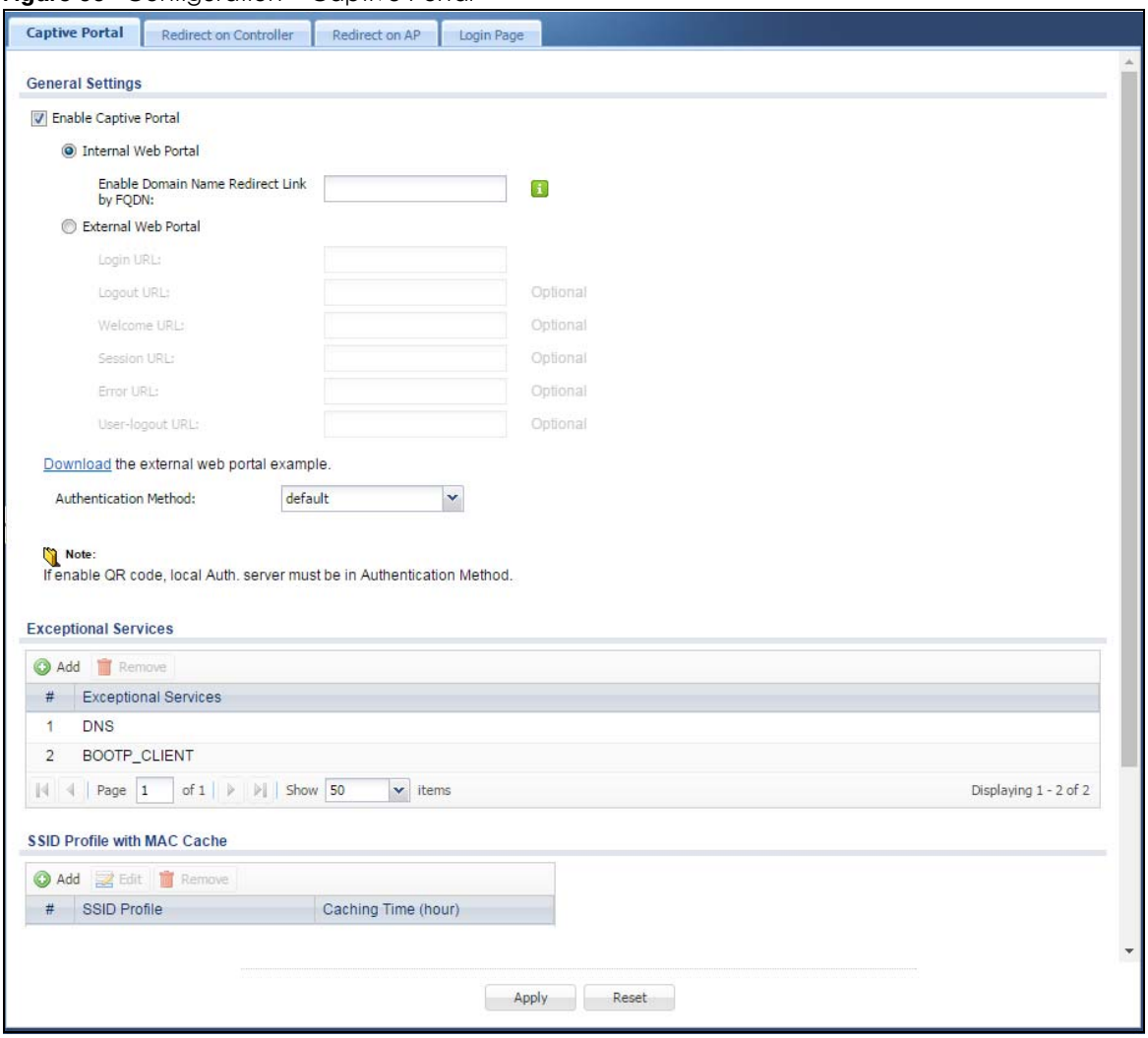
## 14.2 Captive Portal

This screen allows you to enable captive portal and specify whether the default captive portal page is built into the NXC or from an external web portal when client makes an initial network connection.

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 **Login Page** screen; see Section 14.5 on page 182 for details.

**Figure 96** Configuration > Captive Portal




The following table describes the labels in this screen.

Table 87 Configuration > Captive Portal

| LABEL | DESCRIPTION |
|---|---|
| Enable Captive Portal | Select this to turn on the captive portal feature.<br><br>Once enabled, all network traffic is blocked until a client authenticates with the NXC through the specifically designated captive portal page. |
| Internal Web Portal | Select this to use the login page built into the NXC.<br><br>The login page appears whenever the web portal intercepts network traffic, preventing unauthorized users from gaining access to the network. |

Table 87 Configuration > Captive Portal (continued)

| LABEL | DESCRIPTION |
|---|---|
| Enable Domain Name Redirect Link by FQDN | This field is optional.<br>Enter the Fully-Qualified Domain Name (FQDN) of the NXC interface to which the clients connect. This is the internal login page's URL. |
| 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.<br>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.asp. You must configure this field if you select **External Web Portal**.<br>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.asp.<br>The Internet Information Server (IIS) is the web server on which the web portal files are installed. |
| Welcome URL | Specify the welcome page's URL; for example, http://IIS server IP Address/welcome.asp.<br>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.asp. 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.<br>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.asp.<br>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.asp.<br>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. |
| 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 25 on page 277).<br>This sets the default for all wireless clients interacting with the network through the captive portal page. You can override this in the **Auth. Policy Edit** screen (Section 14.4.2 on page 180).<br>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. |
| Exceptional Services | This table allows you to configure exceptions to the captive portal interception of network traffic. |
| 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. |
| SSID Profile with MAC Cache | This table shows the SSID profile's MAC caching time,<br>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 seesion times out. |

Table 87 Configuration > Captive Portal (continued)

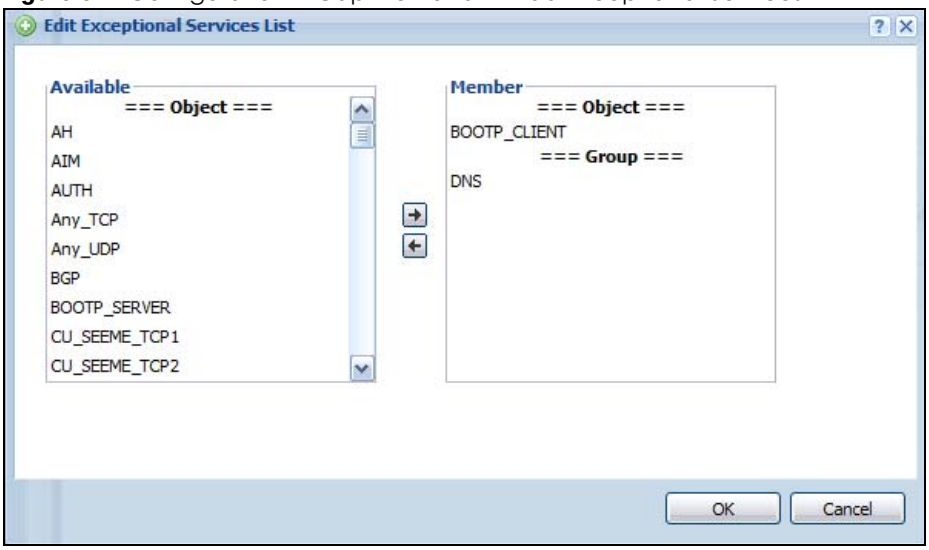
| LABEL | DESCRIPTION |
|---|---|
| Add | Click this to add a new rule. |
| Edit | Select an entry and click this to change the rule settngs.<br>The new setting applies to the new client's MAC address if you change the MAC caching time after a rule is created. |
| Remove | Select an entry and click this to delect 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? |
| 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 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 97** Configuration > Captive Portal > Add Exceptional Services




The following table describes the labels in this screen.

Table 88 Configuration > Captive Portal > Add Exceptional Services

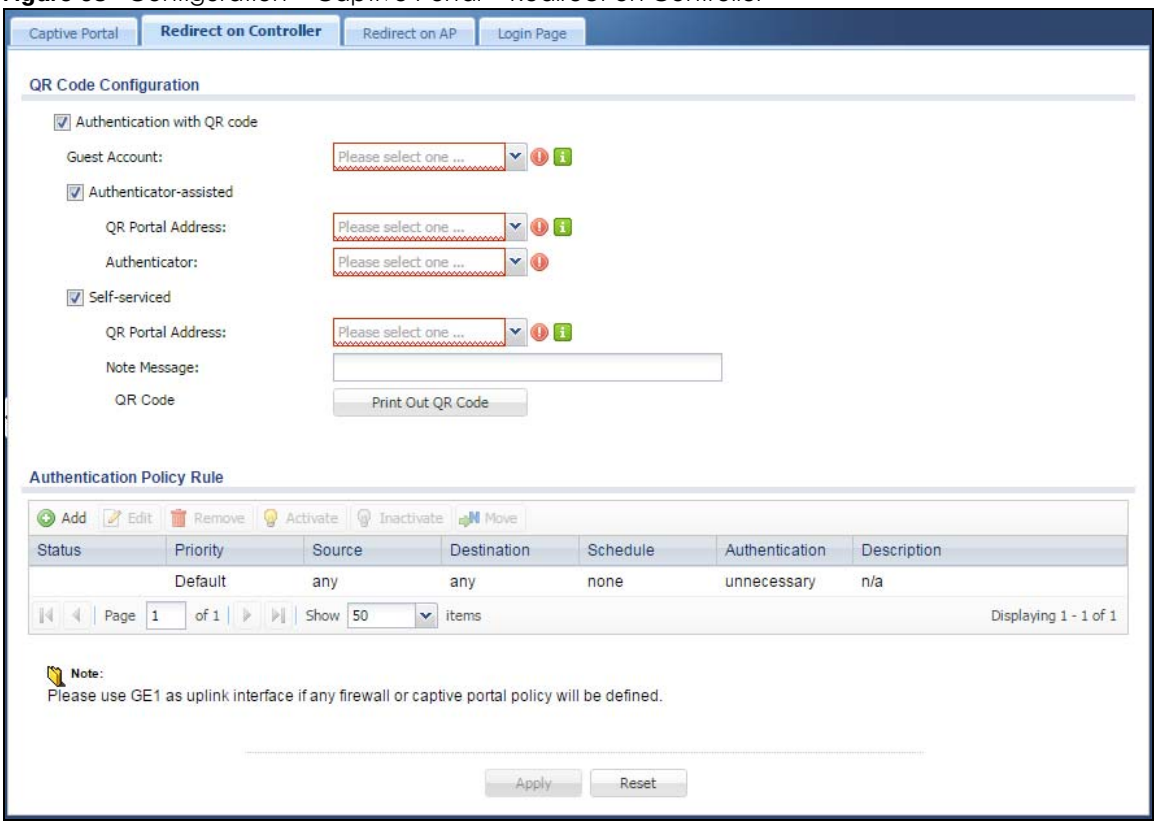
| LABEL | DESCRIPTION |
|---|---|
| Available | This lists all available network services eligible for being excepted from captive portal interception. |
| Member | This lists all networks services currently assigned to the **Exceptional Services** table. |
| OK | Click **OK** to save your changes back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

# 14.3 Redirect on Controller

This screen allows clients to use a QR code for authentication with the NXC, and configures the authentication policy rules for the controller (NXC).

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

**Figure 98** Configuration > Captive Portal > Redirect on Controller




The following table describes the labels in this screen.

Table 89 Configuration > Captive Portal > Redirect on Controller

| LABEL | DESCRIPTION |
|---|---|
| Authentication with QR code | Select this option to allow clients to authenticate themselves with a QR code.<br><br>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.<br><br>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. |

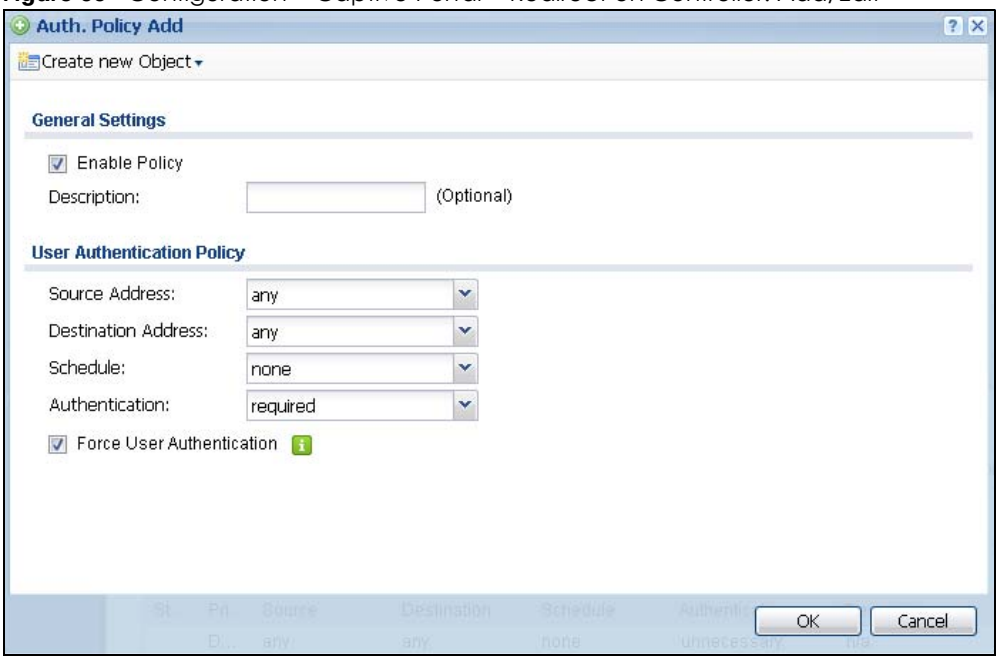
Table 89 Configuration > Captive Portal > Redirect on Controller (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>Note: The authenticator must be able to access the IP address of the specified VLAN interface. |
| 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. |
| 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**.<br>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.<br>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.<br>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.<br>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. |
| 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. |

## 14.3.1 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 99** Configuration > Captive Portal > Redirect on Controller: Add/Edit




The following table describes the labels in this screen.

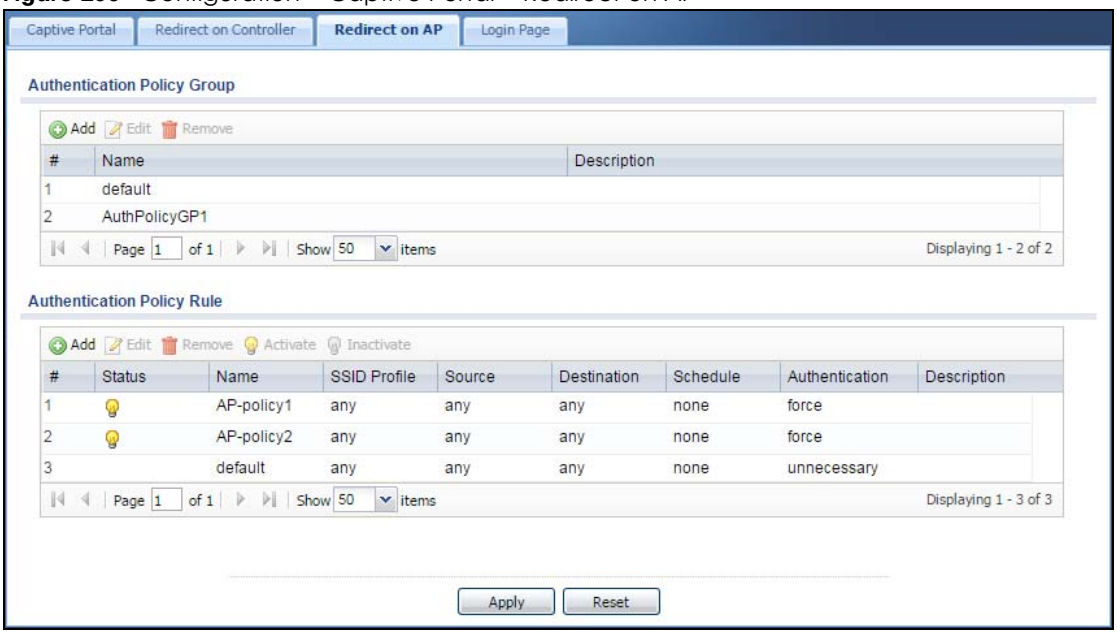
Table 90 Configuration > Captive Portal > Redirect on Controller: Add/Edit

| 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. |
| 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. |
| 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.<br>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.<br>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. |
| Force User Authentication | Select this option to redirect HTTP traffic to the login screen if the user has not logged in yet. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to exit this screen without saving. |

# 14.4 Redirect on AP

Use this screen to configure the authentication policy rules for the managed APs. Click **Configuration > Captive Portal > Redirect on AP** to access this screen.

**Figure 100** Configuration > Captive Portal > Redirect on AP




The following table describes the labels in this screen.

Table 91 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. |
| # | 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.<br><br>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**. |

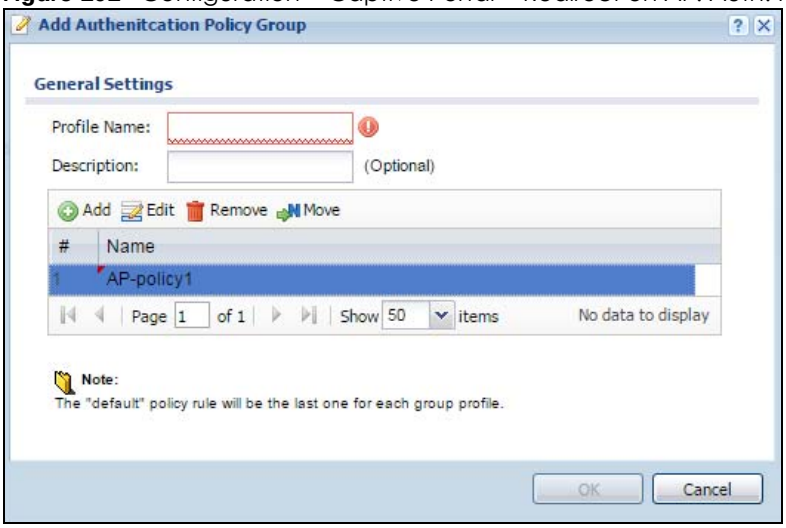
Table 91 Configuration > Captive Portal > Redirect on AP (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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.<br>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.<br>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. |
| 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. |

## 14.4.1 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 101** Configuration > Captive Portal > Redirect on AP: Auth. Policy Group Add/Edit



The following table describes the labels in this screen.

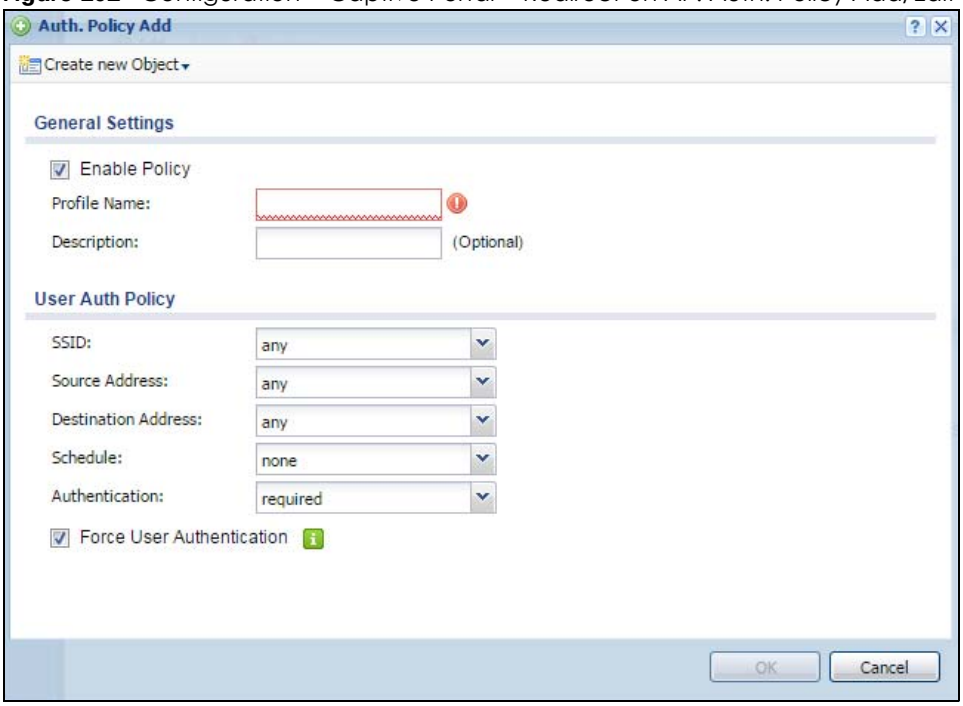
Table 92 Configuration > Captive Portal > Redirect on AP: Auth. Policy Group Add/Edit

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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.<br>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. |

## 14.4.2 Auth. Policy Add/Edit

This screen allows you to add authentication policies for managed APs. 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 102** Configuration > Captive Portal > Redirect on AP: Auth. Policy Add/Edit




The following table describes the labels in this screen.

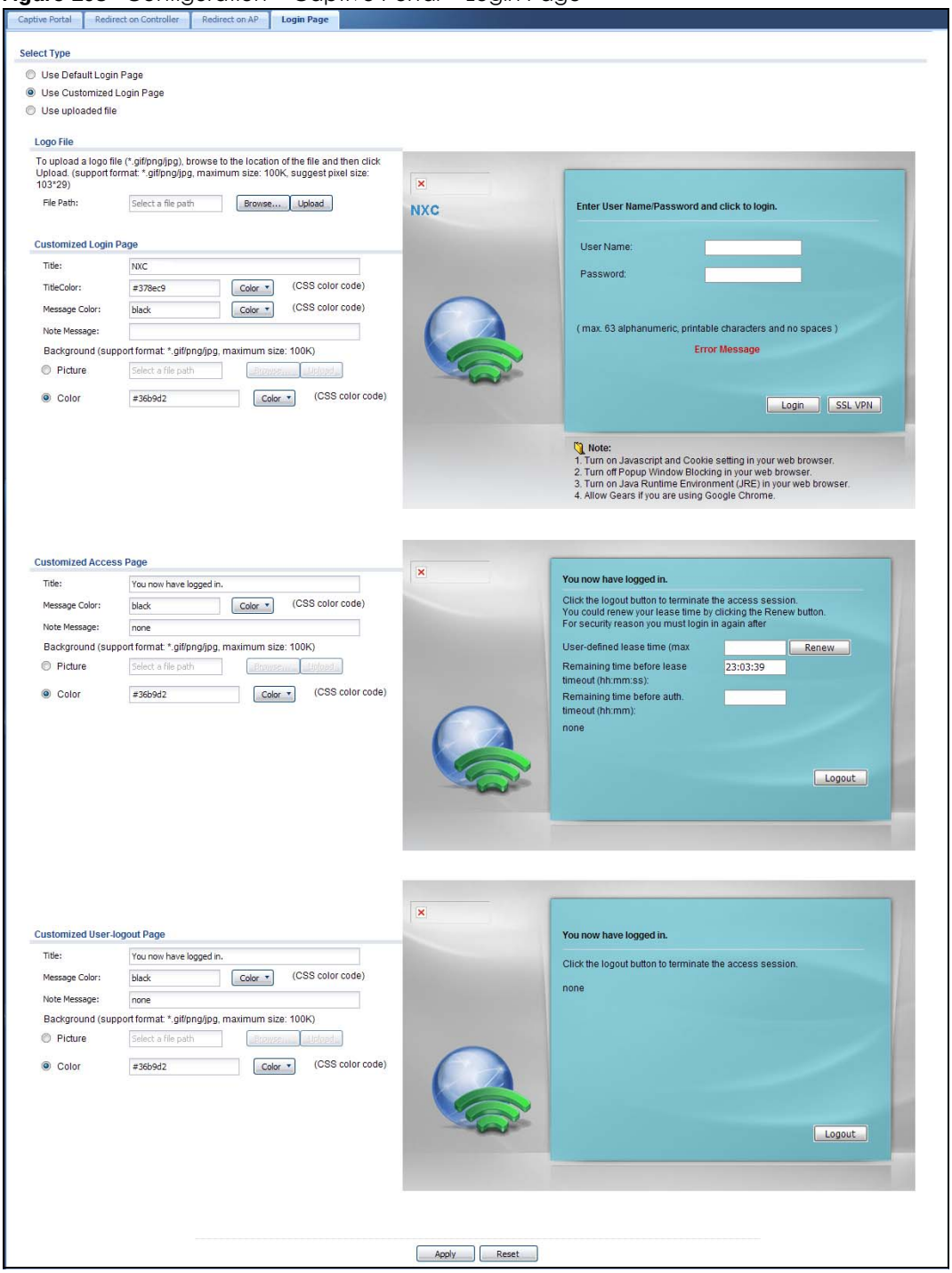
Table 93 Configuration > Captive Portal > Redirect on AP: Auth. Policy Add/Edit

| 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. |
| 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. |
| Profile 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. |
| SSID | Select a pre-defined SSID profile to which the policy is applied. |
| 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.<br><br>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.<br><br>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. |
| Force User Authentication | Select this option to redirect HTTP traffic to the login screen if the user has not logged in yet. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to exit this screen without saving. |

# 14.5 Login Page

The login page appears whenever the captive portal intercepts network traffic, preventing unauthorized users from gaining access to the network. Use this page to customize the default login page that is built into the NXC. Click **Configuration > Captive Portal > Login Page** to display it.

**Figure 103** Configuration > Captive Portal > Login Page



The following table describes the labels in this screen.

Table 94 Configuration > Captive Portal > Login Page

| LABEL | DESCRIPTION |
|---|---|
| Select Type | |
| Use Default Login Page | Select this to use the default login page built into the device. If you later create a custom login page, you can still return to the NXC's default page as it is saved indefinitely. |
| Use Customized Login Page | Select this to use a custom login page instead of the default one built into the NXC. Once this option is selected, the custom login page controls below become active. |
| Use uploaded file | Select this to upload a web portal file with custom html pages to the NXC and use it. Once this option is selected, the screen changes. |
| Logo File | This section allows you to choose and upload a custom logo image for the customized login page.<br>This corresponds to the "Zyxel" logo image in the default page. |
| File Path / 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.<br>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.<br>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.<br>To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the logo graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG.<br>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.<br>To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the logo graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG.<br>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 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. |

Table 94 Configuration > Captive Portal > Login 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.<br>To use a graphic, select **Picture** and upload a graphic. Specify the location and file name of the logo graphic or click **Browse** to locate it. You can use the following image file formats: GIF, PNG, or JPG.<br>To use a color, select **Color** and specify the color. |
| 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. |
| Download | Click this to download an example web portal file for your reference. |
| 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. |
| Download customized zip | Click **Download** to download the web portal file from the NXC to your computer.<br>This button is clickable only after you upload a zipped web port file to the NXC. |
| Preview | Click a button to display the corresponding portal page you uploaded to the NXC.<br>The buttons are clickable only after you upload the corresponding portal pages to the NXC. |
| Restore customization file to default | Click **Restore** to set the NXC back to use the default built-in login page. |
| Apply | Click **Apply** to save your changes back to the NXC. |
| Reset | Click **Reset** to return the screen to its last-saved settings. |

### 14.5.1 Custom Login and Access Pages

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

**Figure 104** Login Page Customization

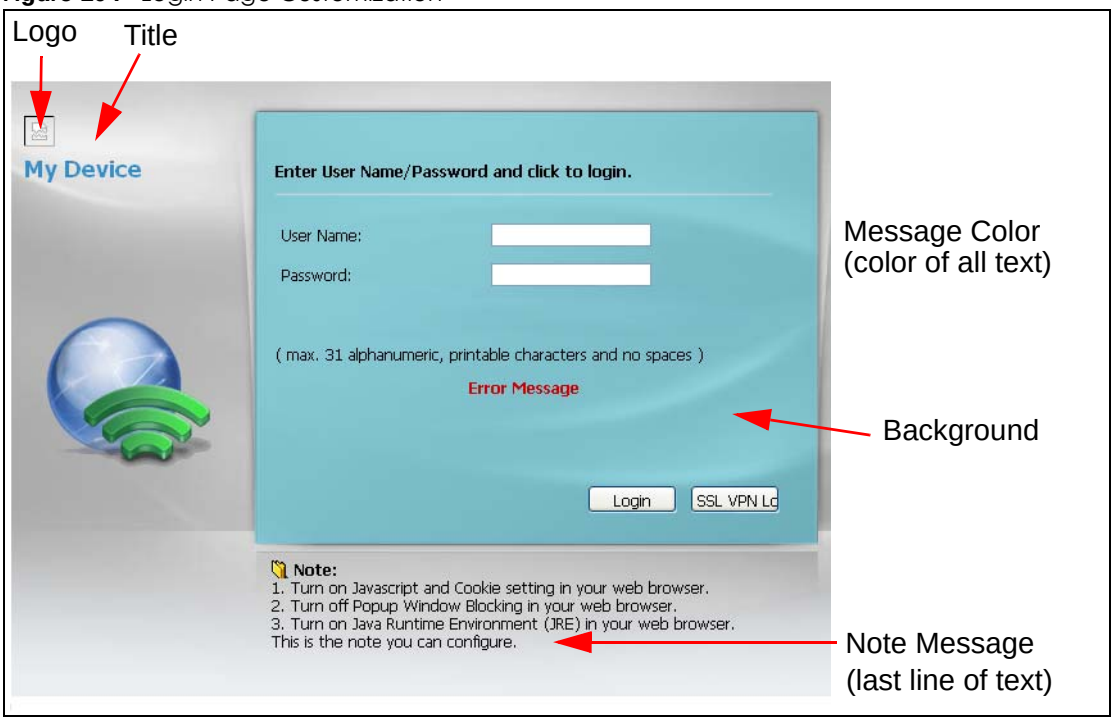



**Figure 105** Access Page Customization

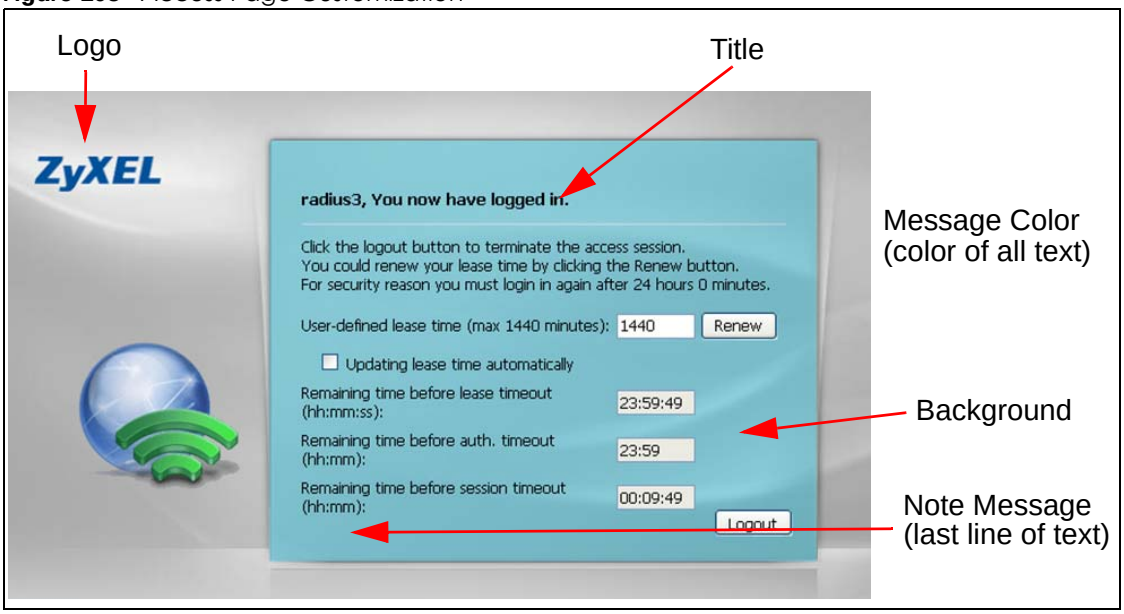
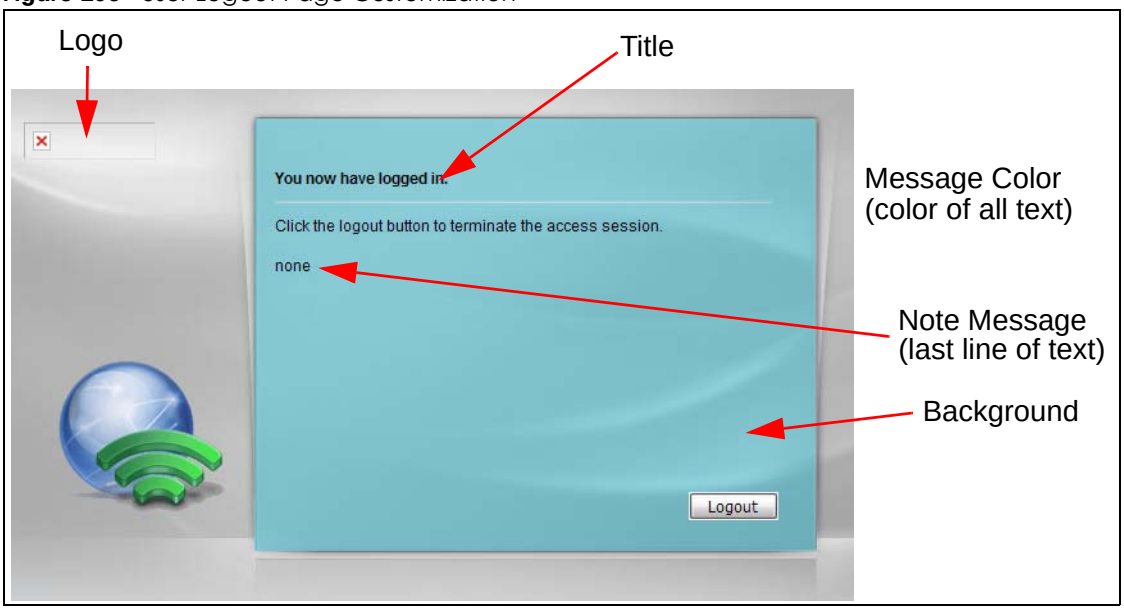


**Figure 106** User Logout Page Customization




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.

## 14.5.2 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 107** External Web Portal Login Page Example


**Figure 108** External Web Portal Welcome Page Example

**Figure 109** External Web Portal Session Page Example

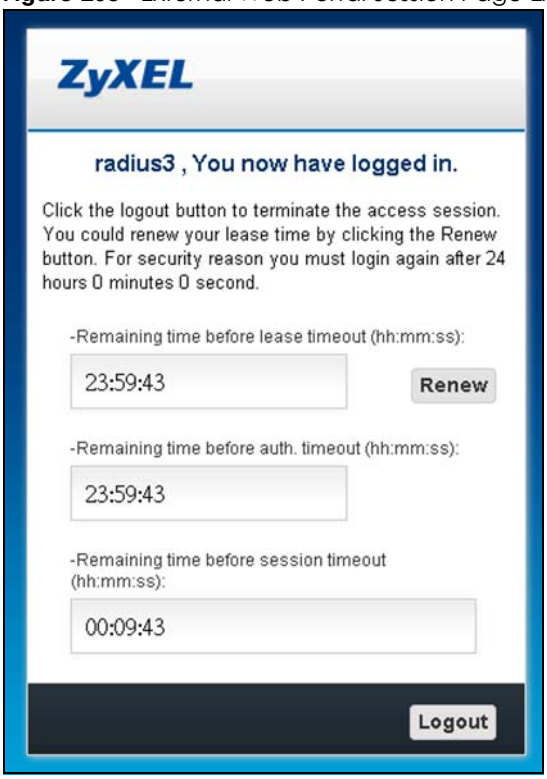



**Figure 110** External Web Portal Logout Page Example

**Figure 111** External Web Portal User Logout Page Example

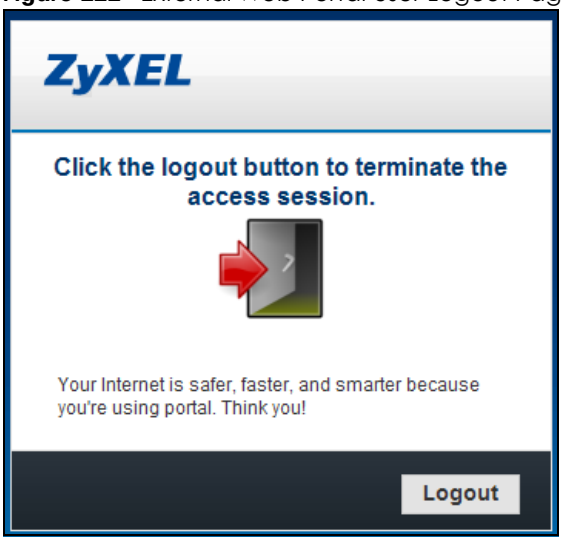



**Figure 112** External Web Portal Error Page Example


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 |

Table 96 HTTP Parameters for External URL

| PARAMETER | DESCRIPTION | LOGIN | WELCOME | SESSION | LOGOUT | ERROR |
|---|---|---|---|---|---|---|
| auth_hour | The remaining hours before authentication timeout | | | 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 | | | | |

# CHAPTER 15
# RTLS

## 15.1 Overview

Ekahau RTLS (Real Time Location Service) tracks battery-powered Wi-Fi 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 Wi-Fi 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).

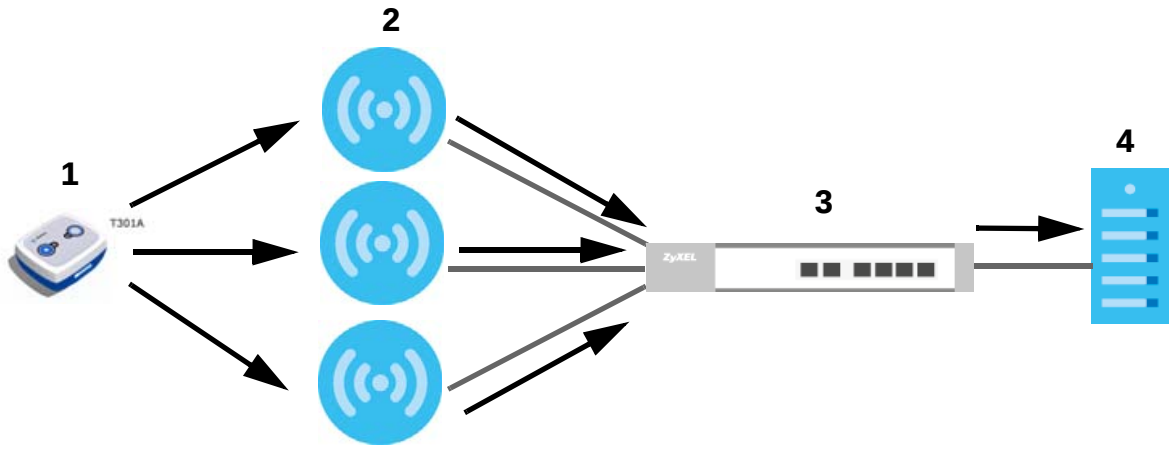
1 The Wi-Fi tag sends blink packets at specified intervals (or triggered by something like motion or button presses).

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 113** RTLS Example




### 15.1.1 What You Can Do in this Chapter

Use the **RTLS** screen (Section 15.3 on page 192) to use the managed APs as part of an Ekahau RTLS to track the location of Ekahau Wi-Fi tags.

# 15.2 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 Wi-Fi 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.

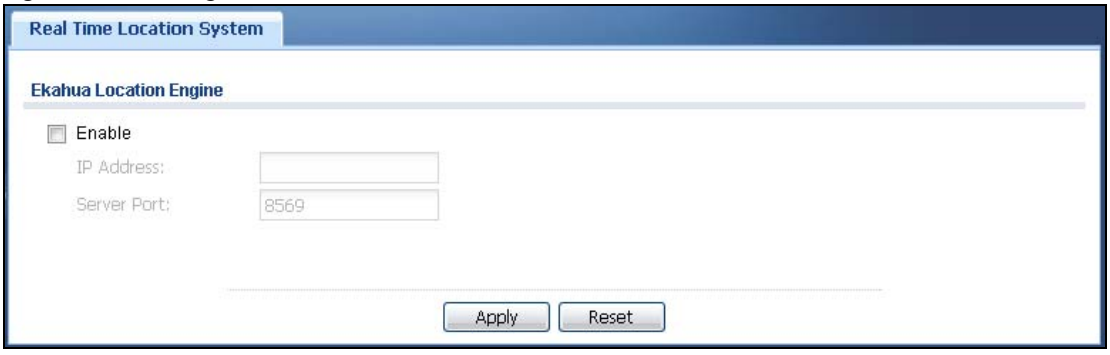
Table 97 RTLS Traffic Port Numbers

| 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 |

# 15.3 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 114** Configuration > RTLS



The following table describes the labels in this screen.

Table 98 Configuration > RTLS

| LABEL | DESCRIPTION |
|---|---|
| Enable | Select this to use Wi-Fi to track the location of Ekahau Wi-Fi 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 16
# Firewall

## 16.1 Overview

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

### 16.1.1 What You Can Do in this Chapter

- The **Firewall** screens (Section 16.2 on page 196) enable or disable the firewall and asymmetrical routes, and manage and configure firewall rules.
- The **Session Control** screens (Section 16.3 on page 200) limit the number of concurrent NAT/firewall sessions a client can use.

### 16.1.2 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 99 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.

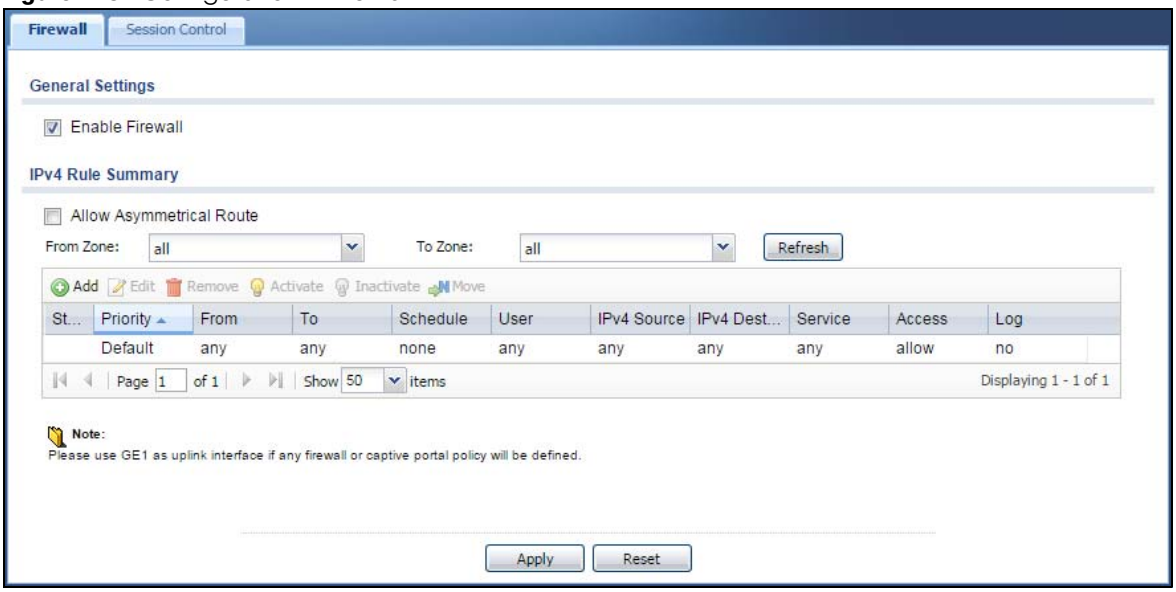
# 16.2 Firewall

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 115** Configuration > Firewall




The following table describes the labels in this screen.

Table 100 Configuration > Firewall

| LABEL | DESCRIPTION |
|---|---|
| General Settings | |
| Enable Firewall | Select this check box to activate the firewall. The NXC performs access control when the firewall is activated. |

Table 100 Configuration > Firewall (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>Select this check box to have the NXC permit the use of asymmetrical route topology on the network (not reset the connection).<br>Note: Allowing asymmetrical routes may let traffic from the WAN go directly to the LAN without passing through the NXC. |
| 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.<br>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.<br>From **any** displays all the firewall rules for traffic going to the selected **To Zone**.<br>To **any** displays all the firewall rules for traffic coming from the selected **From Zone**.<br>From **any** to **any** displays all of the firewall rules.<br>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.<br>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.<br>**Default** displays for the default firewall behavior that the NXC performs on traffic that does not match any other firewall rule. |
| From<br>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. |

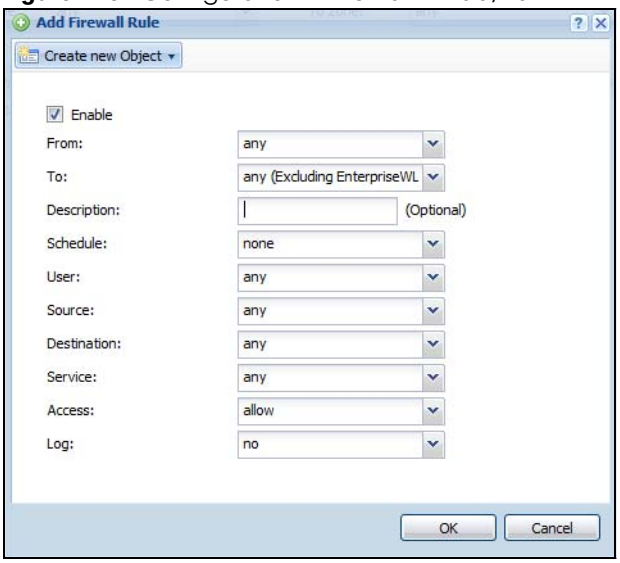
Table 100 Configuration > Firewall (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |

## 16.2.1 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 116** Configuration > Firewall > Add/Edit




The following table describes the labels in this screen.

Table 101 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<br><br>To | For through-NXC rules, select the direction of travel of packets to which the rule applies.<br><br>**any** means all interfaces.<br><br>**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. |

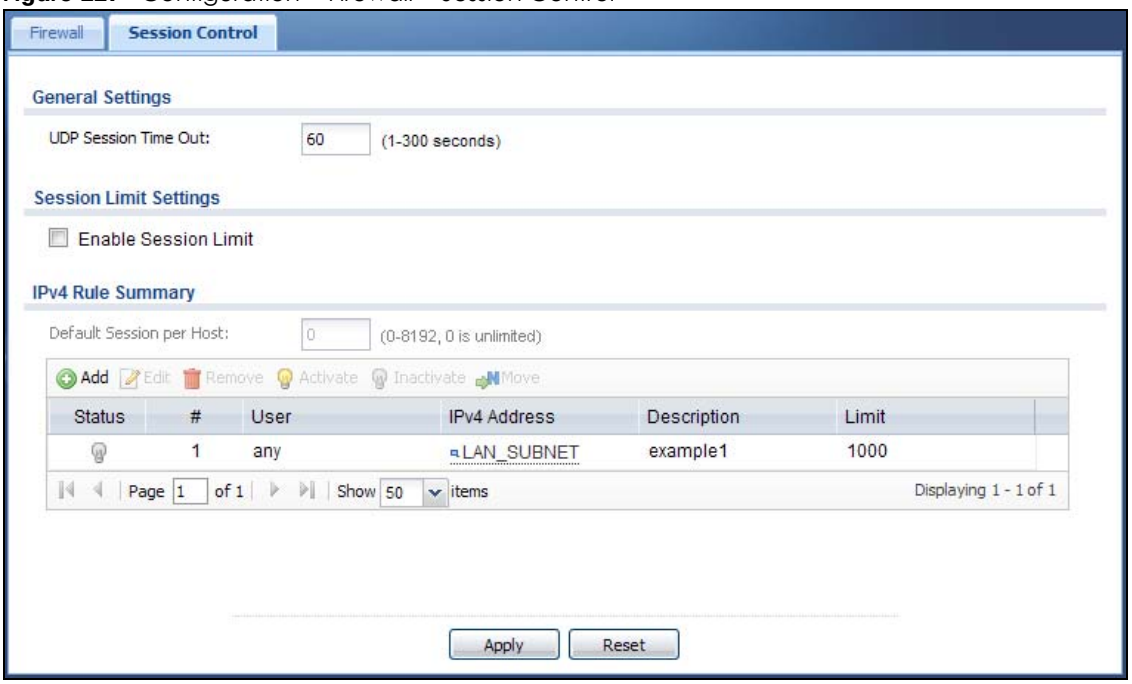
Table 101 Configuration > Firewall > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| User | This field is not available when you are configuring a to-NXC rule.<br>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.<br>Otherwise, select **any** and there is no need for user logging.<br>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. |
| 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.<br>Select **deny** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender.<br>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.<br>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. |

# 16.3 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 117** Configuration > Firewall > Session Control




The following table describes the labels in this screen.

Table 102 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 | |
| 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.<br>Use this field to set a common limit to the number of concurrent NAT/firewall sessions each client computer can have.<br>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.<br>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. |

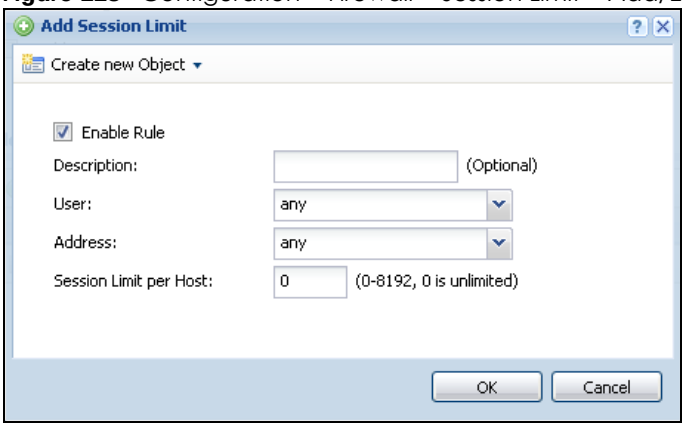
Table 102 Configuration > Firewall > Session Control (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>The ordering of your rules is important as they are applied in order of their numbering. |
| Status | This icon is lit when the entry is active and dimmed when the entry is inactive. |
| # | This is the index number of a session limit rule. It is not associated with a specific rule. |
| 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. |

## 16.3.1 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 118** Configuration > Firewall > Session Limit > Add/Edit




The following table describes the labels in this screen.

Table 103 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. |

Table 103 Configuration > Firewall > Session Limit > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>Otherwise, select **any** and there is no need for user logging.<br>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.<br>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 17
# User/Group

## 17.1 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.

### 17.1.1 What You Can Do in this Chapter

- The **User** screen (see Section 17.2 on page 205) lets you see, add, and edit user accounts.
- The **Group** screen (see Section 17.3 on page 209) 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 17.4 on page 211) 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 17.5 on page 220) lists all the mappings of MAC addresses to MAC address user accounts (MAC roles).

### 17.1.2 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 104 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)<br>Perform basic diagnostics (CLI) | WWW, TELNET, SSH, Console |
| Access Users | | |
| user | Access network services<br>Browse user-mode commands (CLI) | Captive Portal, TELNET, SSH |
| guest | Access network services | Captive Portal |

Table 104 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** 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 18.3.2.1 on page 234).
3. Click **Configuration > Object > User/Group > User > Add** and create a MAC address user account (see Section 17.2.1 on page 206).
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 17.5 on page 220.

### 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

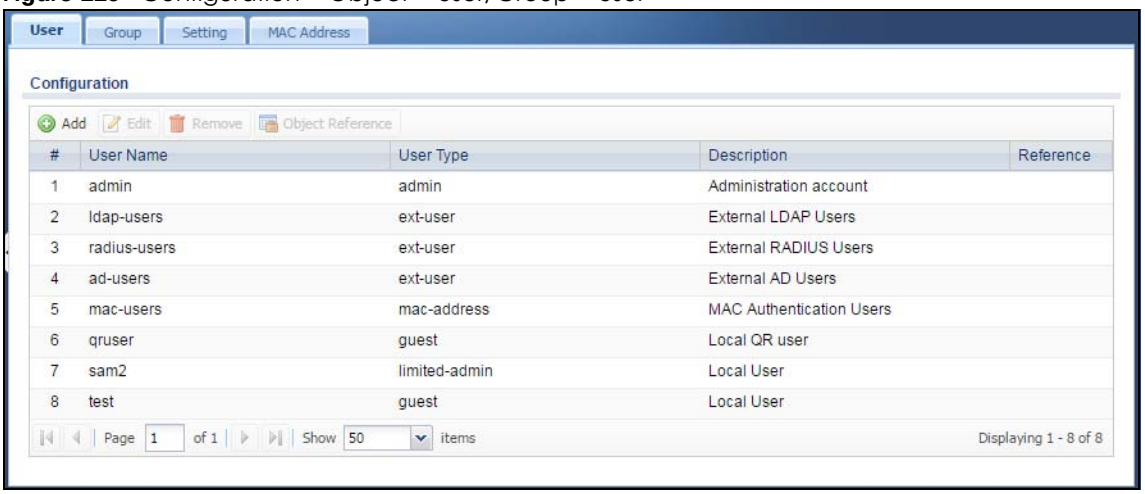
The NXC checks the following in order of priority.

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).

## 17.2 User Summary

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

**Figure 119** Configuration > Object > User/Group > User




The following table describes the labels in this screen.

Table 105 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 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 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.<br>• **admin** - this user can look at and change the configuration of the NXC<br>• **limited-admin** - this user can look at the configuration of the NXC but not to change it<br>• **user** - this user has access to the NXC's services but cannot look at the configuration.<br>• **guest** - this user has access to the NXC's services but cannot look at the configuration.<br>• **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Master Manager** screen that pops up.<br>• **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. |

## 17.2.1 Add/Edit User

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

### 17.2.1.1 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 120** Configuration > Object > User/Group > User > Add/Edit A User (user)

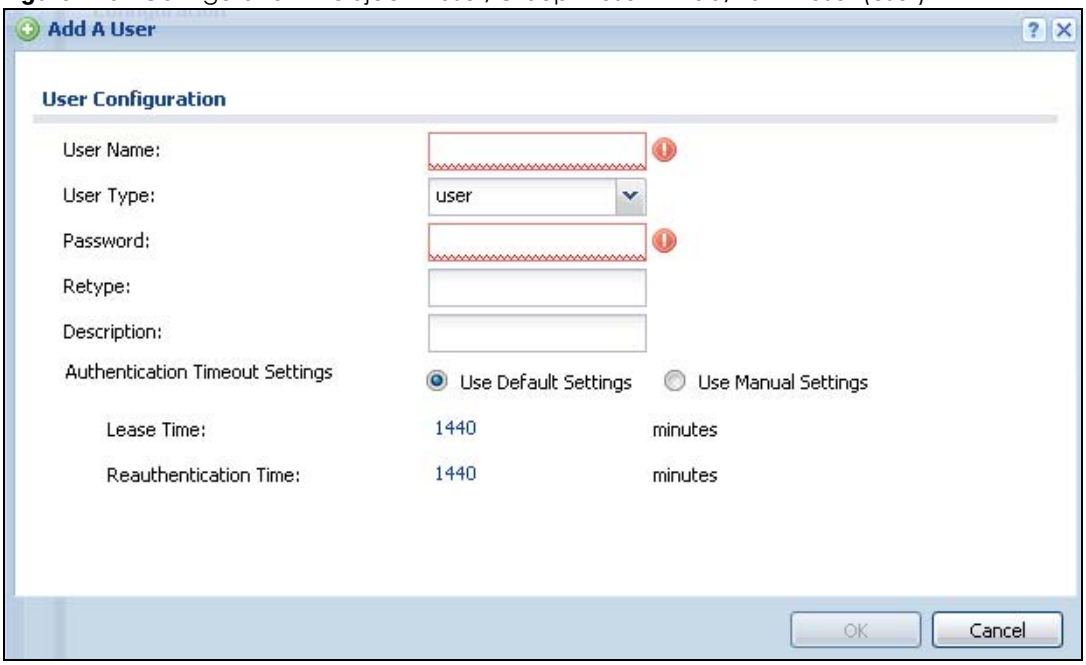
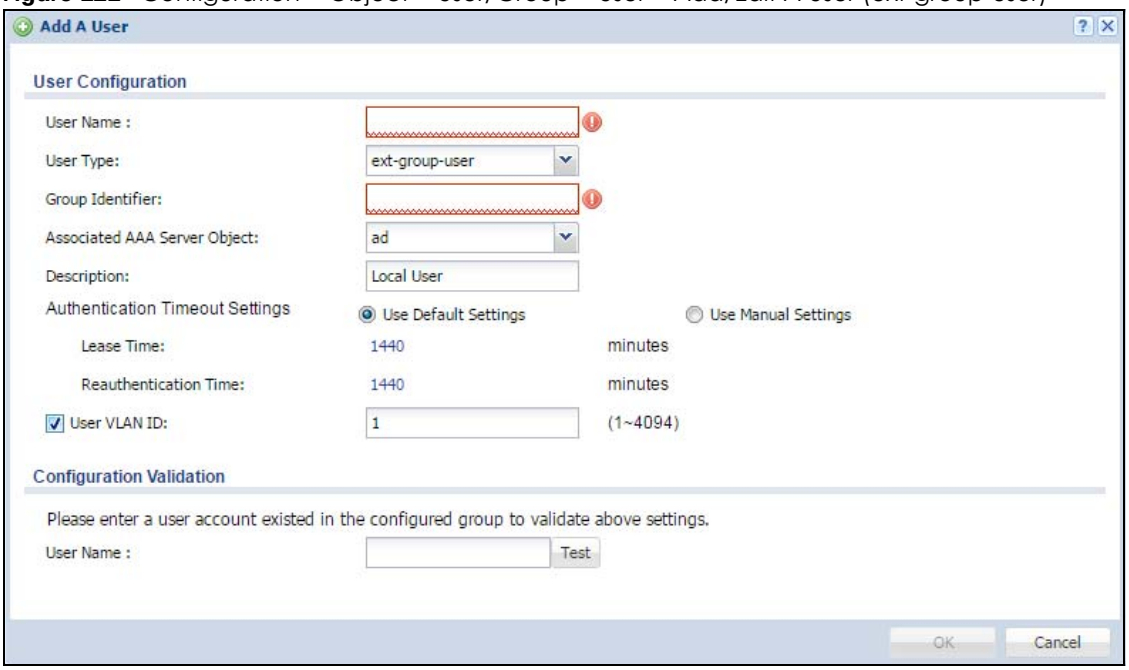


**Figure 121** Configuration > Object > User/Group > User > Add/Edit A User (ext-group-user)




The following table describes the labels in this screen.

Table 106 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:<br>• **admin** - this user can look at and change the configuration of the NXC<br>• **limited-admin** - this user can look at the configuration of the NXC but not to change it<br>• **user** - this user has access to the NXC's services but cannot look at the configuration<br>• **guest** - this user has access to the NXC's services but cannot look at the configuration<br>• **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Master Manager** screen that pops up<br>• **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.<br>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.<br>Retype the password for confirmation. |
| Group Identifier | This field is available for a **ext-group-user** type user account.<br>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. |

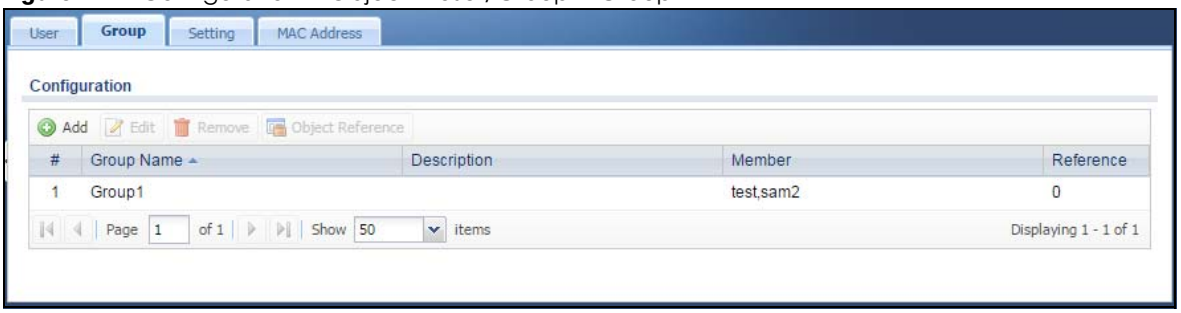
Table 106 Configuration > Object > User/Group > User > Add/Edit A User (continued)

| LABEL | DESCRIPTION |
|---|---|
| Description | Enter the description of each user, if any. You can use up to 60 printable ASCII characters. Default descriptions are provided. |
| 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.<br>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 sepcify here.<br>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. |

# 17.3 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 122** Configuration > Object > User/Group > Group



The following table describes the labels in this screen.

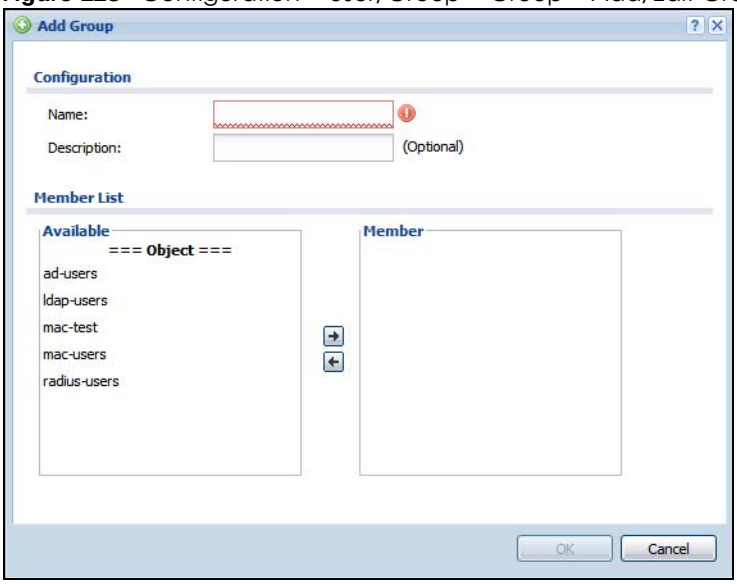
Table 107 Configuration > Object > User/Group > Group

| 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. |
| 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 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 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. |

## 17.3.1 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 123** Configuration > User/Group > Group > Add/Edit Group




The following table describes the labels in this screen.

Table 108 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 108 Configuration > User/Group > Group > Add/Edit Group (continued)

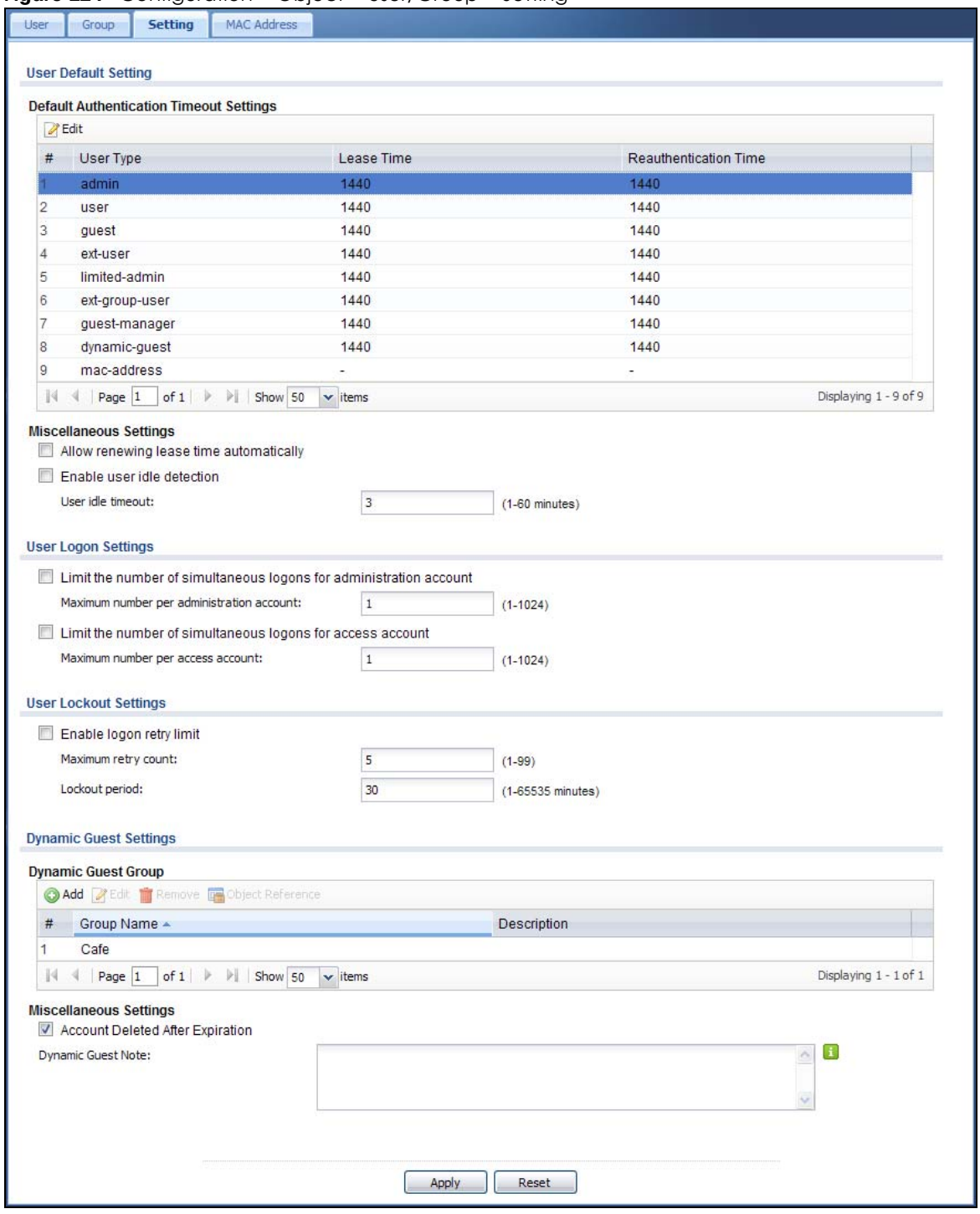
| LABEL | DESCRIPTION |
|---|---|
| Member List | The **Member** list displays the names of the users and user groups that have been added to the user group. The order of members is not important. Select users and groups from the **Available** list that you want to be members of this group and move them 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.<br>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. |

# 17.4 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 124** Configuration > Object > User/Group > Setting



The following table describes the labels in this screen.

Table 109 Configuration > Object > User/Group > Setting

| LABEL | DESCRIPTION |
|---|---|
| User Default Settings | |
| 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.<br>• **admin** - this user can look at and change the configuration of the NXC<br>• **limited-admin** - this user can look at the configuration of the NXC but not to change it<br>• **user** - this user has access to the NXC's services but cannot look at the configuration.<br>• **guest** - this user has access to the NXC's services but cannot look at the configuration.<br>• **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Master Manager** screen that pops up.<br>• **dynamic-guest** - this user has access to the NXC's services within a given period of time but cannot look at the configuration.<br>• **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.<br>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.<br>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.<br>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 109 Configuration > Object > User/Group > Setting (continued)

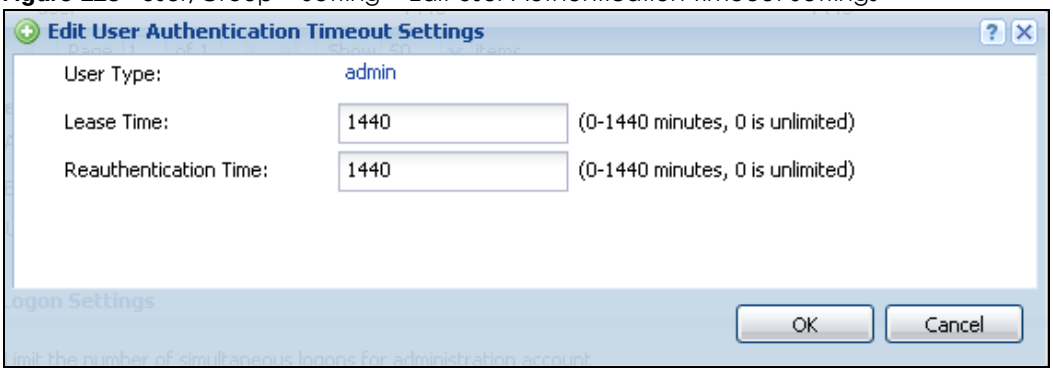
| LABEL | DESCRIPTION |
|---|---|
| Limit the number of simultaneous logons for administration account | Select this check box if you want to set a limit on the number of simultaneous logins by admin users. If you do not select this, admin users can login as many times as they want at the same time using 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 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 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. |
| 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. |

## 17.4.1 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 125** User/Group > Setting > Edit User Authentication Timeout Settings




The following table describes the labels in this screen.

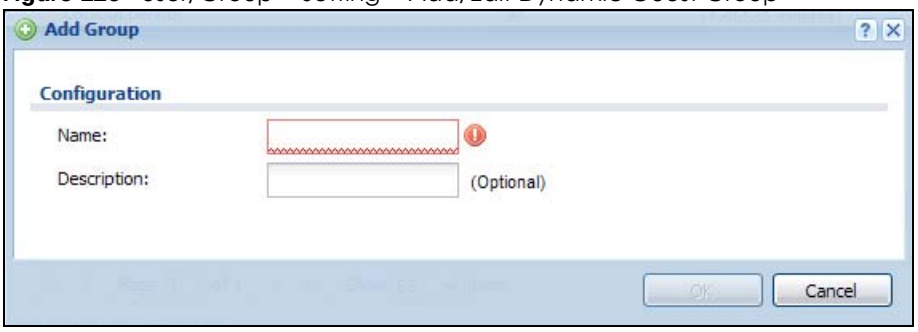
Table 110 User/Group > Setting > Edit User Authentication Timeout Settings

| LABEL | DESCRIPTION |
|---|---|
| User Type | This read-only field identifies the type of user account for which you are configuring the default settings.<br>• **admin** - this user can look at and change the configuration of the NXC<br>• **limited-admin** - this user can look at the configuration of the NXC but not to change it<br>• **user** - this user has access to the NXC's services but cannot look at the configuration.<br>• **guest** - this user has access to the NXC's services but cannot look at the configuration.<br>• **ext-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **ext-group-user** - this user account is maintained in a remote server, such as RADIUS or LDAP.<br>• **guest-manager** - this user can log in via the web configurator login screen and create dynamic guest accounts using the **Master Manager** screen that pops up.<br>• **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.<br>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. |

## 17.4.2 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 126** User/Group > Setting > Add/Edit Dynamic Guest Group




The following table describes the labels in this screen.

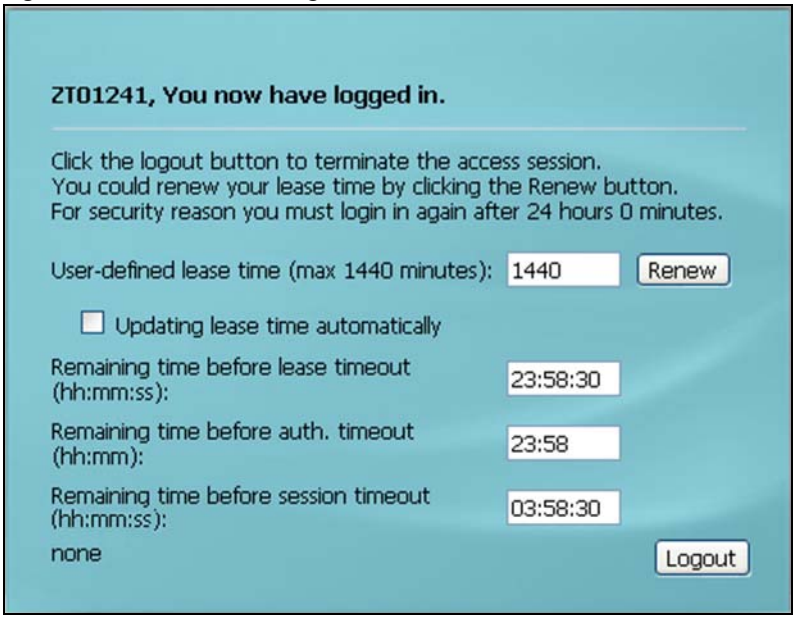
Table 111 User/Group > Setting > Add/Edit Dynamic Guest Group

| 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. |

## 17.4.3 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 127** User Aware Login



The following table describes the labels in this screen.

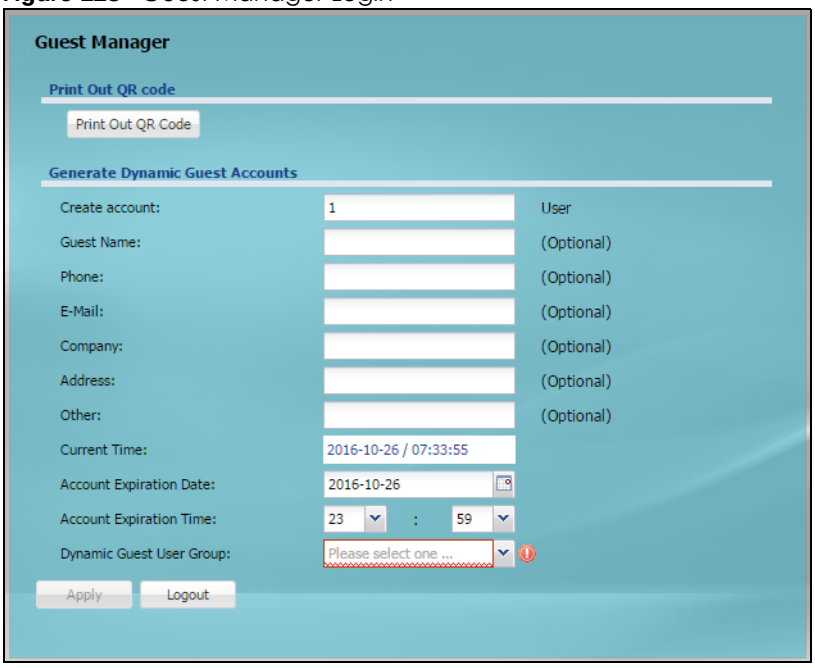
Table 112 User Aware Login

| 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<br>• **User-defined lease time** field in this screen.<br>• **Lease time** field in the **User Add/Edit** screen.<br>• **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. |
| Remaining time before session timeout | This field displays how much longer the user can use the session before the NXC automatically logs the access user out. |

## 17.4.4 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 128** Guest Manager Login



The following table describes the labels in this screen.

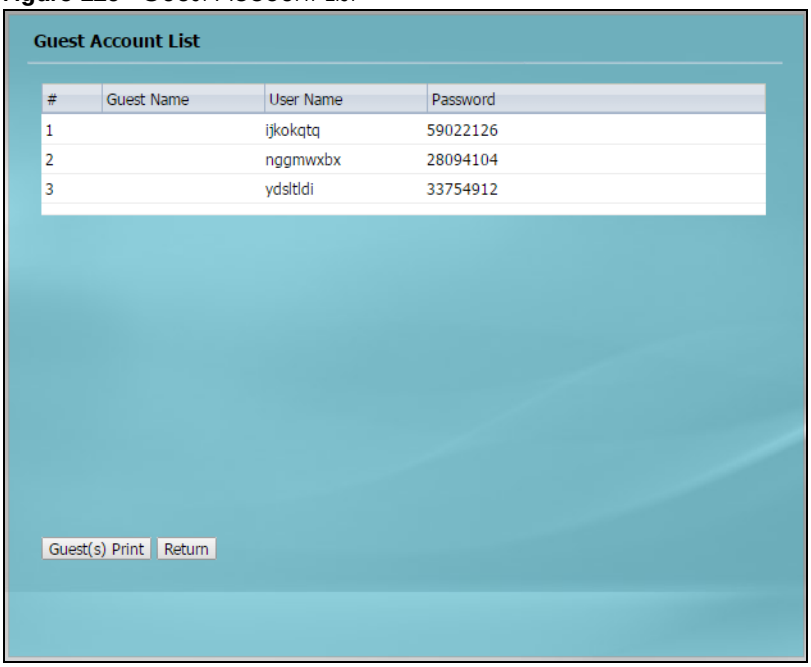
Table 113 Guest Manager Login

| LABEL | DESCRIPTION |
|---|---|
| Print Out QR Code | Click the **Print Out QR Code** button to view and print the QR code.<br>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.<br>Enter the name for the guest account. |
| Phone | This field is available only when you want to create one account.<br>Enter the telephone number for the guest account. |
| E-mail | This field is available only when you want to create one account.<br>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. |

### 17.4.4.1 Guest Account List

After you click **Apply** to create dynamic guest accounts, the following guest account list screen appears.

**Figure 129** Guest Account List



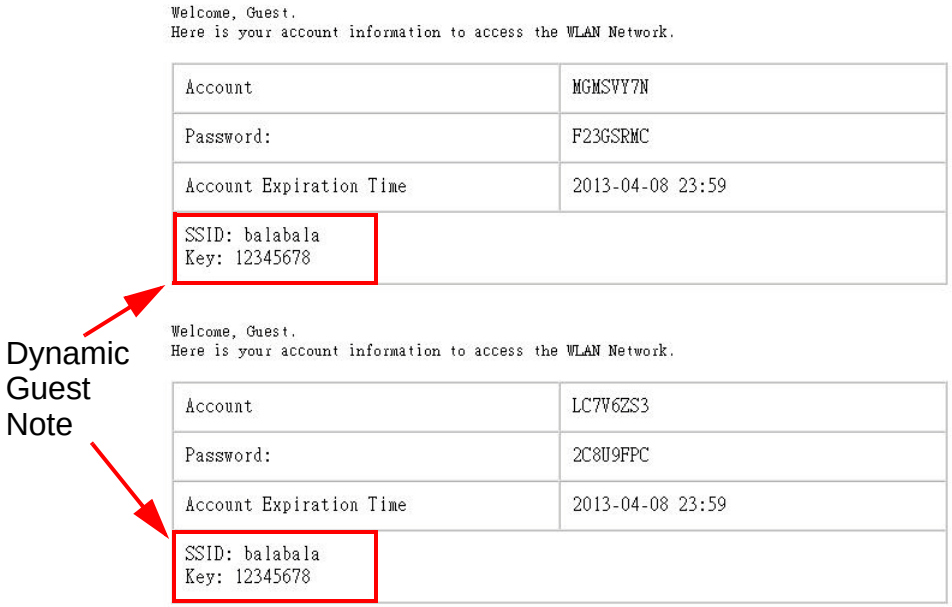

The following table describes the labels in this screen.

Table 114 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. |
| 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. |
| Return | Click this icon to go back to the previous screen. |

The following figure shows the dynamic guest account printout example.

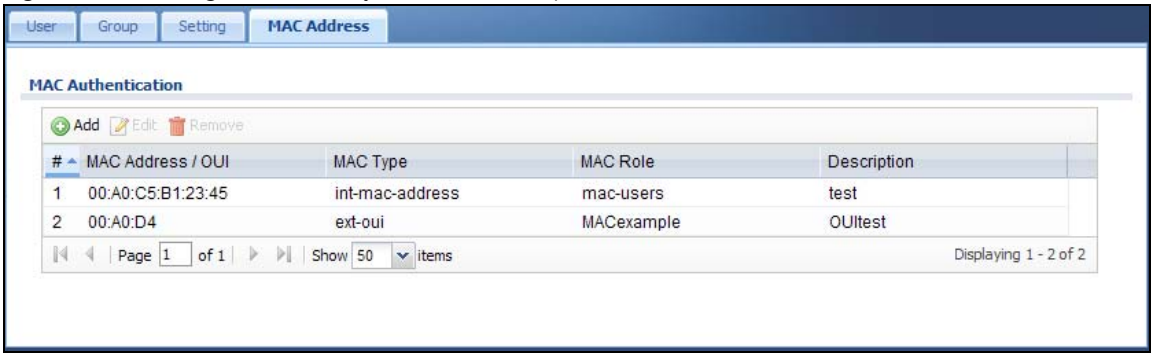
**Figure 130** Preview of Dynamic Guest Account Printout




# 17.5 MAC Address

The **MAC Address** screen maps wireless client MAC addresses to MAC roles (MAC address user accounts). See MAC Address Accounts on page 205 for more on MAC address user accounts and MAC roles. Click **Configuration > Object > User/Group > MAC Address** to open this screen.

**Figure 131** Configuration > Object > User/Group > MAC Address




The following table describes the labels in this screen.

Table 115 Configuration > Object > User/Group > MAC Address

| 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. |
| # | This field is a sequential value, and it is not associated with a specific entry. |

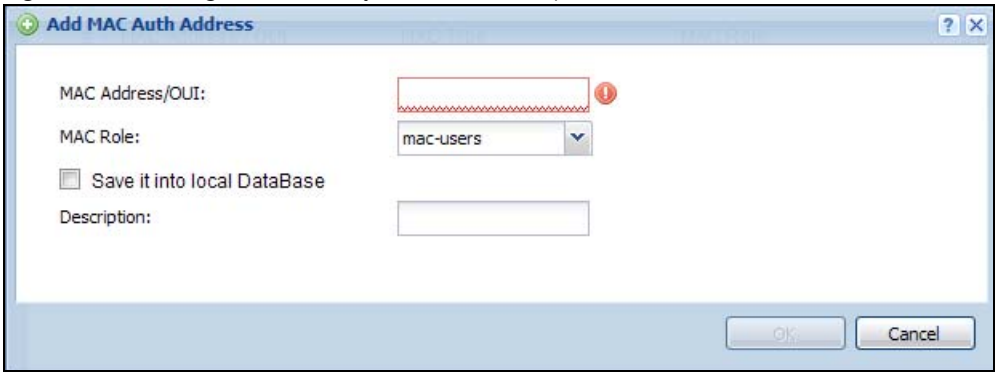
Table 115 Configuration > Object > User/Group > MAC Address (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| MAC Type | This displays whether the entry is for a MAC address or an OUI.<br>**ext-mac-address** is a MAC address authenticated by an external server.<br>**int-mac-address** is a MAC address authenticated by the NXC's local user database.<br>**ext-oui** is an OUI authenticated by an external server.<br>**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. |

## 17.5.1 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 132** Configuration > Object > User/Group > MAC Address > Add




The following table describes the labels in this screen.

Table 116 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 18
# AP Profile

## 18.1 Overview

This chapter shows you how to configure preset profiles for the Access Points (APs) connected to your NXC's wireless network.

### 18.1.1 What You Can Do in this Chapter

- The **Radio** screen (Section 18.2 on page 223) creates radio configurations that can be used by the APs.
- The **SSID** screen (Section 18.3 on page 229) configures three different types of profiles for your networked APs.

### 18.1.2 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

Wi-Fi 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

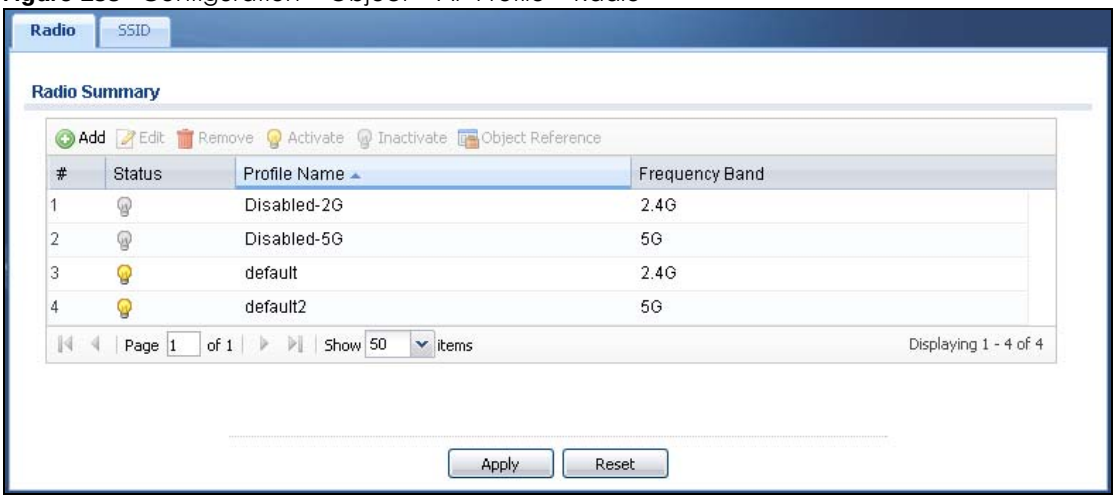
The IEEE 802.1x standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication is done using an external RADIUS server.

## 18.2 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 133** Configuration > Object > AP Profile > Radio



The following table describes the labels in this screen.

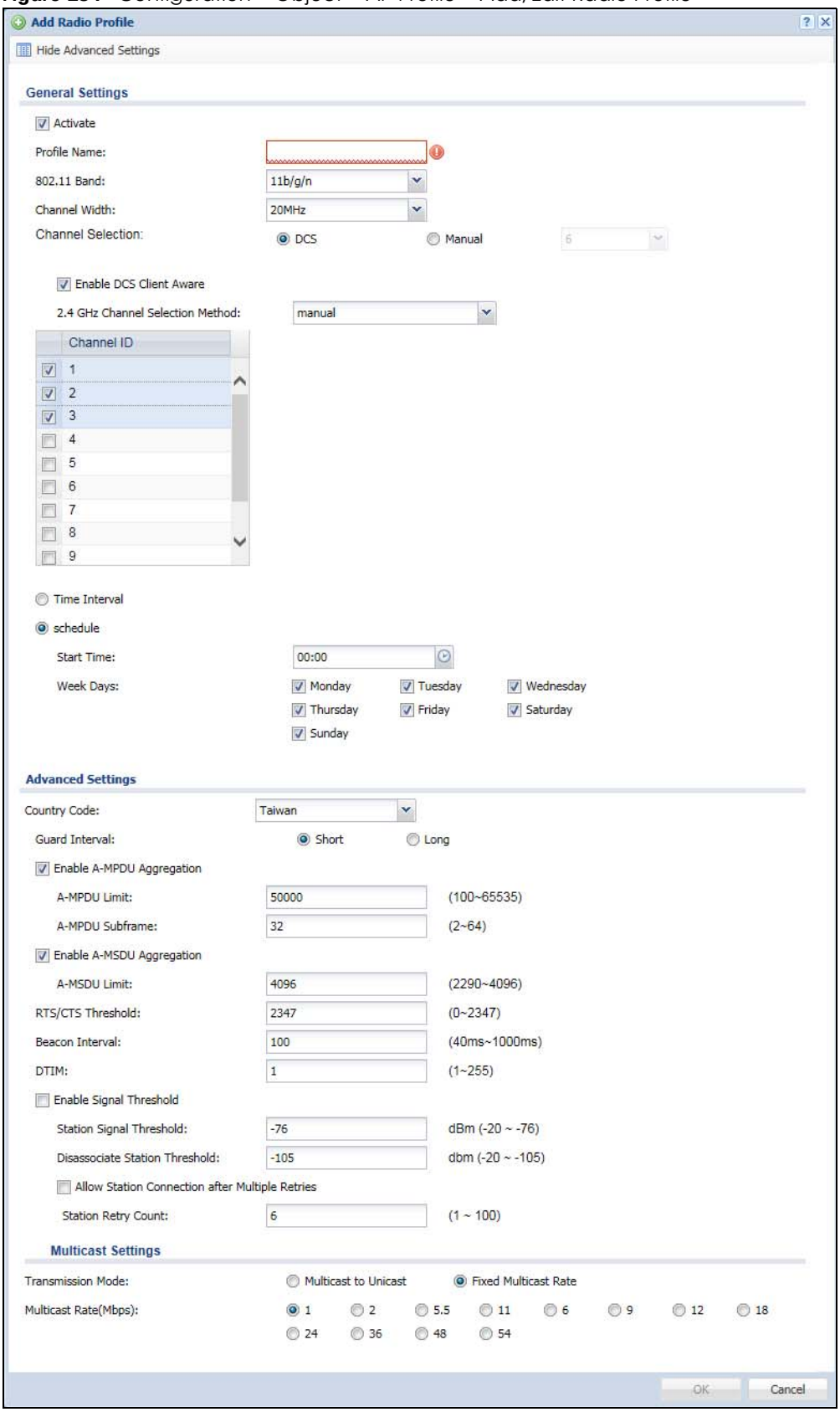
Table 117 Configuration > Object > AP Profile > Radio

| LABEL | DESCRIPTION |
|---|---|
| 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 Reference | 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 entry is active and dimmed when the entry 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. |

## 18.2.1 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 134** Configuration > Object > AP Profile > Add/Edit Radio Profile



The following table describes the labels in this screen.

Table 118 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 how to let wireless clients connect to the AP.<br>• **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.<br>• **11b/g/n**: allows IEEE802.11b, IEEE802.11g and IEEE802.11n compliant WLAN devices to associate with the AP. The transmission rate of your AP might be reduced.<br>• **11a**: allows only IEEE 802.11a compliant WLAN devices to associate with the AP.<br>• **11a/n**: allows both IEEE802.11n and IEEE802.11a compliant WLAN devices to associate with the AP. The transmission rate of your AP might be reduced.<br>• **11ac**: allows only IEEE802.11ac compliant WLAN devices to associate with the AP.<br>Note: If you select **11ac** but the WLAN devices in the network do not support IEEE 802.11ac, the NXC automatically sets the AP to use **11a/n**. |
| Channel Width | Select the wireless channel bandwidth you want the AP to use.<br>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.<br>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.<br>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.<br>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. |
| Channel Selection | Select the wireless channel which this radio profile should use.<br>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.<br>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.<br>Note: If you change the country code later, **Channel Selection** is set to **Manual** automatically.<br>Select **Manual** and specify the channels the AP uses. |

Table 118 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

| LABEL | DESCRIPTION |
|---|---|
| Enable DCS Client Aware | This field is available when you set **Channel Selection** to **DCS**.<br>Select this to have the AP wait until all connected clients have disconnected before switching channels.<br>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**.<br>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.<br>Select **manual** and specify the channels the AP uses in the 2.4 GHz band.<br>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**.<br>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**.<br>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.<br>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. |
| Enable 5 GHz DFS Aware | This field is available only when you select **11a**, **11a/n** or **11ac** in the **802.11 Band** field and set **5 GHz Channel Selection Method** to **auto**.<br>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.<br>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.<br>Select **manual** and specify the channels the AP uses in the 5 GHz band.<br>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**.<br>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. |

Table 118 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

| LABEL | DESCRIPTION |
|---|---|
| DCS Time Interval | This field is available when you set **Channel Selection** to **DCS** and select the **Time Interval** option.<br><br>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 specifc 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.<br><br>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**.<br><br>Set the guard interval for this radio profile to either **Short** or **Long**.<br><br>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.<br><br>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. |
| 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.<br><br>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).<br><br>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. |

Table 118 Configuration > Object > AP Profile > Add/Edit Radio Profile (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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.<br>-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.<br>-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 |
| 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.<br>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.<br>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. |
| 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. |

# 18.3 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.

## 18.3.1 SSID List

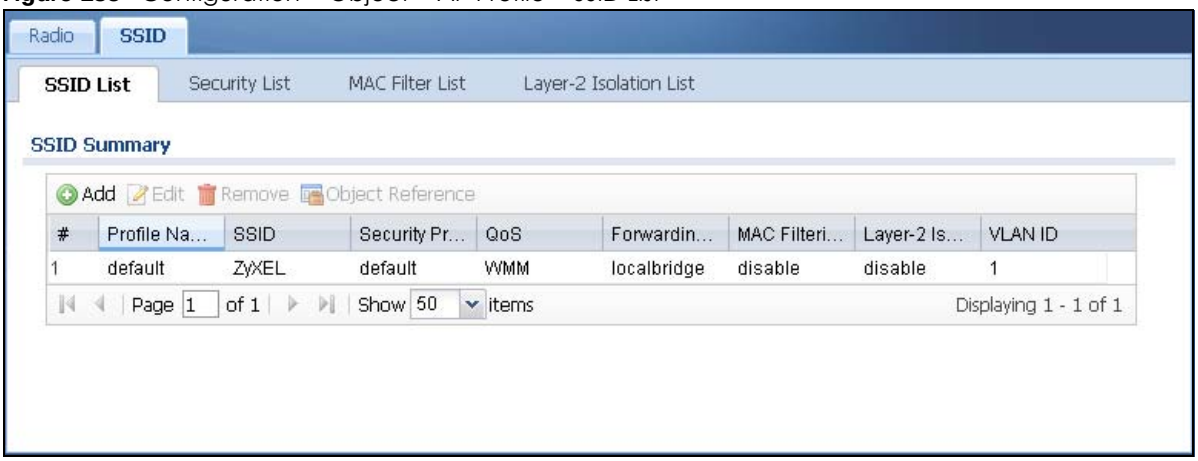
This screen allows you to create and manage SSID configurations that can be used by the APs. An SSID, or Service Set IDentifier, is basically the name of the wireless network to which a wireless client can connect. The SSID appears as readable text to any device capable of scanning for wireless frequencies

(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 135** Configuration > Object > AP Profile > SSID List




The following table describes the labels in this screen.

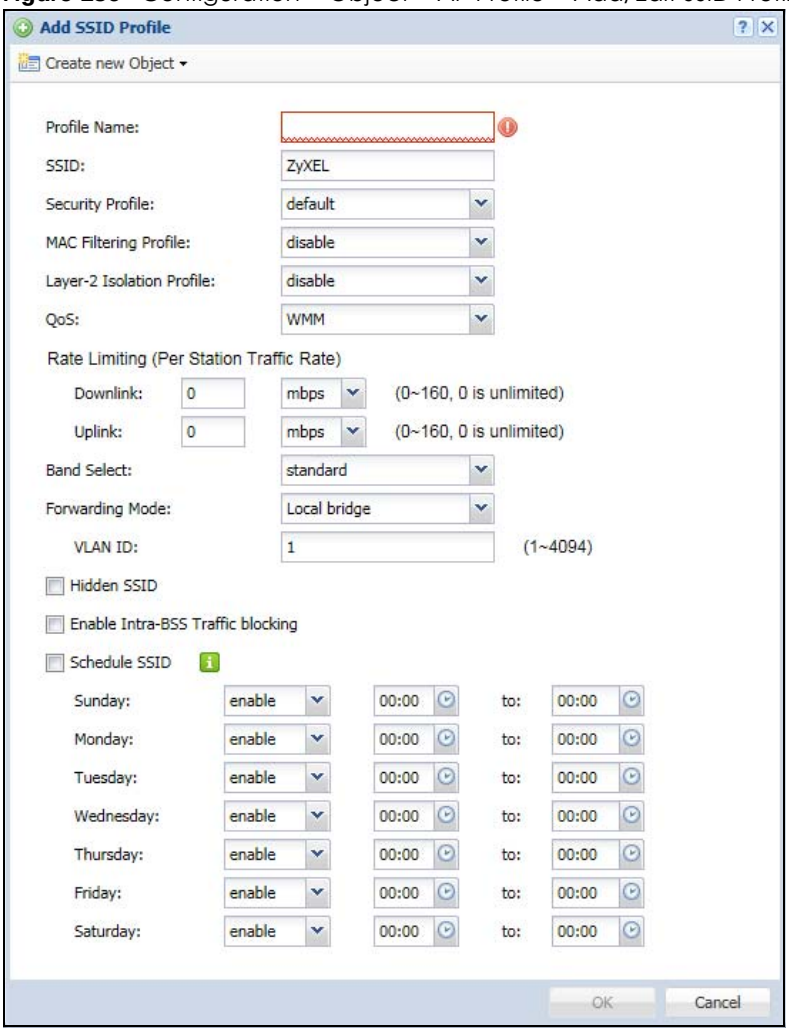
Table 119 Configuration > Object > AP Profile > SSID List

| 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. |
| Object Reference | 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. |

### 18.3.1.1 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 136** Configuration > Object > AP Profile > Add/Edit SSID Profile




The following table describes the labels in this screen.

Table 120 Configuration > Object > AP Profile > 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 and underscores are allowed. |
| SSID | Enter the SSID name for this profile. This is the name visible on the network to wireless clients. Enter up to 32 characters, spaces and underscores are allowed. |
| 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.<br><br>Note: It is highly recommended that you create security profiles for all of your SSIDs to enhance your network security. |

Table 120 Configuration > Object > AP Profile > 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.<br><br>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.<br><br>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.<br><br>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.<br><br>QoS access categories are as follows:<br><br>**disable**: Turns off QoS for this SSID. All data packets are treated equally and not tagged with access categories.<br><br>**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.<br><br>**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.<br><br>**WMM_VIDEO**: All wireless traffic to the SSID is tagged as video data. This is recommended for activities like video conferencing.<br><br>**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.<br><br>**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 | This section is not available when you set **Forwarding Mode** to **Tunnel**. |
| 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.<br><br>Select **standard** to have the AP try to connect the wireless clients to the same SSID using the 5 GHZ band. Connections to an SSID using the 2.4GHz band are still allowed.<br><br>Select **force** to have the wireless clients always connect to an SSID using the 5 GHZ band. Connections to an SSID using the 2.4GHz band are not allowed. It is recommanded you select this option when the AP and wireless clients can function in either frequency band.<br><br>Otherwise, select **disable** to turn off this feature. |
| Stop Threshold | This field is not available when you disable **Band Select**.<br><br>Select this option and set the threshold number of the connected wireless clients at which the NXC disables the band select feature. |

Table 120 Configuration > Object > AP Profile > Add/Edit SSID Profile (continued)

| LABEL | DESCRIPTION |
|---|---|
| Balance Ratio | This field is not available when you disable **Band Select**.<br><br>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. |
| VLAN Interface | If you selected the **Tunnel** forwarding mode, select a VLAN interface. |
| 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.<br><br>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.<br><br>Note: If you associate a layer-2 isolation profile with the SSID, this option will be selected automatically and cannot be configured. |
| 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. |

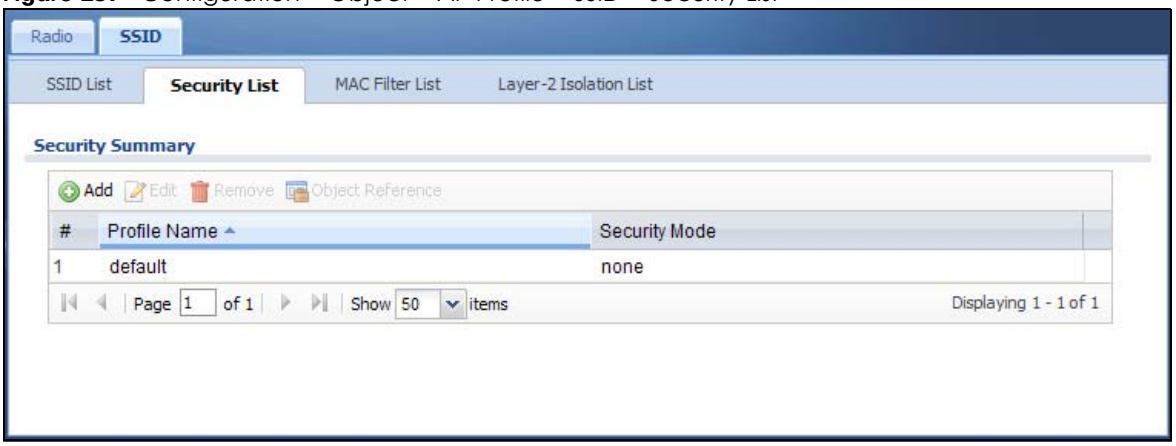
## 18.3.2 Security List

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 137** Configuration > Object > AP Profile > SSID > Security List



The following table describes the labels in this screen.

Table 121 Configuration > Object > AP Profile > SSID > Security List

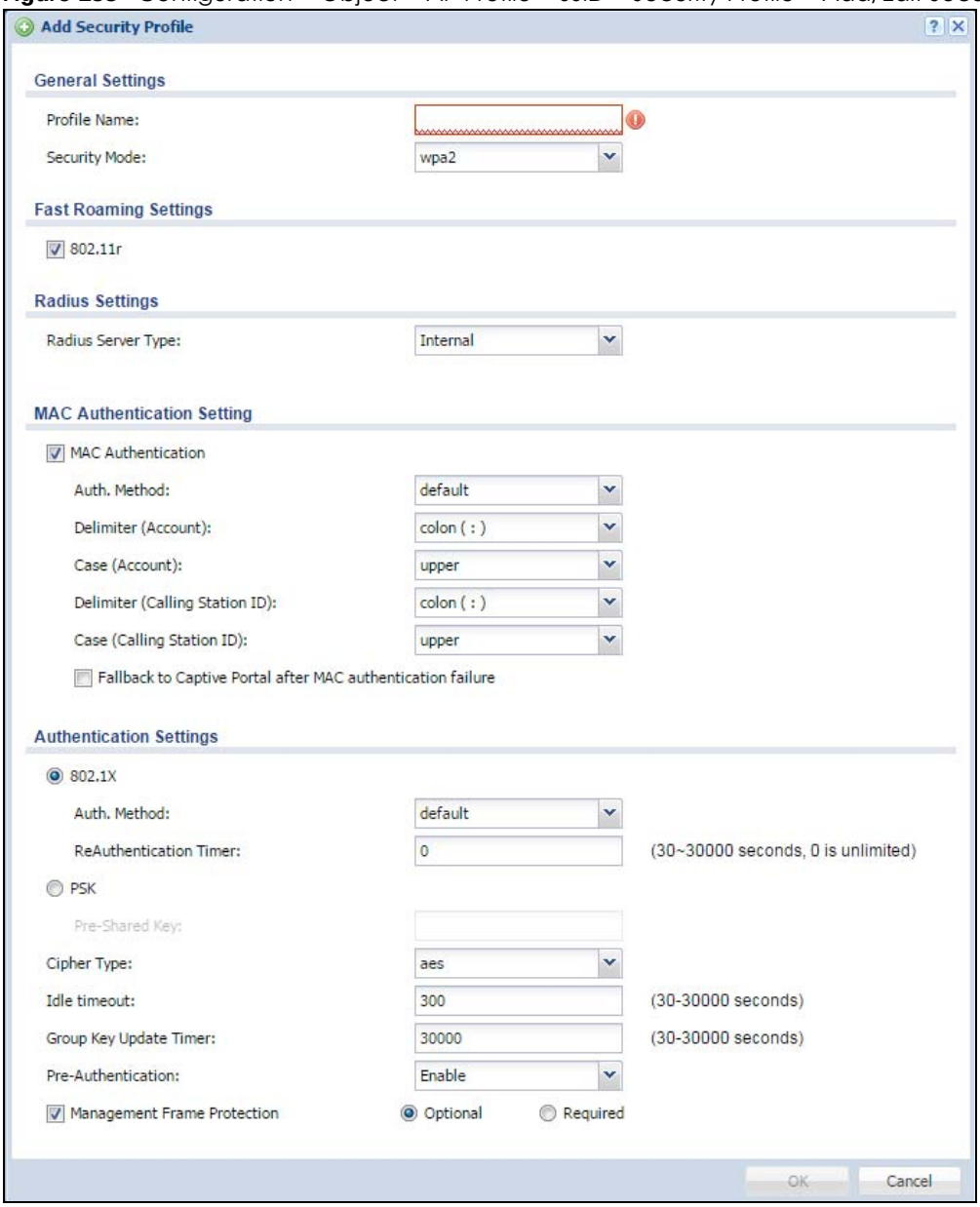
| LABEL | DESCRIPTION |
|---|---|
| Add | Click this to add a new security profile. |
| Edit | Click this to edit the selected security profile. |
| Remove | Click this to remove the selected security profile. |
| Object Reference | Click this to view which other objects are linked to the selected security 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 (if any). |

### 18.3.2.1 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 138** Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile




The following table describes the labels in this screen.

Table 122 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security 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 and underscores are allowed. |
| Security Mode | Select a security mode from the list: **none**, **wep**, **wpa2**, or **wpa2-mix**. |
| 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. |

Table 122 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

| LABEL | DESCRIPTION |
|---|---|
| 802.11r | This field is available only when you set **Security Mode** to **wpa2** or **wpa2-mix**.<br>Select this to turn on IEEE 802.11r fast roaming on the AP. |
| 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. |
| 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.<br>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 | 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 205 for information on MAC address user accounts.<br>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**.<br>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.<br>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. |

Table 122 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>If MAC authentication fails and captive portal is disabled, the client can log into the network without authentication. |
| Authentication Settings | |
| 802.1X | Select this to enable 802.1x secure authentication. |
| Auth. Method | This field is available only when you set the RADIUS server type to **Internal**.<br>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.<br>If you select **WEP-64**:<br>• Enter 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0x11AA22BB33) for each **Key** used.<br>or<br>• Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for each **Key** used.<br>If you select **WEP-128**:<br>• Enter 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0x00112233445566778899AABBCC) for each **Key** used.<br>or<br>• 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. |
| PSK | Select this option to use a Pre-Shared Key with WPA 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. |
| Cipher Type | Select an encryption cipher type from the list.<br>• **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.<br>• **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.<br>**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. |

Table 122 Configuration > Object > AP Profile > SSID > Security Profile > Add/Edit Security Profile

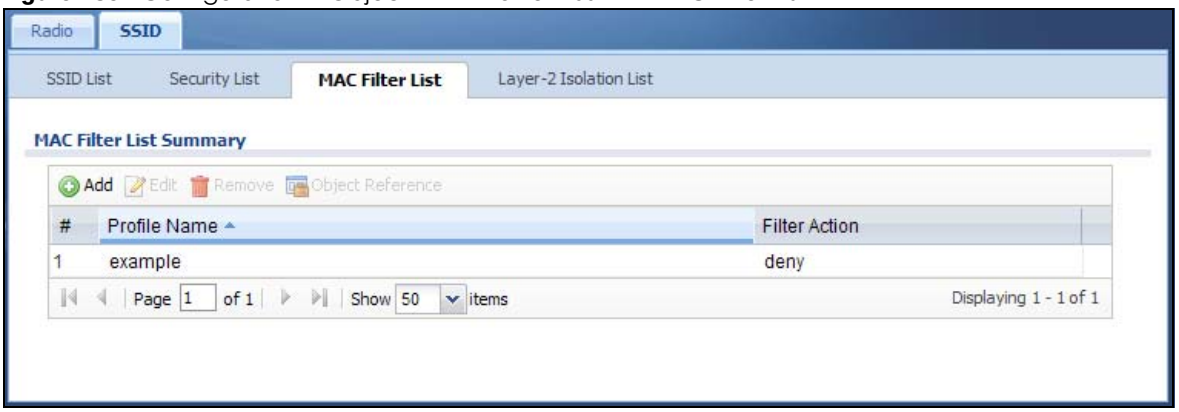
| LABEL | DESCRIPTION |
|---|---|
| Management Frame Protection | This field is available only when you select **wpa2** in the **Security Mode** field and set **Cipher Type** to **aes**.<br><br>Data frames in 802.11 WLANs can be encrypted and authenticated with WEP, WPA or WPA2. But 802.11 management 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.<br><br>Select the check box to enable management frame protection (MFP) to add security to 802.11 management frames.<br><br>Select **Optional** if you do not require the wireless clients to support MFP. Management frames will be encrypted if the clients support MFP.<br><br>Select **Required** and wireless clients must support MFP in order to join the AP's wireless network. |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to exit this screen without saving your changes. |

## 18.3.3 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 139** Configuration > Object > AP Profile > SSID > MAC Filter List




The following table describes the labels in this screen.

Table 123 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 Reference | Click this to view which other objects are linked to the selected MAC filtering profile (for example, SSID profile). |

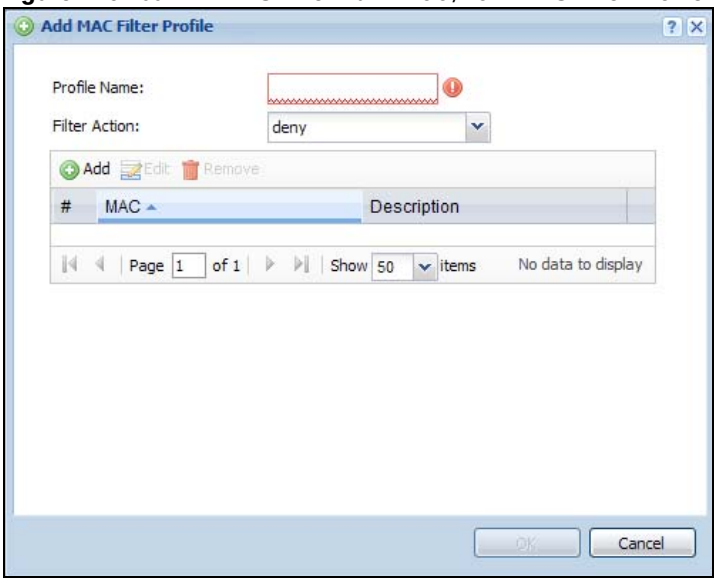
Table 123 Configuration > Object > AP Profile > SSID > MAC Filter List (continued)

| LABEL | DESCRIPTION |
|---|---|
| # | 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). |

### 18.3.3.1 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 140** SSID > MAC Filter List > Add/Edit MAC Filter Profile




The following table describes the labels in this screen.

Table 124 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 and underscores are 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. |

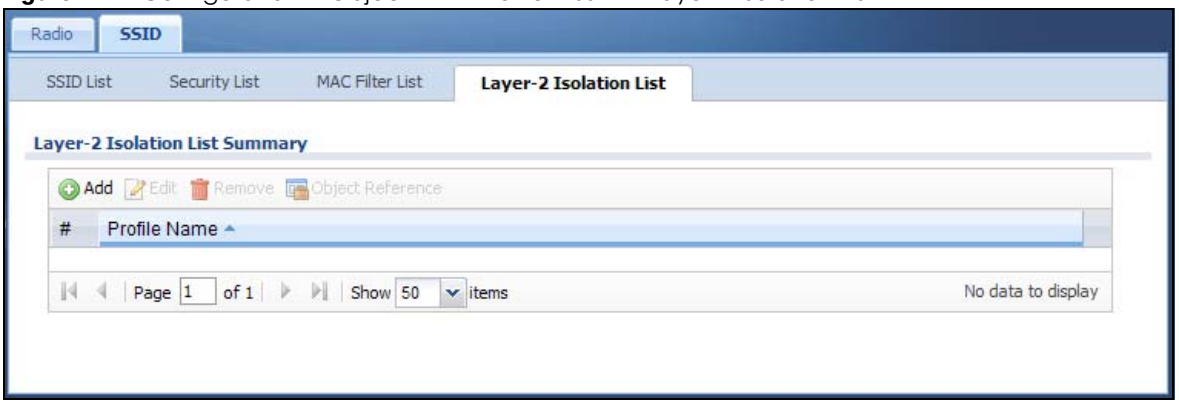
## 18.3.4 Layer-2 Isolation List

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 141** Configuration > Object > AP Profile > SSID > Layer-2 Isolation List




The following table describes the labels in this screen.

Table 125 Configuration > Object > AP Profile > SSID > Layer-2 Isolation List

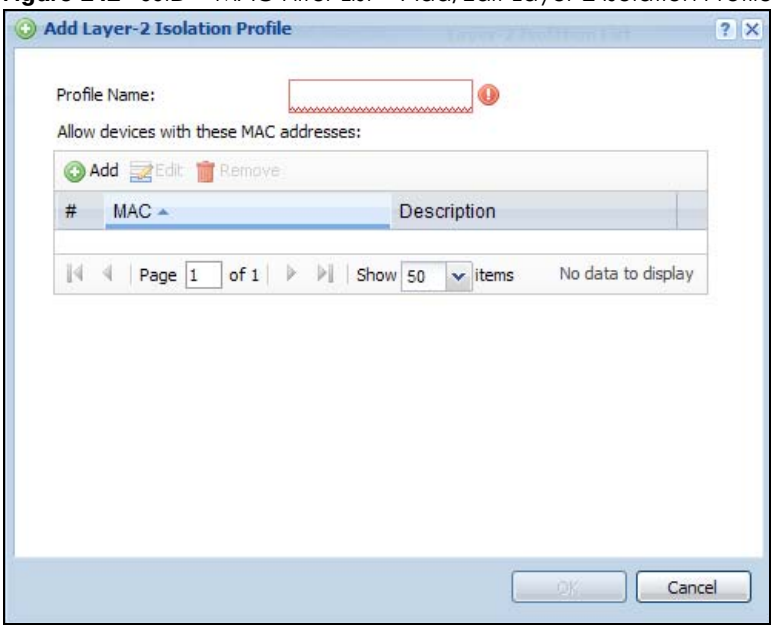
| LABEL | DESCRIPTION |
|---|---|
| Add | Click this to add a new layer-2 isolation profile. |
| Edit | Click this to edit the selected layer-2 isolation profile. |
| Remove | Click this to remove the selected layer-2 isolation profile. |
| Object Reference | Click this to view which other objects are 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. |

### 18.3.4.1 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 142** SSID > MAC Filter List > Add/Edit Layer-2 Isolation Profile




The following table describes the labels in this screen.

Table 126 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 19
# MON Profile

## 19.1 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 MON Mode screen (Section 7.4 on page 114) to classify them as either rogue or friendly and then manage them accordingly.

### 19.1.1 What You Can Do in this Chapter

The **MON Profile** screen (Section 19.2 on page 242) creates preset monitor mode configurations that can be used by the APs.

### 19.1.2 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.

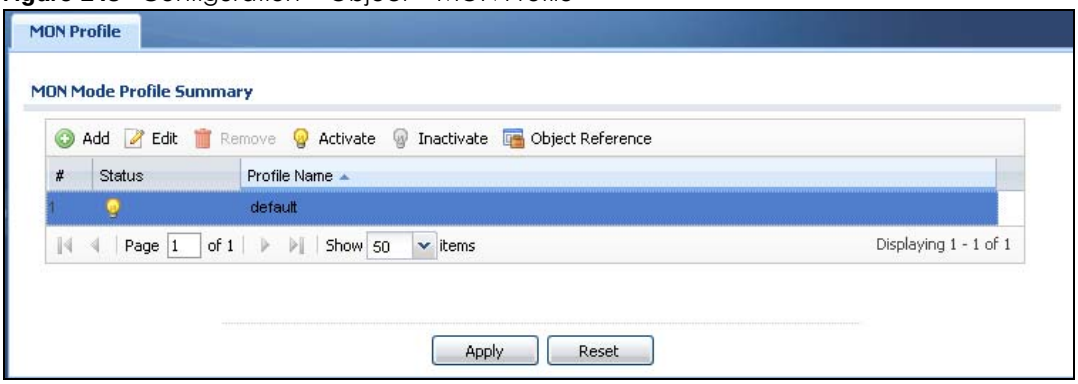
#### Passive Scan

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.

## 19.2 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 143** Configuration > Object > MON Profile




The following table describes the labels in this screen.

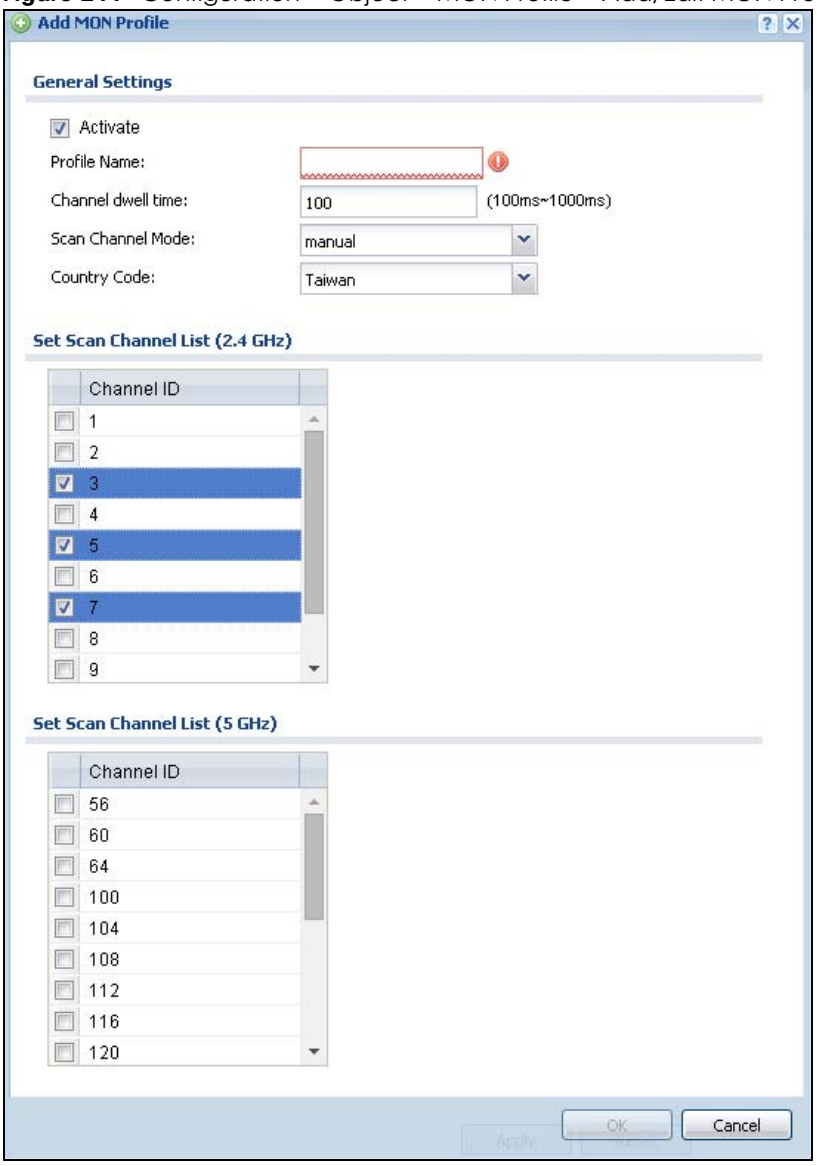
Table 127 Configuration > Object > MON Profile

| 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 Reference | 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. |

## 19.2.1 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 144** Configuration > Object > MON Profile > Add/Edit MON Profile




The following table describes the labels in this screen.

Table 128 Configuration > Object > MON Profile > Add/Edit MON Profile

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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. |

Table 128 Configuration > Object > MON Profile > Add/Edit MON Profile (continued)

| LABEL | DESCRIPTION |
|---|---|
| Country Code | Select the country where the NXC is located/installed.<br>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. |
| 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**.<br>These channels are limited to the 2 GHz range (802.11 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**.<br>These channels are limited to the 5 GHz range (802.11 a/n). |
| OK | Click **OK** to save your changes back to the NXC. |
| Cancel | Click **Cancel** to exit this screen without saving your changes. |

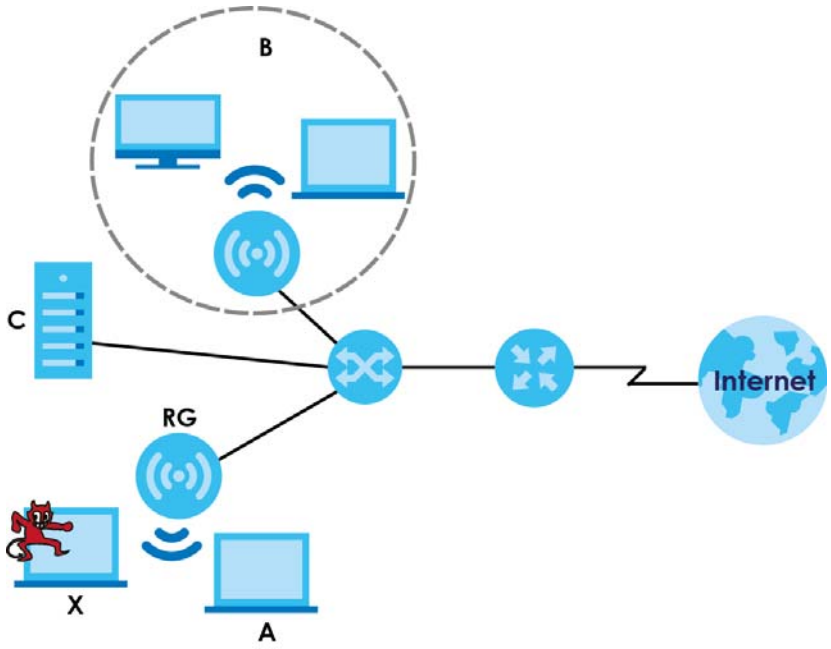
# 19.3 Technical Reference

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 145** 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 20
# ZyMesh Profile

## 20.1 Overview

This chapter shows you how to configure ZyMesh profiles for the NXC to apply to the managed APs.

ZyMesh is a Zyxel-proprietary feature. In a ZyMesh, multiple managed APs form a WDS (Wireless Distribution System) to expand the wireless network and 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.

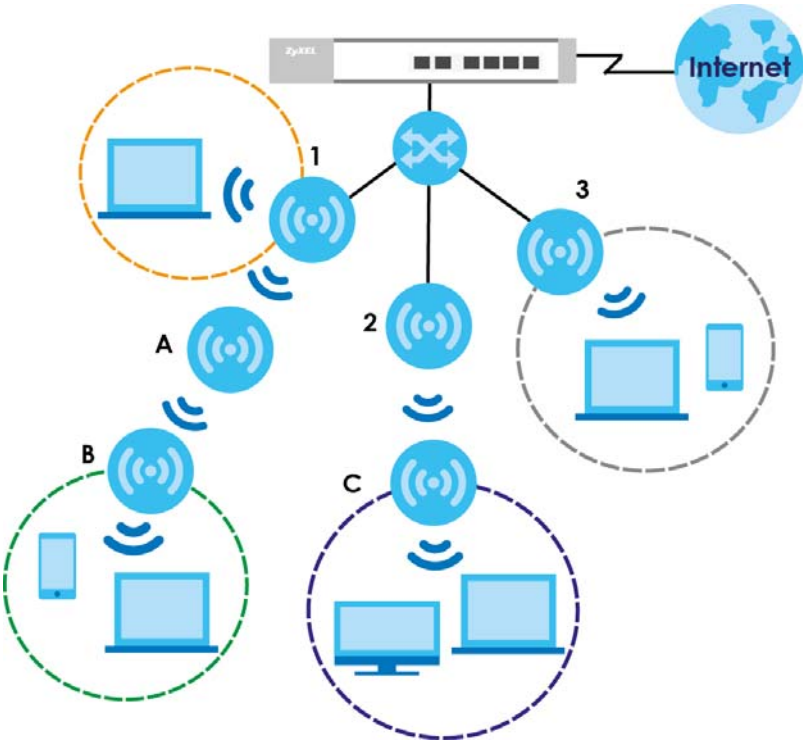
The managed APs in a WDS or ZyMesh must use the same SSID, channel number and pre-shared key. A manged AP can be either a root AP or repeater in a ZyMesh.

Note: All managed APs should be connected to the NXC directly to get the configuration file before being deployed to build a ZyMesh/WDS. Ensure you restart the managed AP after you change its operating mode using the **Configuration > Wireless > AP Management** screen (see Section 7.3 on page 99).

- 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/WDS 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 beteen 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/WDS 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 Etherent cable.

### 20.1.1 What You Can Do in this Chapter

The **ZyMesh Profile** screen (Section 20.2 on page 248) creates preset ZyMesh configurations that can be used by the NXC.

## 20.2 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 146** Configuration > Object > ZyMesh Profile


The following table describes the labels in this screen.

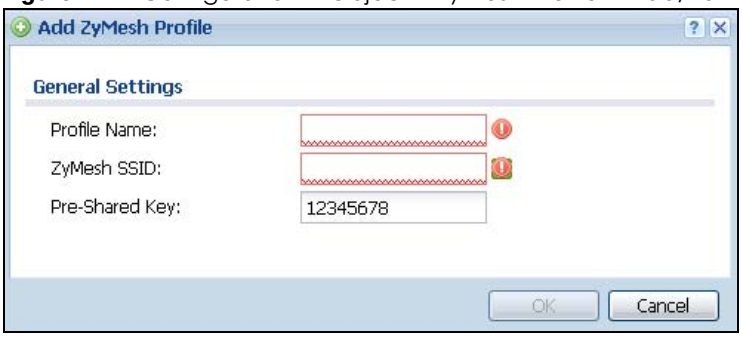
Table 129 Configuration > Object > ZyMesh Profile

| 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.<br>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.<br>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.<br>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. |

## 20.2.1 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 147** Configuration > Object > ZyMesh Profile > Add/Edit ZyMesh Profile




The following table describes the labels in this screen.

Table 130 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.<br><br>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.<br><br>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 21
# Addresses

## 21.1 Overview

Address objects can represent a single IP address or a range of IP addresses.

### 21.1.1 What You Can Do in this Chapter

- The **Address** screen (Section 21.2 on page 251) provides a summary of all addresses in the NXC.
- The **Address Group** summary screen (Section 21.3 on page 253) and the **Address Group Add/Edit** screen maintain address groups in the NXC.

### 21.1.2 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.

## 21.2 Address Summary

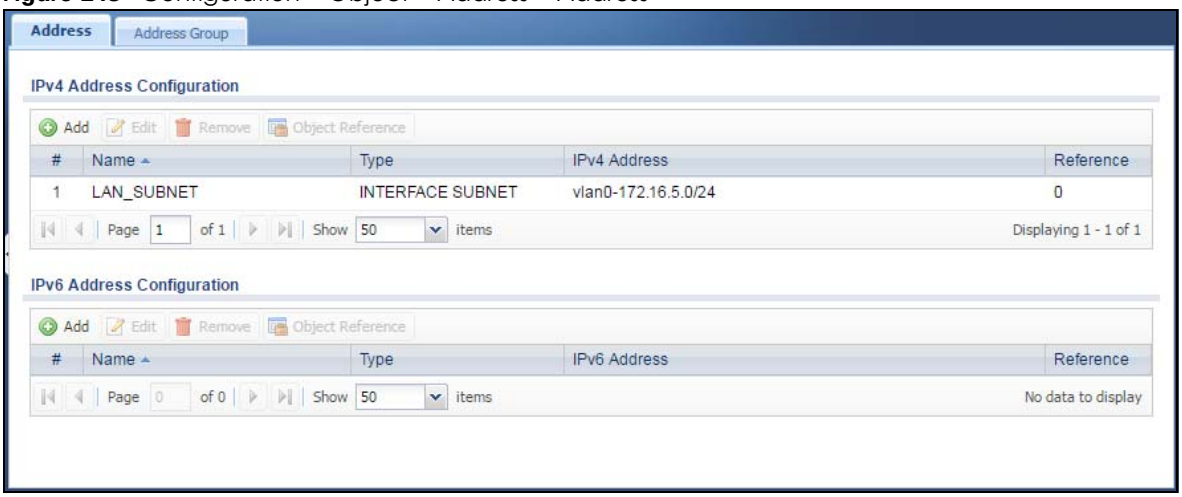
The address screens are used to create, maintain, and remove addresses. There are the types of address objects.

- **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 148** Configuration > Object > Address > Address




The following table describes the labels in this screen.

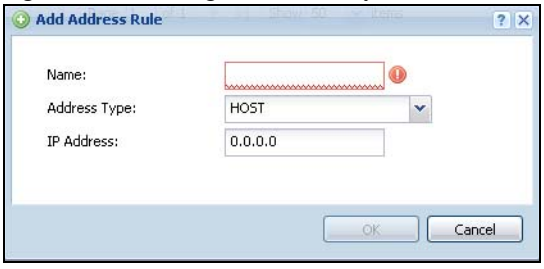
Table 131 Configuration > Object > Address > Address

| 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 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 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. |

## 21.2.1 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 149** Configuration > Object > Address > Address > Add/Edit



The following table describes the labels in this screen.

Table 132 Configuration > Object > Address > Address > Add/Edit

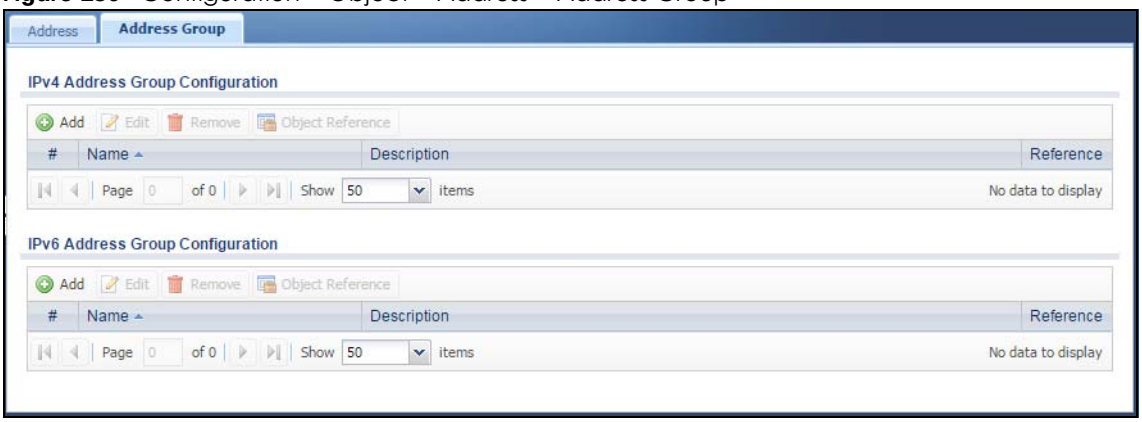
| LABEL | DESCRIPTION |
|---|---|
| Name | Type the name used to refer to the address. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. |
| Address Type | Select the type of address you want to create. Choices are: **HOST**, **RANGE**, **SUBNET**, **INTERFACE IP**, **INTERFACE SUBNET**, and **INTERFACE GATEWAY**.<br><br>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**.<br><br>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**.<br><br>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. |

# 21.3 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 150** Configuration > Object > Address > Address Group




The following table describes the labels in this screen.

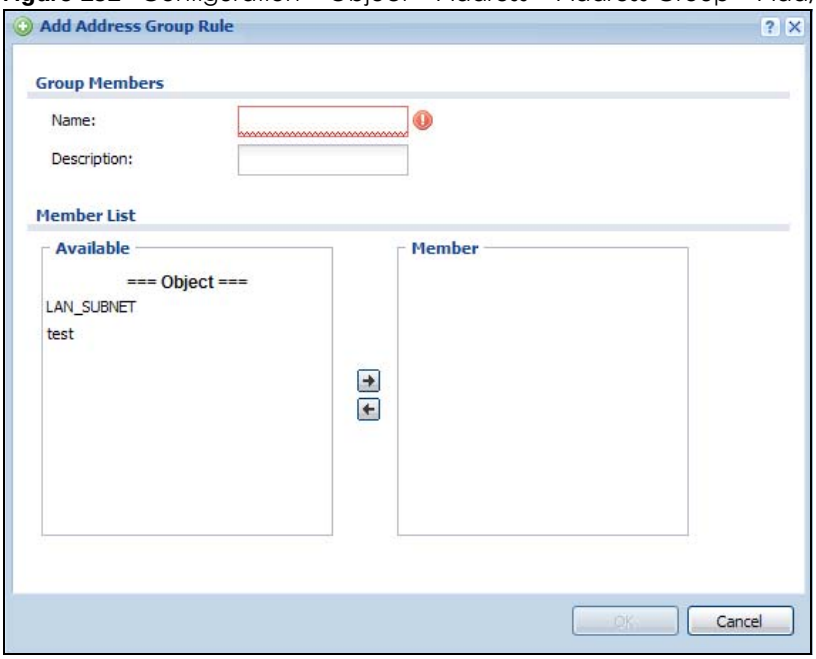
Table 133 Configuration > Object > Address > Address Group

| 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 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 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. |

## 21.3.1 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 151** Configuration > Object > Address > Address Group > Add/Edit




The following table describes the labels in this screen.

Table 134 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.<br>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.<br>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 22
# Services

## 22.1 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.

### 22.1.1 What You Can Do in this Chapter

- The **Service** screens (Section 22.2 on page 257) display and configure the NXC's list of services and their definitions.
- The **Service Group** screens (Section 22.2 on page 257) display and configure the NXC's list of service groups.

### 22.1.2 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.

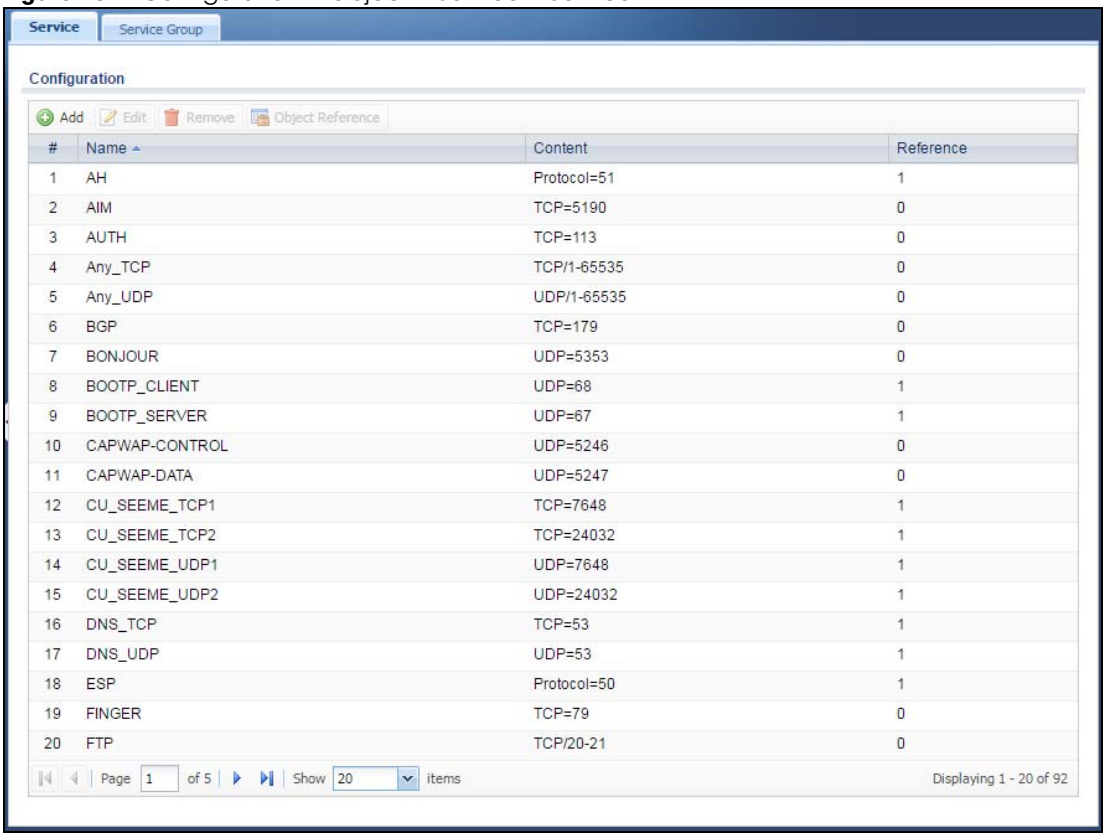
Use service groups when you want to create the same rule for several services, instead of creating separate rules for each service. Service groups may consist of services and other service groups. The sequence of members in the service group is not important.

## 22.2 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 152** Configuration > Object > Service > Service



The following table describes the labels in this screen.

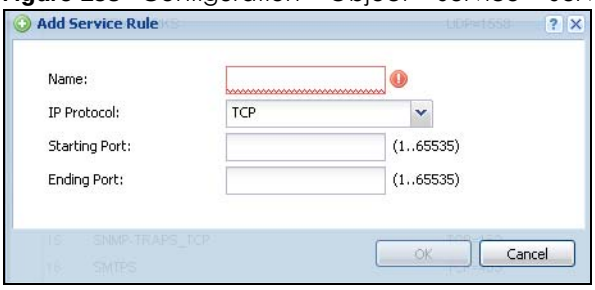
Table 135 Configuration > Object > Service > Service

| 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 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 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. |

## 22.2.1 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 153** Configuration > Object > Service > Service > Add/Edit




The following table describes the labels in this screen.

Table 136 Configuration > Object > Service > Service > Add/Edit

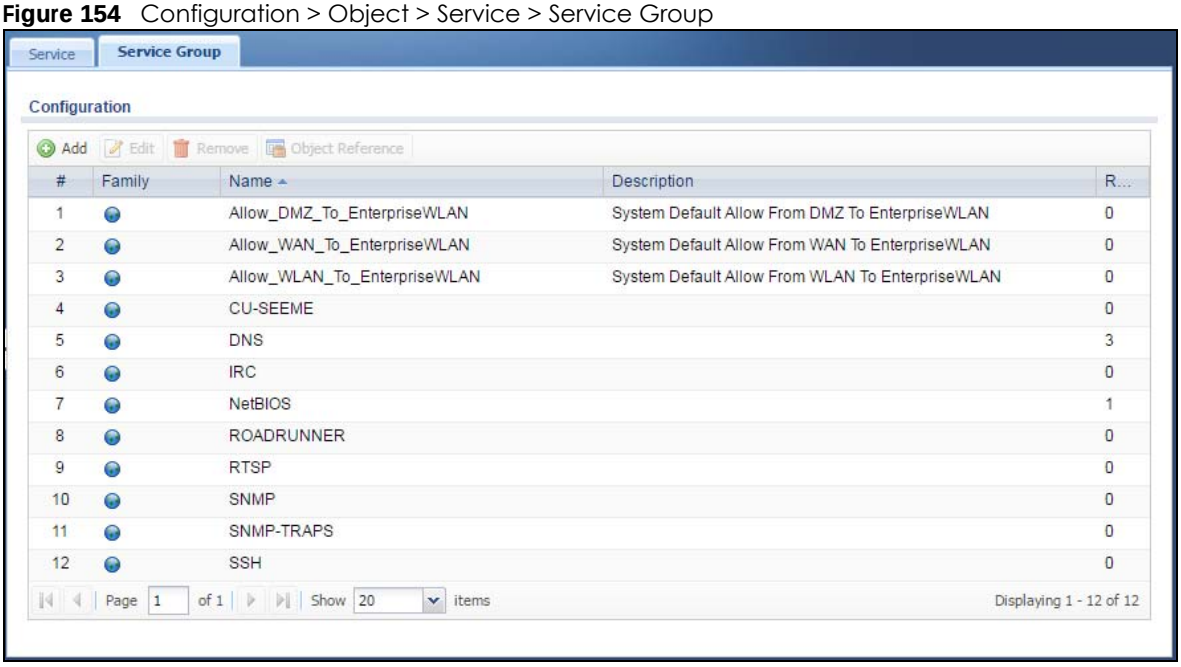
| LABEL | DESCRIPTION |
|---|---|
| Name | Type the name used to refer to the service. You may use 1-31 alphanumeric characters, underscores(_), or dashes (-), but the first character cannot be a number. This value is case-sensitive. |
| IP Protocol | Select the protocol the service uses. Choices are: **TCP**, **UDP**, **ICMP**, **ICMPv6** and **User Defined**. |
| Starting Port<br><br>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**.<br><br>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**.<br><br>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. |

# 22.3 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 154** Configuration > Object > Service > Service Group




The following table describes the labels in this screen.

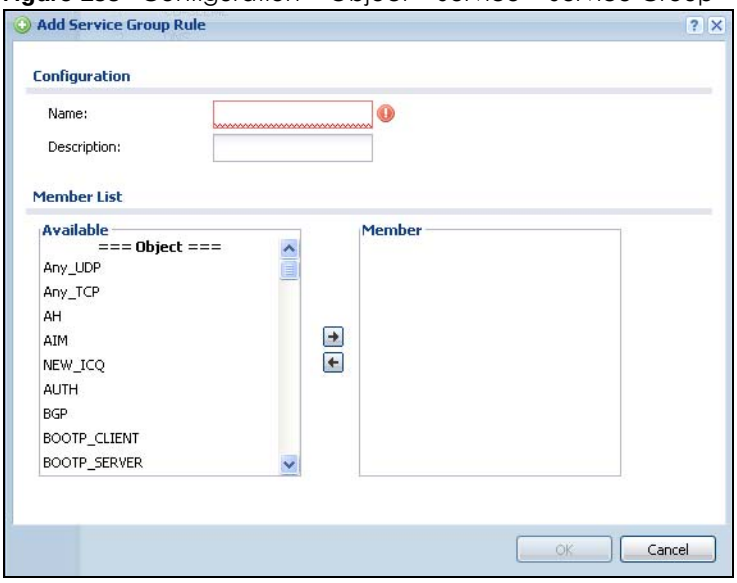
Table 137 Configuration > Object > Service > Service Group

| 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 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 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. |

## 22.3.1 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 155** Configuration > Object > Service > Service Group > Add/Edit




The following table describes the labels in this screen.

Table 138 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.<br><br>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.<br><br>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
# Schedules

## 23.1 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.

### 23.1.1 What You Can Do in this Chapter

- The **Schedule** screen (Section 23.2 on page 261) displays a list of all schedules in the NXC.
- The **One-Time Schedule Add/Edit** screen (Section 23.2.1 on page 263) creates or edits a one-time schedule.
- The **Recurring Schedule Add/Edit** screen (Section 23.2.2 on page 264) creates or edits a recurring schedule.

### 23.1.2 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.

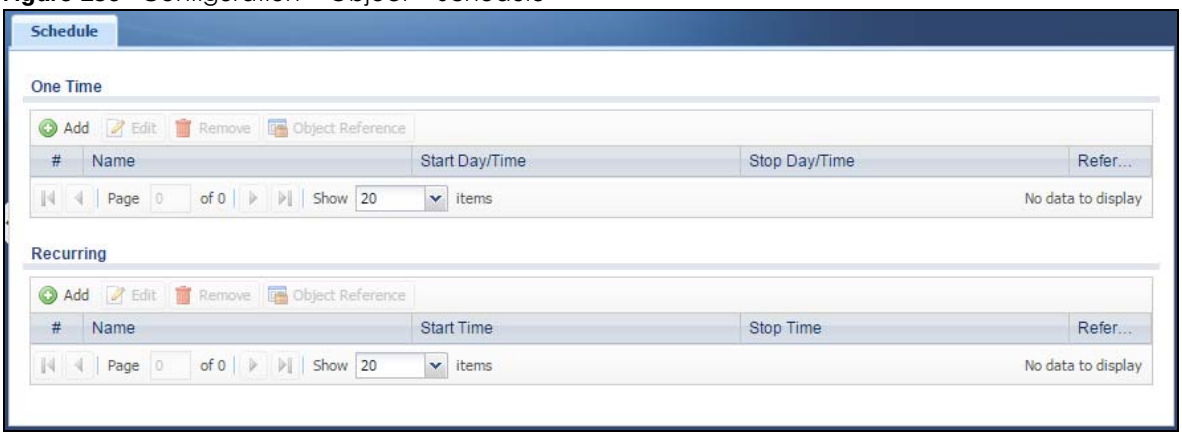
#### Recurring Schedules

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.

## 23.2 Schedule Summary

The **Schedule** summary screen provides a summary of all schedules in the NXC. To access this screen, click **Configuration > Object** > **Schedule**.

**Figure 156** Configuration > Object > Schedule




The following table describes the labels in this screen.

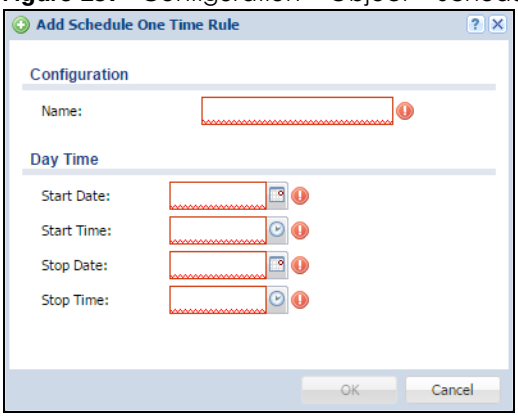
Table 139 Configuration > Object > Schedule

| 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 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 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 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 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. |

## 23.2.1 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 157** Configuration > Object > Schedule > Add/Edit (One-Time)




The following table describes the labels in this screen.

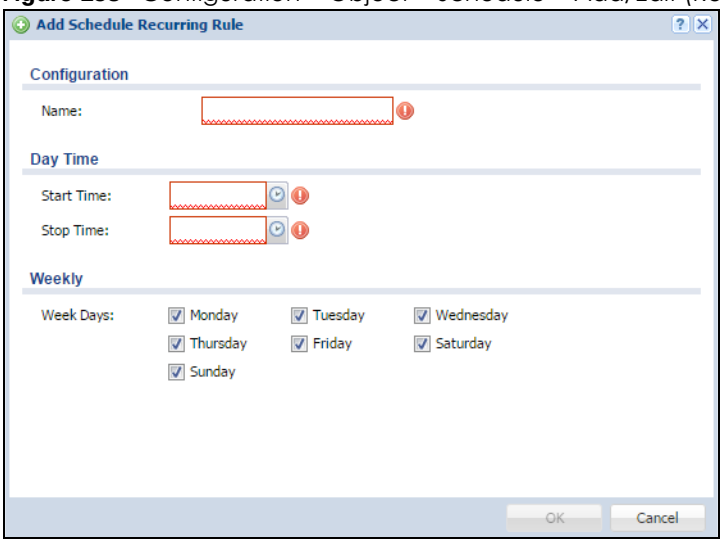
Table 140 Configuration > Object > Schedule > Add/Edit (One-Time)

| 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.<br>**Year** - 1900 - 2999<br>**Month** - 1 - 12<br>**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.<br>**Hour** - 0 - 23<br>**Minute** - 0 - 59 |
| Stop Date | Specify the year, month, and day when the schedule ends.<br>**Year** - 1900 - 2999<br>**Month** - 1 - 12<br>**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.<br>**Hour** - 0 - 23<br>**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. |

## 23.2.2 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 158** 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 141 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.<br>**Hour** - 0 - 23<br>**Minute** - 0 - 59 |
| Stop Time | Specify the hour and minute when the schedule ends each day.<br>**Hour** - 0 - 23<br>**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 24
# AAA Server

## 24.1 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.

### 24.1.1 What You Can Do in this Chapter

- The **Active Directory** / **LDAP** screens (Section 24.2 on page 268) configure Active Directory or LDAP server objects.
- The **RADIUS** screen (Section 24.3 on page 273) configures the default external RADIUS server to use for user authentication.

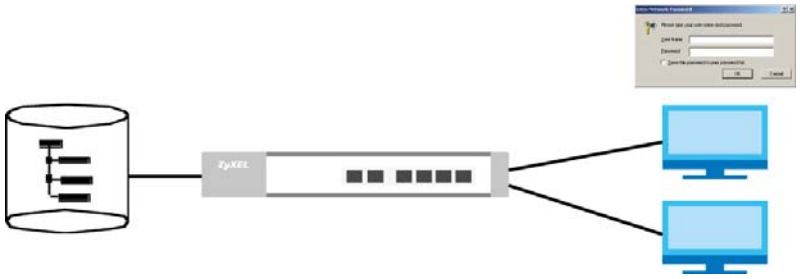
### 24.1.2 What You Need To Know

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 159** Example: Directory Service Client and Server



The following describes the user authentication procedure via an LDAP/AD server.

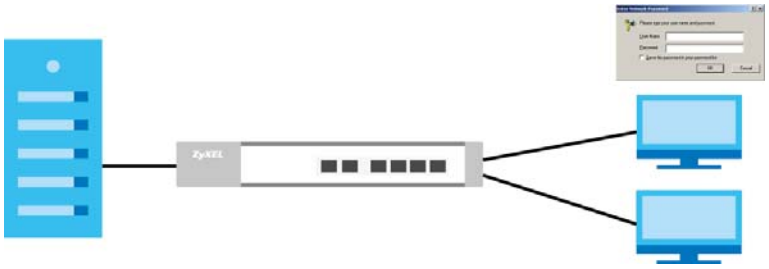
1. A user logs in with a user name and password pair.
2. The NXC tries to bind (or log in) to the LDAP/AD server.
3. When the binding process is successful, the NXC checks the user information in the directory against the user name and password pair.

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 160** RADIUS Server Network Example



## Authentication Capability List

This list displays the NXC's authentication capabilities:

Table 142 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

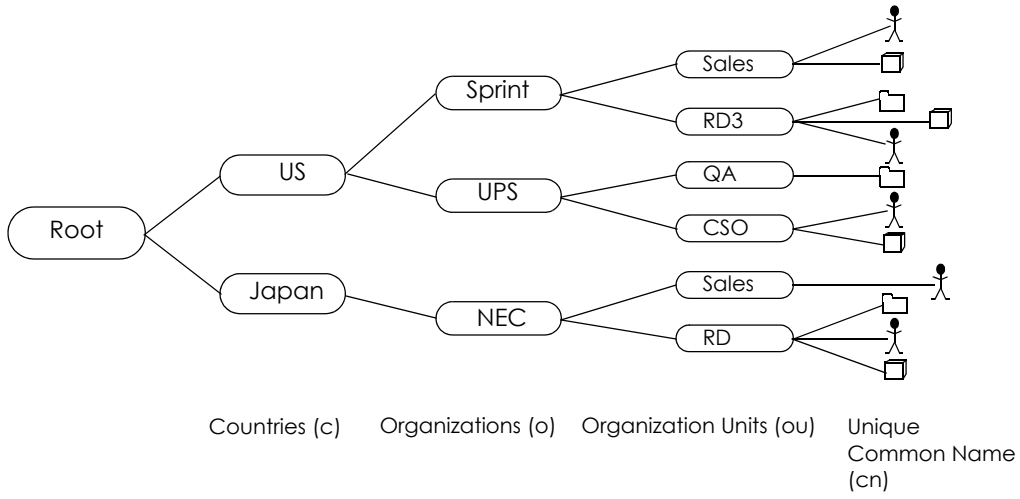
  RADIUS (Remote Authentication Dial-In User Service) authentication is a popular protocol used to authenticate users by means of an external or built-in RADIUS server. RADIUS authentication allows you to validate a large number of users from a central location.

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 161** 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.

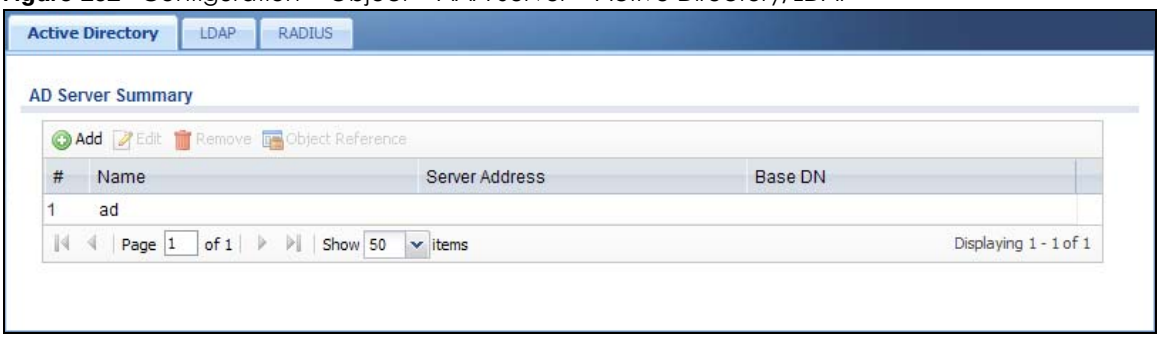
## 24.2 Active Directory / LDAP

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 162** Configuration > Object > AAA Server > Active Directory/LDAP




The following table describes the labels in this screen.

Table 143 Configuration > Object > AAA Server > Active Directory/LDAP

| 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 Reference | Select an entry and click **Object Reference** 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 143 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`. |

## 24.2.1 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 163** Configuration > Object > AAA Server > Active Directory > Add/Edit

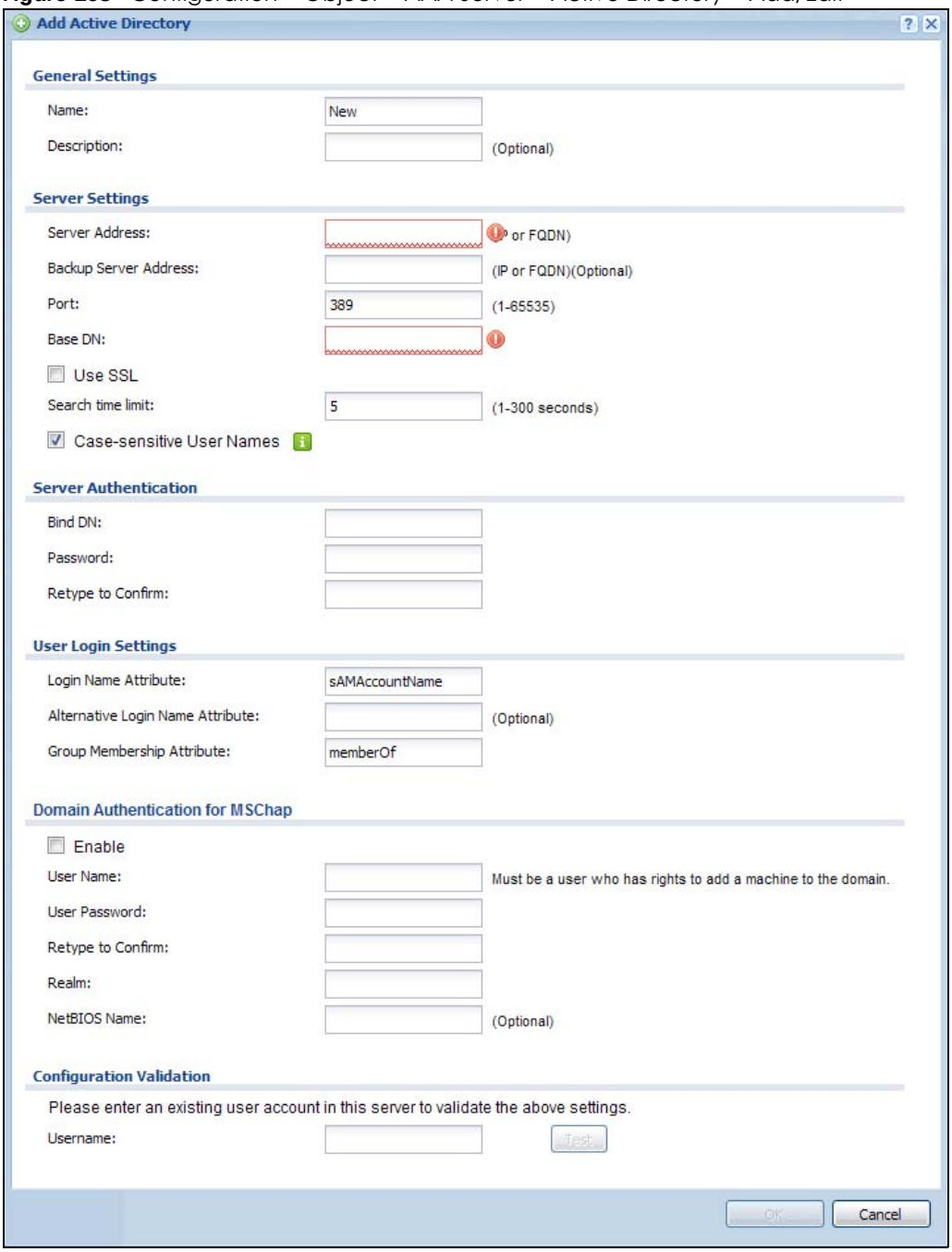
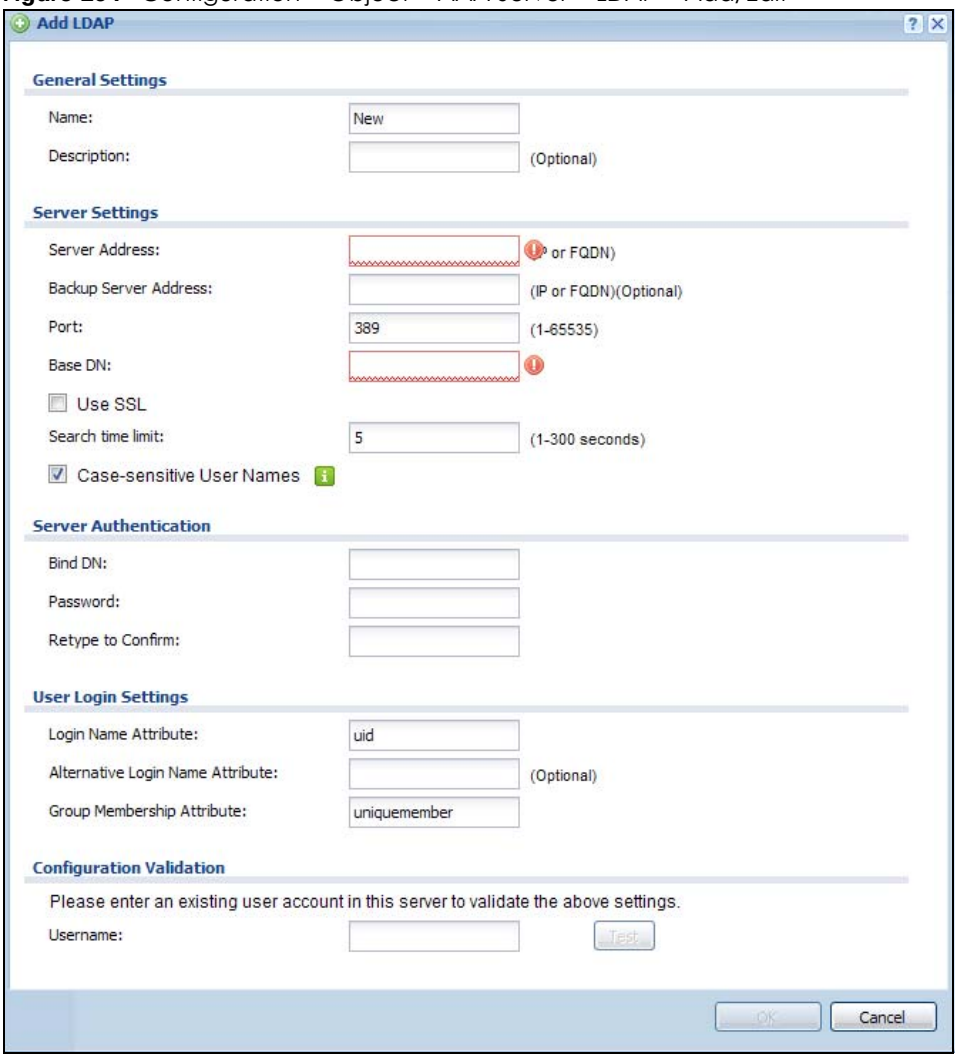


**Figure 164** Configuration > Object > AAA Server > LDAP > Add/Edit




The following table describes the labels in these screens.

Table 144 Configuration > Object > AAA Server > Active Directory (or LDAP) > Add/Edit

| LABEL | DESCRIPTION |
|---|---|
| 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 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.<br><br>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). |

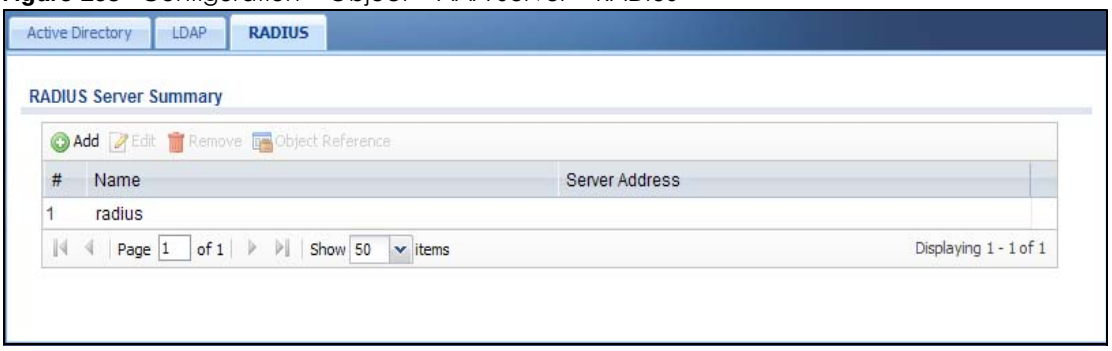
Table 144 Configuration > Object > AAA Server > Active Directory (or LDAP) > Add/Edit (continued)

| 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.<br>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. |
| Bind DN | Specify the bind DN for logging into the AD or LDAP server. Enter up to 127 alphanumerical characters.<br>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. |
| 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.<br>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". |
| 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.<br>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.<br>Note: This is only for **Active Directory**. |
| User Password | Enter the password for the associated user name.<br>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).<br>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.<br>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**. |
| OK | Click **OK** to save the changes. |
| Cancel | Click **Cancel** to discard the changes. |

# 24.3 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 165** Configuration > Object > AAA Server > RADIUS




The following table describes the labels in this screen.

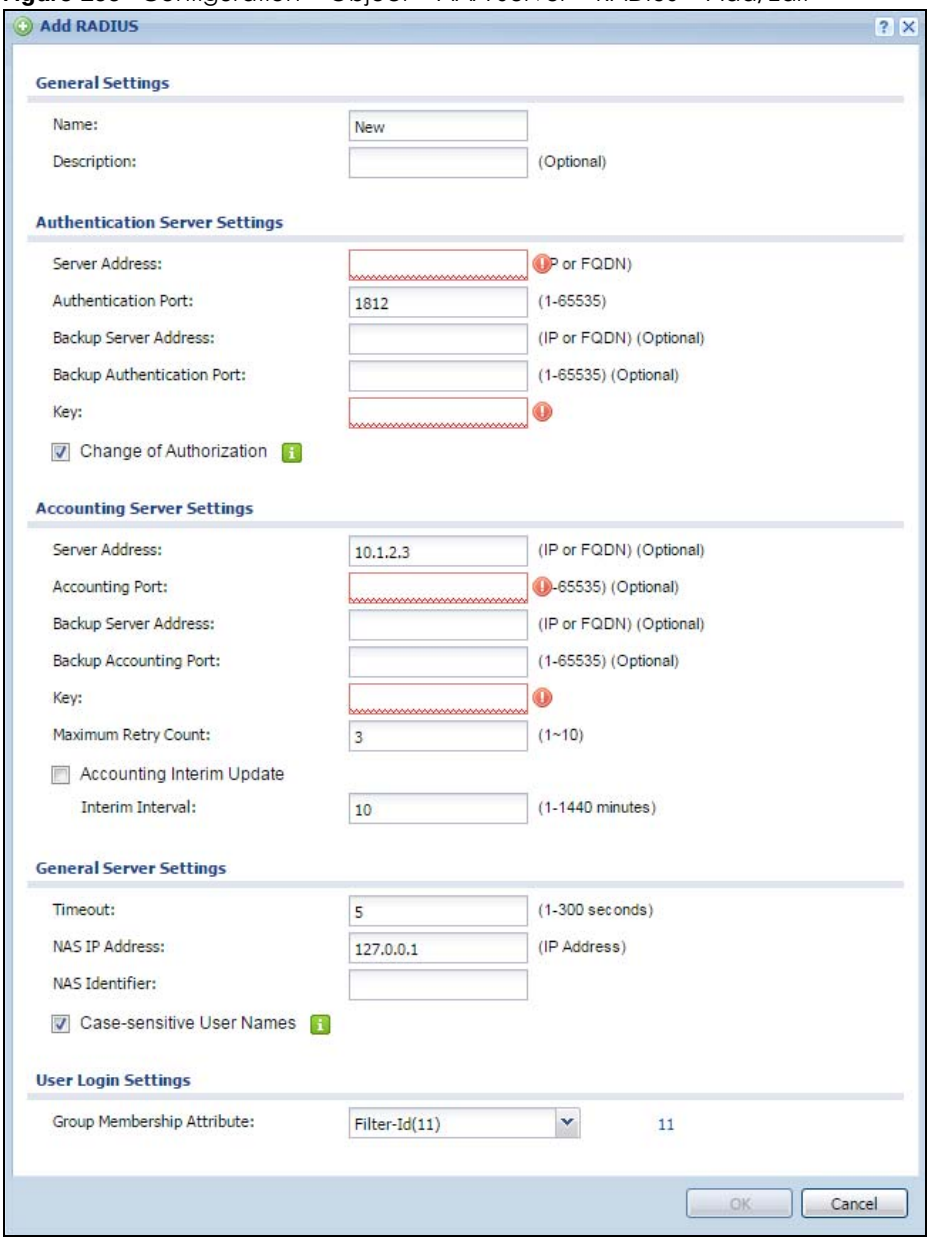
Table 145 Configuration > Object > AAA Server > RADIUS

| 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 Reference | Select an entry and click **Object Reference** 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. |

## 24.3.1 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 166** Configuration > Object > AAA Server > RADIUS > Add/Edit




The following table describes the labels in this screen.

Table 146 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 146 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 15 alphanumeric characters) as the key to be shared between the external authentication server and the NXC.<br>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.<br>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 15 alphanumeric characters) as the key to be shared between the external authentication server and the NXC.<br>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.<br>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.<br>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.<br>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.<br>Search timeout occurs when either the user information is not in the RADIUS server or the RADIUS server is down. |

Table 146 Configuration > Object > AAA Server > RADIUS > Add/Edit (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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.<br><br>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.<br><br>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 25
# Authentication Method

## 25.1 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.

### 25.1.1 What You Can Do in this Chapter

The **Auth. Method** screens (Section 25.2 on page 277) create and manage authentication method objects.

### 25.1.2 Before You Begin

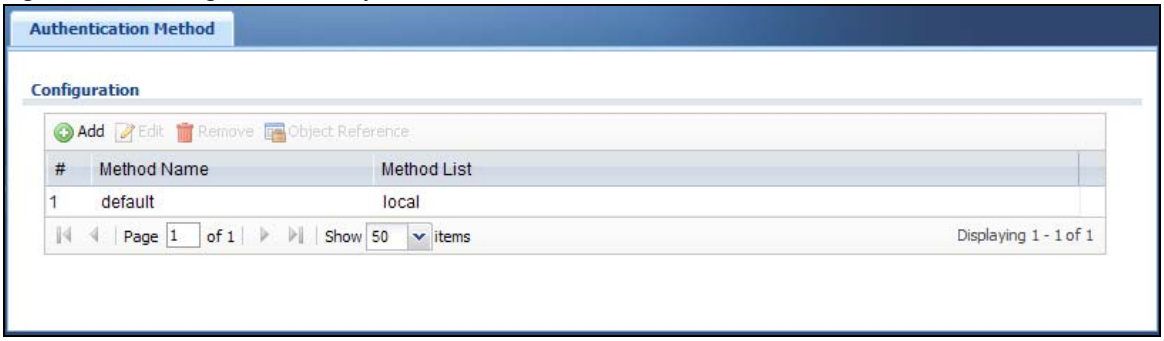
Configure AAA server objects before you configure authentication method objects.

## 25.2 Authentication Method

Click **Configuration > Object > Auth. Method** to display this screen.

Note: You can create up to 16 authentication method objects.

**Figure 167** Configuration > Object > Auth. Method



The following table describes the labels in this screen.

Table 147 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 Reference | Select an entry and click **Object Reference** 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. |

## 25.2.1 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".

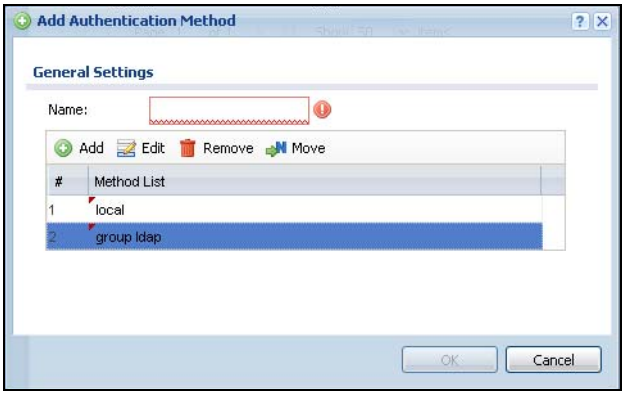
4 Click **Add** to insert an authentication method in the table.

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 148 Configuration > Object > Auth. Method > Add

| LABEL | DESCRIPTION |
|---|---|
| Name | Specify a descriptive name for identification purposes.<br><br>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.<br><br>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.<br><br>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.<br><br>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 26
# Certificates

## 26.1 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.

### 26.1.1 What You Can Do in this Chapter

- The **My Certificate** screens (Section 26.2 on page 283) generate and export self-signed certificates or certification requests and import the NXC's CA-signed certificates.
- The **Trusted Certificates** screens (Section 26.3 on page 291) 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.

### 26.1.2 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.

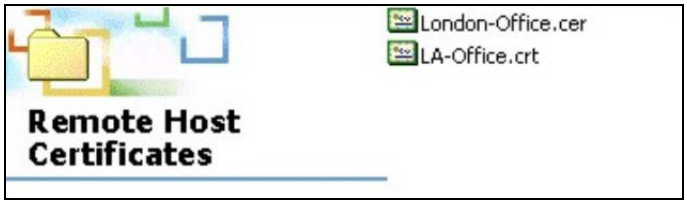
Note: Be careful not to convert a binary file to text during the transfer process. It is easy for this to occur since many programs use text files by default.

## 26.1.3 Verifying a Certificate

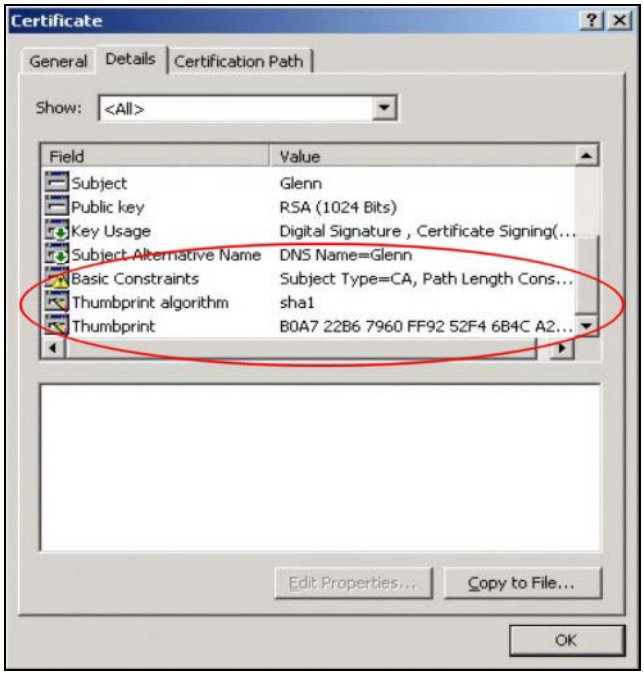
Before you import a trusted certificate into the NXC, you should verify that you have the correct certificate. You can do this using the certificate's fingerprint. A certificate's fingerprint is a message digest calculated using the MD5 or SHA1 algorithm. The following procedure describes how to check 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.

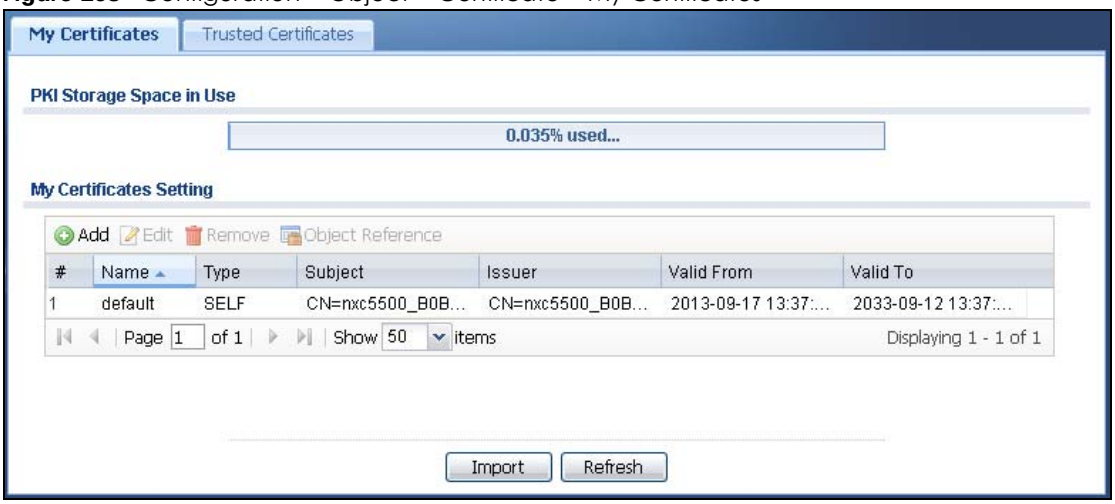



4 Use a secure method to verify that the certificate owner has the same information in the **Thumbprint Algorithm** and **Thumbprint** fields. The secure method may very based on your situation. Possible examples would be over the telephone or through an HTTPS connection.

# 26.2 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 168** Configuration > Object > Certificate > My Certificates




The following table describes the labels in this screen.

Table 149 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. |
| 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 Reference | You cannot delete certificates that any of the NXC's features are configured to use. Select an entry and click **Object Reference** 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.<br>**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.<br>**SELF** represents a self-signed certificate.<br>**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. |

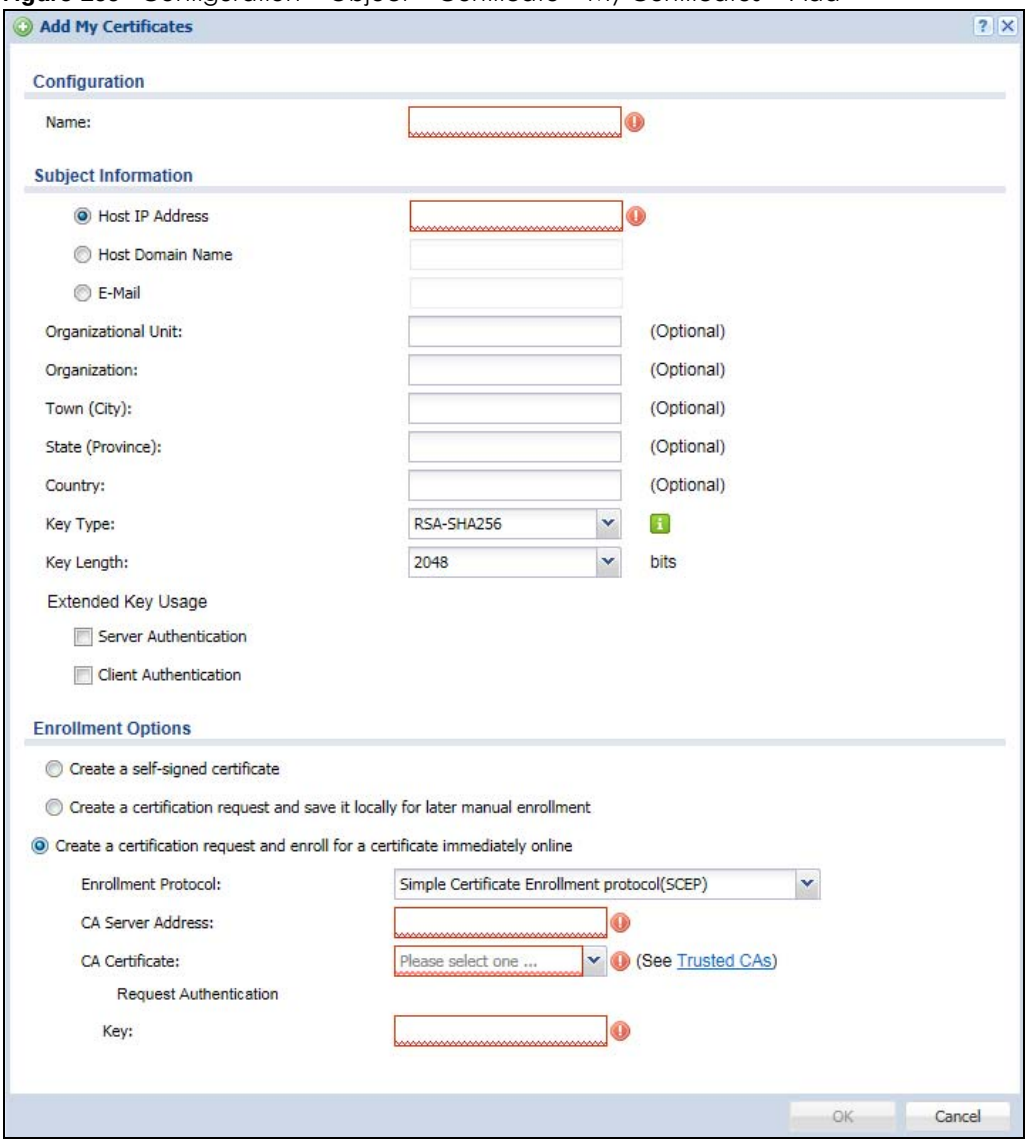
Table 149 Configuration > Object > Certificate > My Certificates (continued)

| 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. |

## 26.2.1 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 169** Configuration > Object > Certificate > My Certificates > Add




The following table describes the labels in this screen.

Table 150 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. |

Table 150 Configuration > Object > Certificate > My Certificates > Add (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br><br>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.<br><br>A domain name can be up to 255 characters. You can use alphanumeric characters, the hyphen and periods.<br><br>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.<br><br>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.<br><br>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.<br><br>Copy the certification request from the **My Certificate Details** screen and then send it to the certification authority. |

Table 150 Configuration > Object > Certificate > My Certificates > Add (continued)

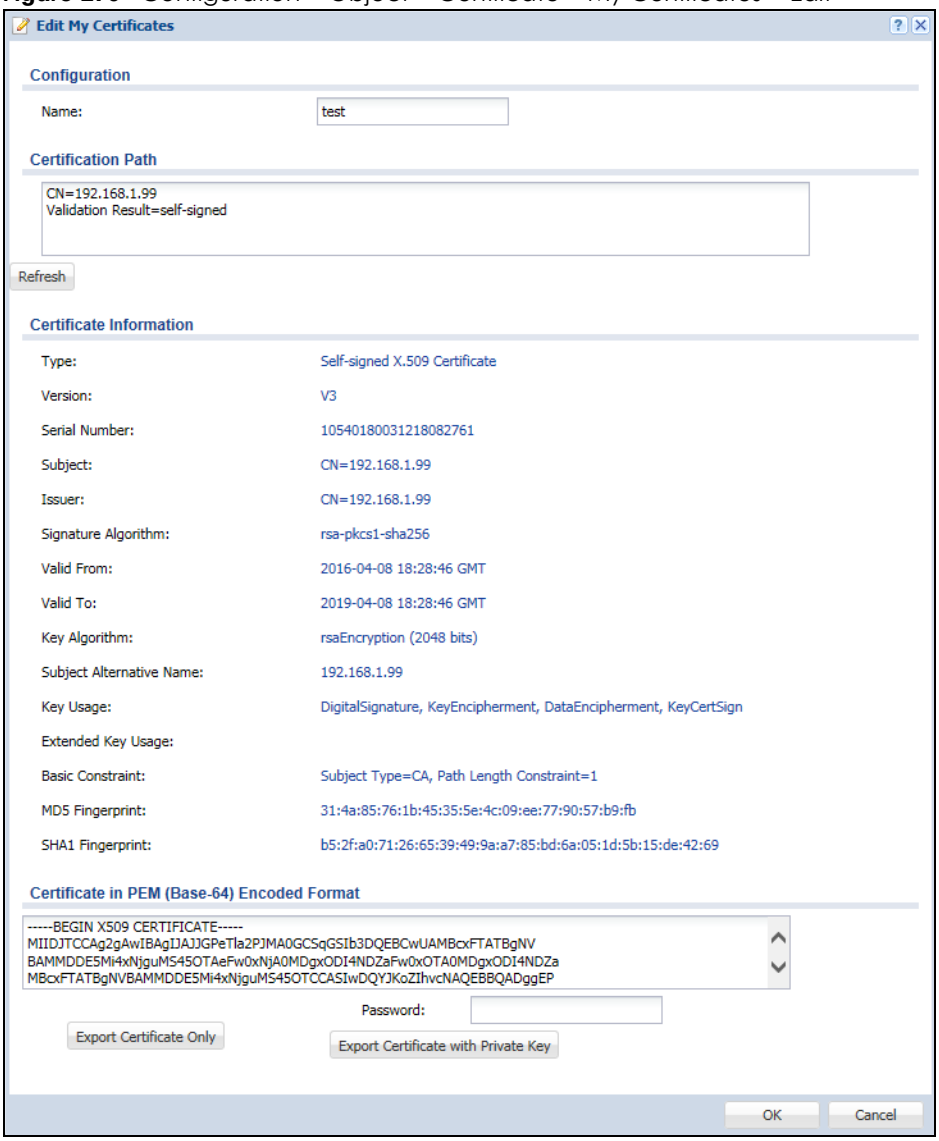
| LABEL | DESCRIPTION |
|---|---|
| Create a certification request and enroll for a certificate immediately online | Select this to have the NXC generate a request for a certificate and apply to a certification authority for a certificate.<br>You must have the certification authority's certificate already imported in the **Trusted Certificates** screen.<br>When you select this option, you must select the certification authority's enrollment protocol and the certification authority's certificate from the drop-down list boxes and enter the certification authority's server address. You also need to fill in the **Reference Number** and **Key** if the certification authority requires them. |
| Enrollment Protocol | This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Select the certification authority's enrollment protocol from the drop-down list box.<br>**Simple Certificate Enrollment Protocol (SCEP)** is a TCP-based enrollment protocol that was developed by VeriSign and Cisco.<br>**Certificate Management Protocol (CMP)** is a TCP-based enrollment protocol that was developed by the Public Key Infrastructure X.509 working group of the Internet Engineering Task Force (IETF) and is specified in RFC 2510. |
| CA Server Address | This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Enter the IP address (or URL) of the certification authority server.<br>For a URL, you can use up to 511 of the following characters. a-zA-Z0-9'()+,/:.=?;!*#@$_%- |
| CA Certificate | This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Select the certification authority's certificate from the **CA Certificate** drop-down list box.<br>You must have the certification authority's certificate already imported in the **Trusted Certificates** screen. Click **Trusted CAs** to go to the **Trusted Certificates** screen where you can view (and manage) the NXC's list of certificates of trusted certification authorities. |
| Request Authentication | When you select **Create a certification request and enroll for a certificate immediately online**, the certification authority may want you to include a reference number and key to identify you when you send a certification request.<br>Fill in both the **Reference Number** and the **Key** fields if your certification authority uses the CMP enrollment protocol. Just the **Key** field displays if your certification authority uses the SCEP enrollment protocol.<br>For the reference number, use 0 to 99999999.<br>For the key, use up to 31 of the following characters. a-zA-Z0-9; \| `~!@#$%^&*()_+\{}':,./<>=- |
| OK | Click **OK** to begin certificate or certification request generation. |
| Cancel | Click **Cancel** to quit and return to the **My Certificates** screen. |

If you configured the **My Certificate Create** screen to have the NXC enroll a certificate and the certificate enrollment is not successful, you see a screen with a **Return** button that takes you back to the **My Certificate Create** screen. Click **Return** and check your information in the **My Certificate Create** screen. Make sure that the certification authority information is correct and that your Internet connection is working properly if you want the NXC to enroll a certificate online.

## 26.2.2 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 170** Configuration > Object > Certificate > My Certificates > Edit




The following table describes the labels in this screen.

Table 151 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.<br><br>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).<br><br>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. |

Table 151 Configuration > Object > Certificate > My Certificates > Edit

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>With self-signed certificates, this is the same as the **Subject Name** field.<br>"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. |
| 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.<br>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.<br>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**. |

Table 151 Configuration > Object > Certificate > My Certificates > Edit

| LABEL | DESCRIPTION |
|---|---|
| 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. |

## 26.2.3 Importing Certificates

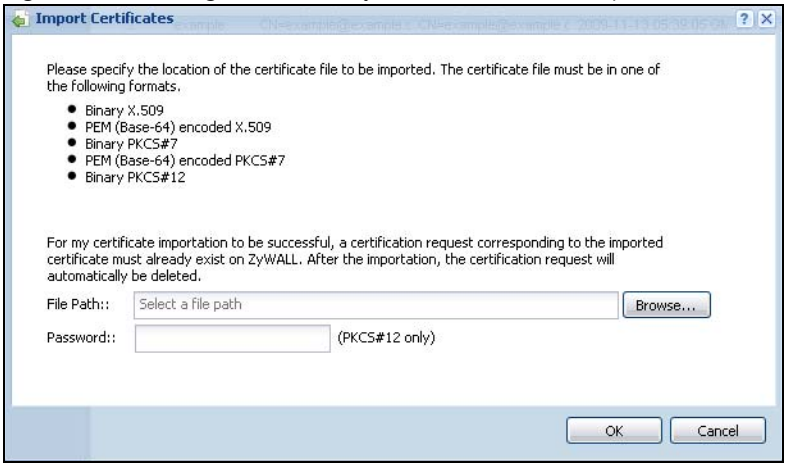
Click **Configuration > Object > Certificate > My Certificates > Import** to open the **My Certificate Import** screen. Follow the instructions in this screen to save an existing certificate to the NXC.

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 171** Configuration > Object > Certificate > My Certificates > Import




The following table describes the labels in this screen.

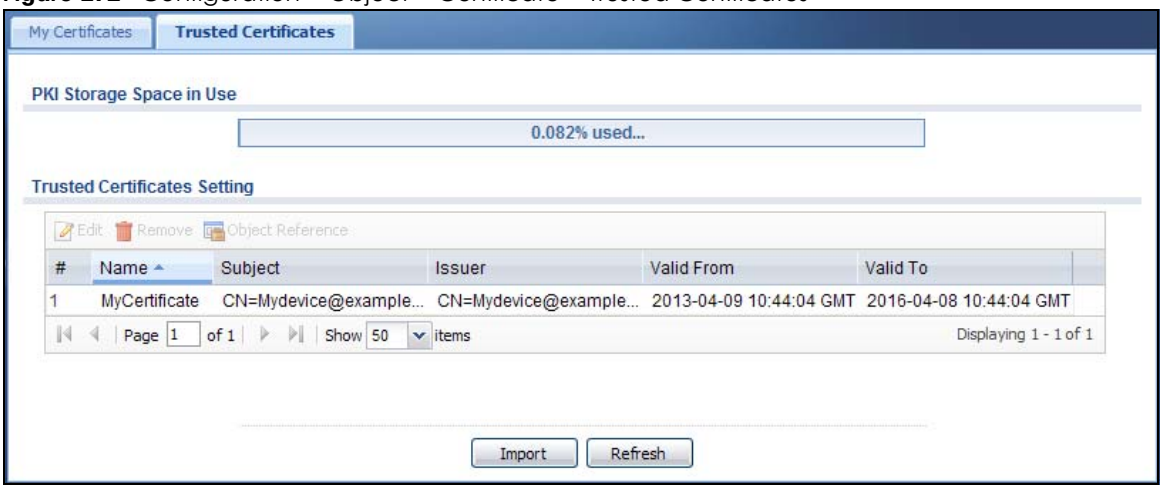
Table 152 Configuration > Object > Certificate > My Certificates > Import

| LABEL | DESCRIPTION |
|---|---|
| File Path | Type in the location of the file you want to upload in this field or click **Browse** to find it.<br><br>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. |

# 26.3 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 172** Configuration > Object > Certificate > Trusted Certificates




The following table describes the labels in this screen.

Table 153 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 Reference | You cannot delete certificates that any of the NXC's features are configured to use. Select an entry and click **Object Reference** 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. |

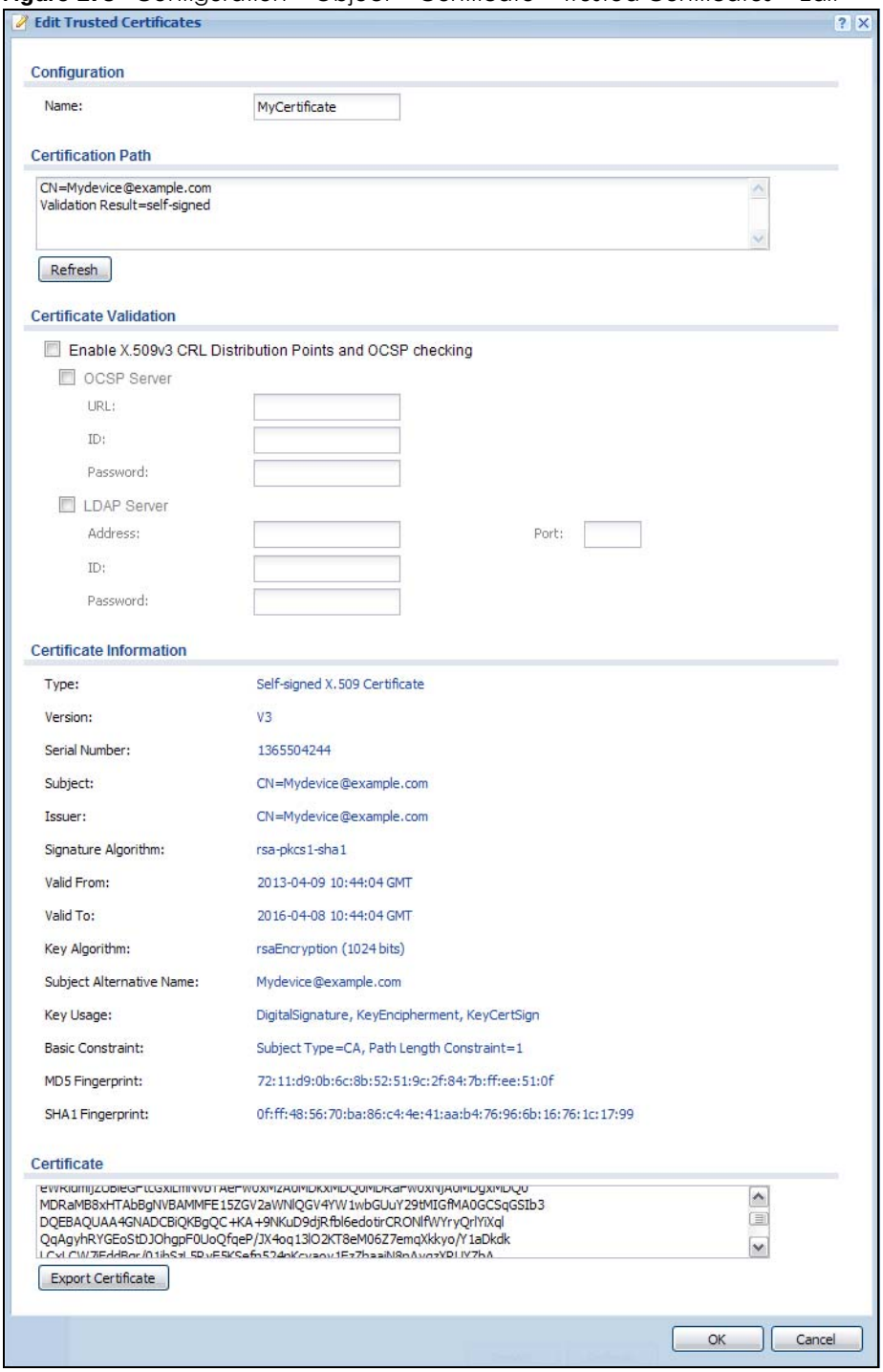
Table 153 Configuration > Object > Certificate > Trusted Certificates (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |

## 26.3.1 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 173** Configuration > Object > Certificate > Trusted Certificates > Edit



The following table describes the labels in this screen.

Table 154 Configuration > Object > Certificate > Trusted Certificates > Edit

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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.<br>With self-signed certificates, this is the same information as in the **Subject Name** field. |
| 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). |

Table 154 Configuration > Object > Certificate > Trusted Certificates > Edit (continued)

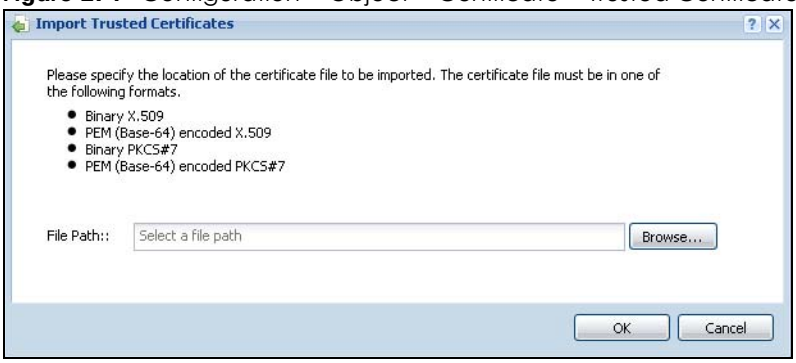
| LABEL | DESCRIPTION |
|---|---|
| Valid From | This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable. |
| Valid To | This field displays the date that the certificate expires. 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.<br>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. |

## 26.3.2 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 174** Configuration > Object > Certificate > Trusted Certificates > Import




The following table describes the labels in this screen.

Table 155 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.<br>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. |

# 26.4 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 27
# DHCPv6

## 27.1 Overview

This chapter describes how to configure DHCPv6 request type objects.

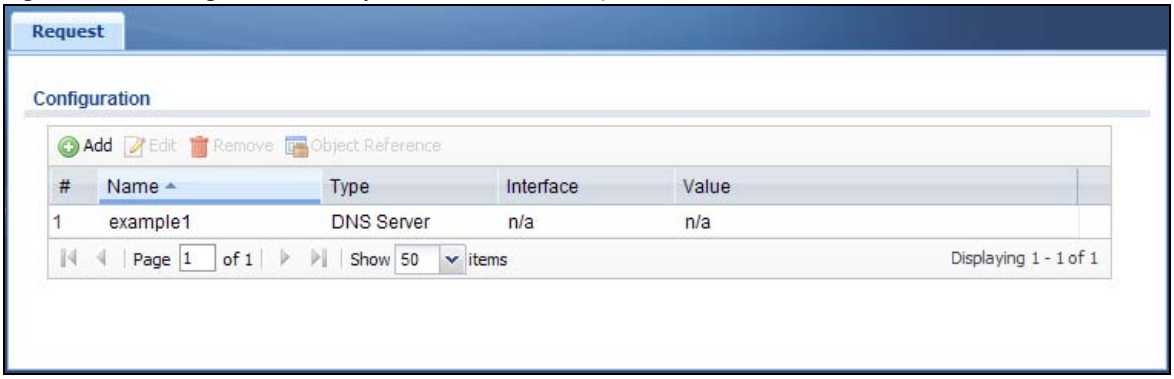
### 27.1.1 What You Can Do in this Chapter

The **Request** screen (Section 27.2 on page 297) allows you to configure DHCPv6 request type objects.

## 27.2 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 175** Configuration > Object > DHCPv6 > Request




The following table describes the labels in this screen.

Table 156 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.<br><br>Note: You cannot delete an entry which is in use. |
| Object Reference | Select an entry and click **Object Reference** to open a screen that shows which settings use the entry. |

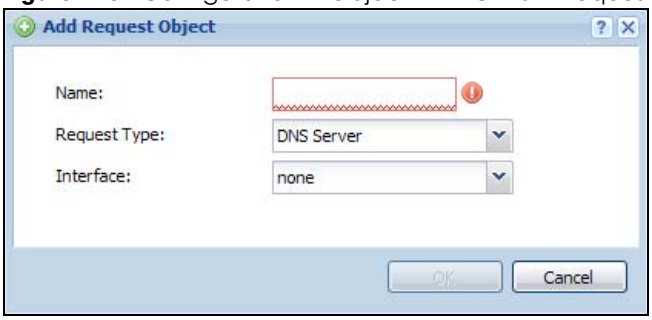
Table 156 Configuration > Object > DHCPv6 > Request (continued)

| LABEL | DESCRIPTION |
|---|---|
| # | 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. |
| Interface | This field displays the interface used for each request object. |
| Value | This field displays the value for each request object. |

## 27.2.1 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 176** Configuration > Object > DHCPv6 > Request > Add




The following table describes the labels in this screen.

Table 157 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 28
# System

## 28.1 Overview

Use the system screens to configure general NXC settings.

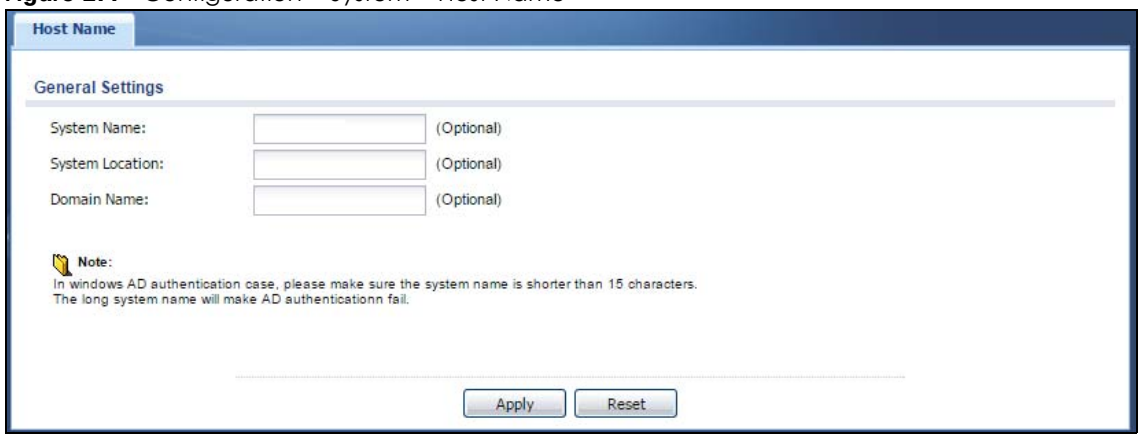
### 28.1.1 What You Can Do in this Chapter

- The **Host Name** screen (Section 28.2 on page 299) configures a unique name for the NXC in your network.
- The **USB Storage** screen (Section 28.3 on page 300) configures the settings for the connected USB devices.
- The **Date/Time** screen (Section 28.4 on page 301) configures the date and time for the NXC.
- The **Console Speed** screen (Section 28.5 on page 304) configures the console port speed when you connect to the NXC via the console port using a terminal emulation program.
- The **DNS** screen (Section 28.6 on page 305) 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 28.7 on page 311) configure settings for HTTP or HTTPS access to the NXC and how the login and access user screens look.
- The **SSH** screen (Section 28.8 on page 322) 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 28.9 on page 326) 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 28.10 on page 328) 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 30 on page 352 for more information about firmware and configuration files.
- The **SNMP** screen (Section 28.11 on page 329) 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 28.12 on page 333) configures the device to operate as a RADIUS server.
- The **Language** screen (Section 28.13 on page 335) sets the user interface language for the NXC's Web Configurator screens.
- The **IPv6** screen (Section 28.14 on page 336) enables or disables IPv6 support on the NXC.

## 28.2 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 177** Configuration > System > Host Name




The following table describes the labels in this screen.

Table 158 Configuration > System > Host Name

| LABEL | DESCRIPTION |
|---|---|
| System Name | Choose a descriptive name to identify your NXC device. 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. |

# 28.3 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 178** Configuration > System > USB Storage

The following table describes the labels in this screen.

Table 159 Configuration > System > USB Storage

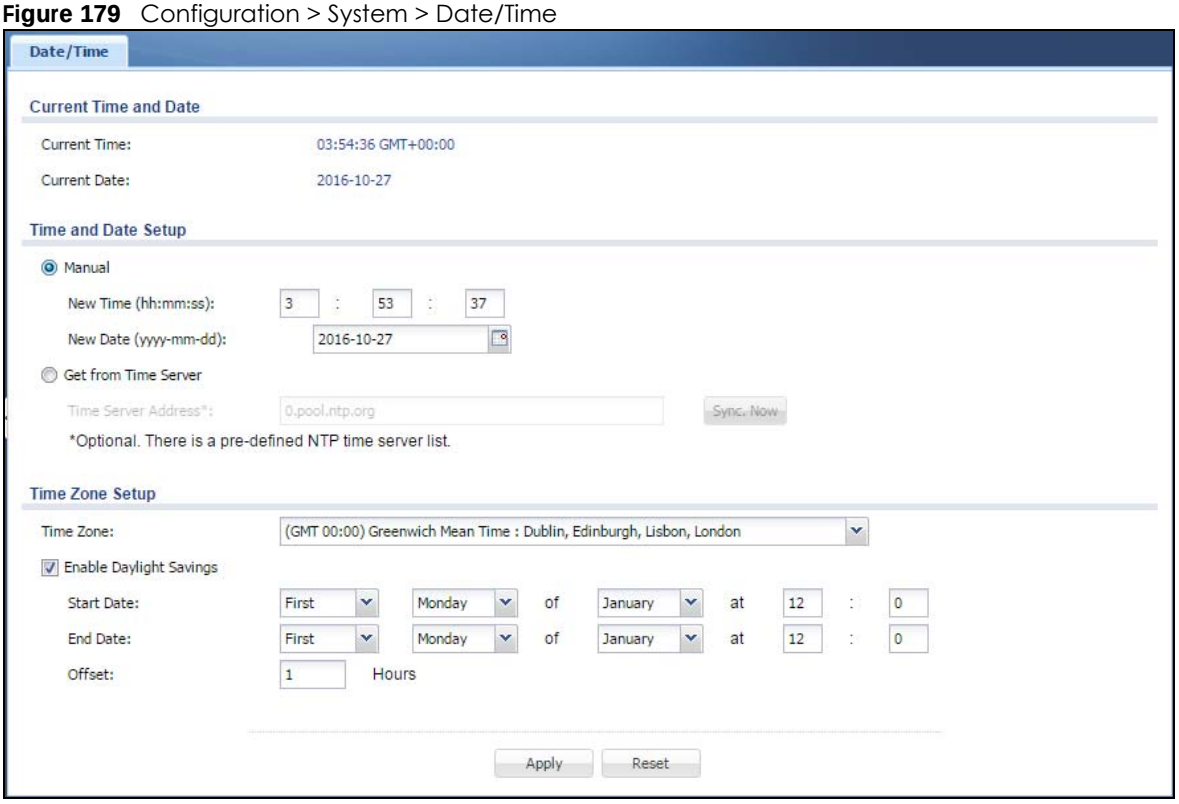
| LABEL | DESCRIPTION |
|---|---|
| Activate USB storage service | Select this if you want to use the connected USB device(s). |
| Disk full warning when remaining space is less than | Set a number and select a unit (**MB** or **%**) to have the NXC send a warning message when the remaining USB storage 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. |

# 28.4 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 179** Configuration > System > Date/Time



The following table describes the labels in this screen.

Table 160 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.<br>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.<br>When you set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**. |
| 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.<br>• When the NXC starts up.<br>• When you click **Apply** or **Synchronize Now** in this screen.<br>• 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 Saving | 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.<br>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 Saving**. The **at** field uses the 24 hour format. Here are a couple of examples:<br>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.<br>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). |

Table 160 Configuration > System > Date/Time (continued)

| LABEL | DESCRIPTION |
|---|---|
| End Date | Configure the day and time when Daylight Saving Time ends if you selected **Enable Daylight Saving**. The **at** field uses the 24 hour format. Here are a couple of examples:<br><br>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.<br><br>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.<br><br>Enter a number from 1 to 5.5 (by 0.5 increments).<br><br>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. |

## 28.4.1 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 161 Default Time Servers

| |
|---|
| 0.pool.ntp.org |
| 1.pool.ntp.org |
| 2.pool.ntp.org |

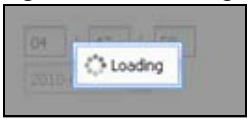
When the NXC uses the pre-defined list of NTP time servers, it randomly selects one server and tries to synchronize with it. If the synchronization fails, then the NXC goes through the rest of the list in order from the first one tried until either it is successful or all the pre-defined NTP time servers have been tried.

## 28.4.2 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 180** 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**.

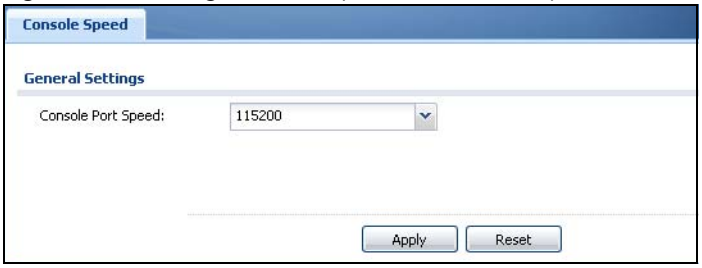
5 Click **Apply**.

# 28.5 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 20 for default console port settings.

Click **Configuration > System > Console Speed** to open this screen.

**Figure 181** Configuration > System > Console Speed



The following table describes the labels in this screen.

Table 162 Configuration > System > Console Speed

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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. |

# 28.6 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.

## 28.6.1 DNS Server Address Assignment

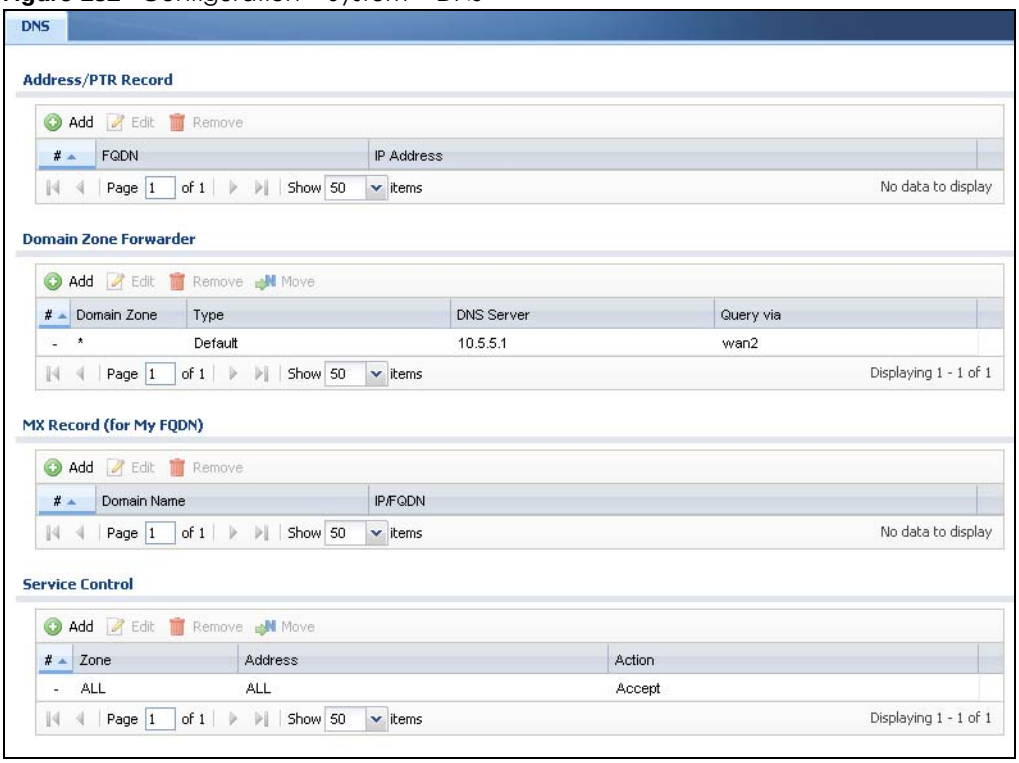
The NXC can get the DNS server addresses in the following ways.

- 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.

## 28.6.2 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 182** Configuration > System > DNS




The following table describes the labels in this screen.

Table 163 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.<br><br>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. |

Table 163 Configuration > System > DNS (continued)

| LABEL | DESCRIPTION |
|---|---|
| # | This is the index number of the domain zone forwarder record. The ordering of your rules is important as rules are applied in sequence.<br><br>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.<br><br>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. |
| 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.<br><br>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**). |

## 28.6.3 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.

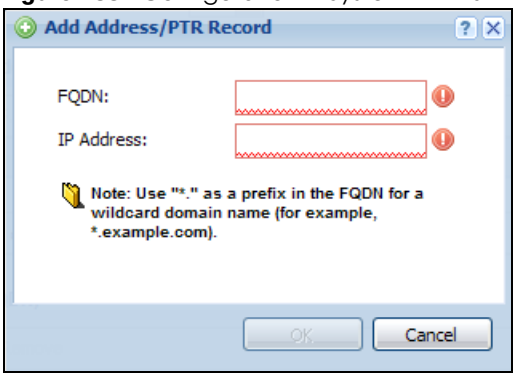
## 28.6.4 PTR Record

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.

## 28.6.5 Adding an Address/PTR Record

Click the **Add** icon in the **Address/PTR Record** table to add an address/PTR record.

**Figure 183** Configuration > System > DNS > Add Address/PTR Record




The following table describes the labels in this screen.

Table 164 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.<br><br>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 |

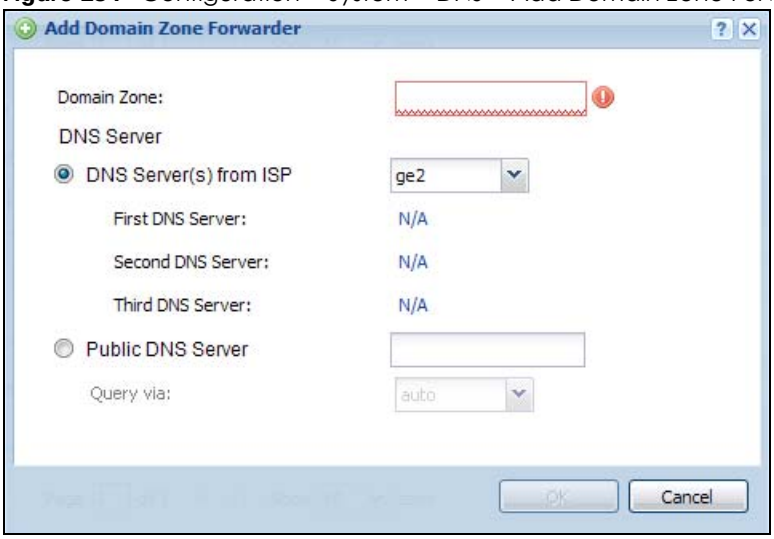
## 28.6.6 Domain Zone Forwarder

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.

## 28.6.7 Add Domain Zone Forwarder

Click the **Add** icon in the **Domain Zone Forwarder** table to add a domain zone forwarder record.

**Figure 184** Configuration > System > DNS > Add Domain Zone Forwarder




The following table describes the labels in this screen.

Table 165 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.<br><br>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.<br><br>Note: If all interfaces are static, then this field is hidden.<br><br>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. |

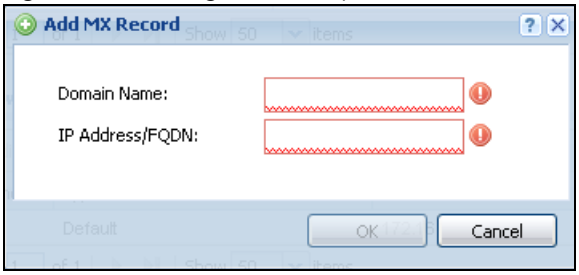
## 28.6.8 MX Record

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.

## 28.6.9 Add MX Record

Click the **Add** icon in the **MX Record** table to add a MX record.

**Figure 185** Configuration > System > DNS > Add MX Record




The following table describes the labels in this screen.

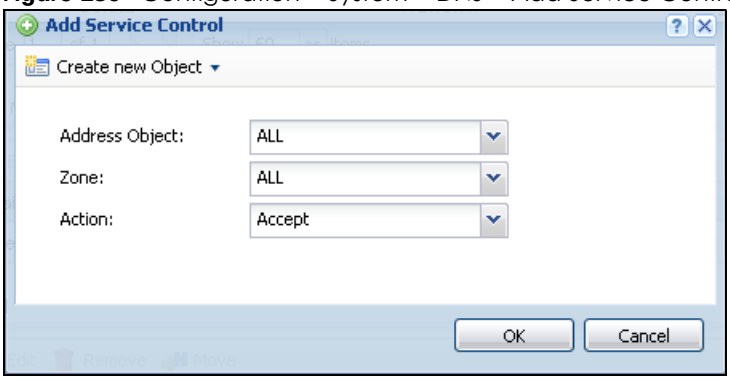
Table 166 Configuration > System > DNS > Add MX Record

| 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. |
| OK | Click **OK** to save your customized settings and exit this screen. |
| Cancel | Click **Cancel** to exit this screen without saving |

## 28.6.10 Add Service Control

Click the **Add** icon in the **Service Control** table to add a service control rule.

**Figure 186** Configuration > System > DNS > Add Service Control Rule



The following table describes the labels in this screen.

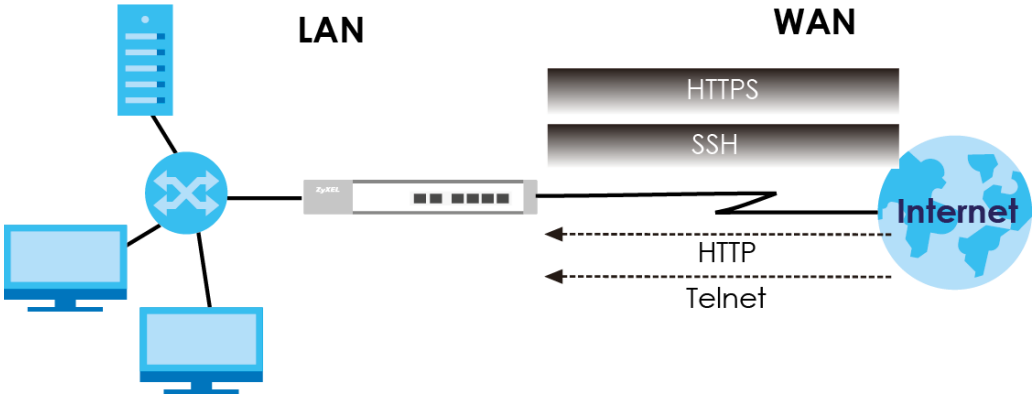
Table 167 Configuration > System > DNS > Add Service Control Rule

| 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.<br>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.<br>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.<br>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 |

# 28.7 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 187** Secure and Insecure Service Access From the WAN




## 28.7.1 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**.

## 28.7.2 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.

## 28.7.3 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 26 on page 280 for more information).

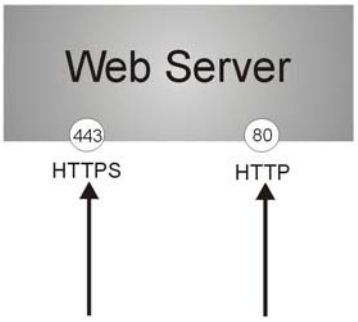
HTTPS on the NXC is used so that you can securely access the NXC using the Web Configurator. The SSL protocol specifies that the HTTPS server (the NXC) must always authenticate itself to the HTTPS client (the computer which requests the HTTPS connection with the NXC), whereas the HTTPS client only should 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 188** HTTP/HTTPS Implementation



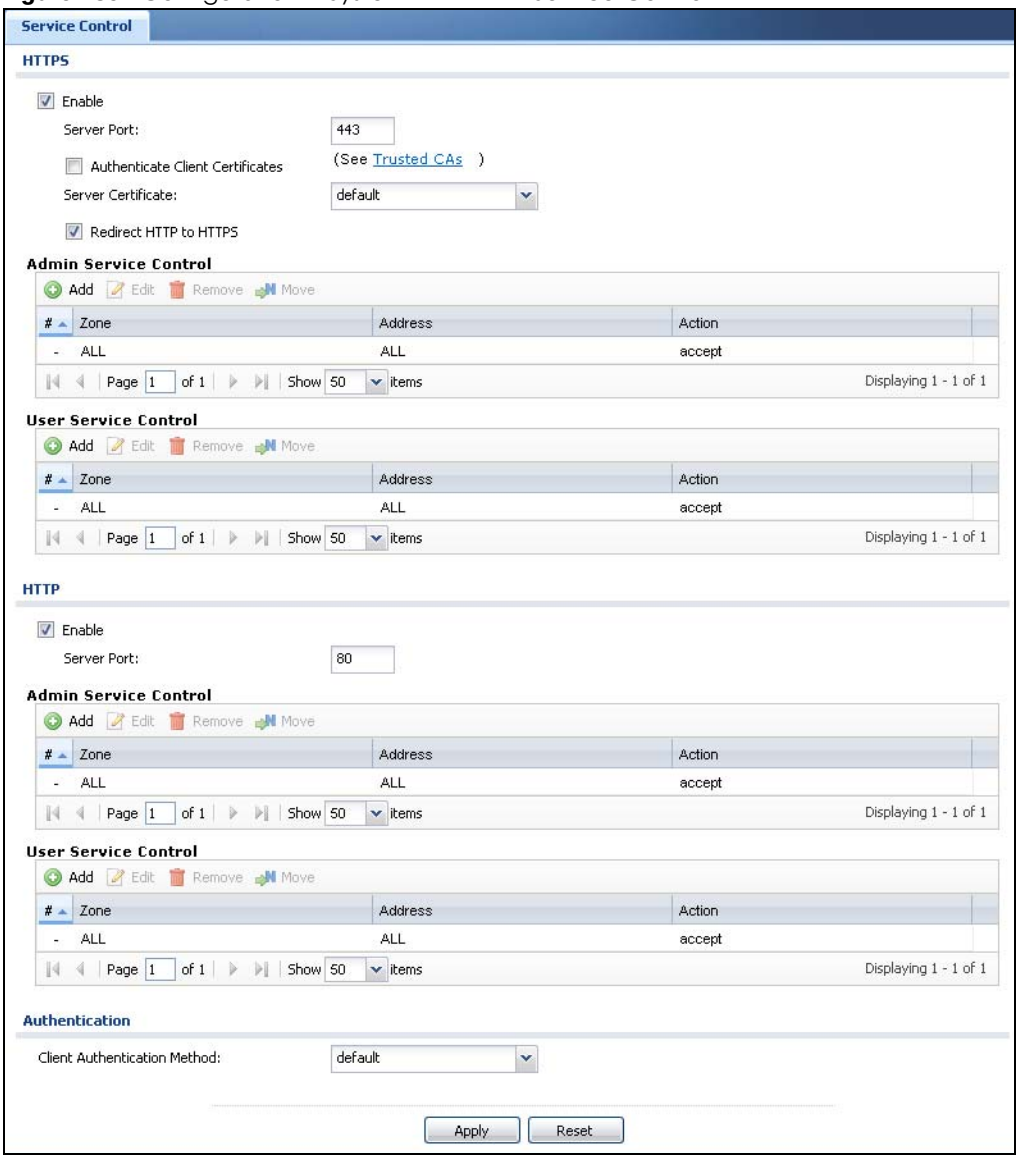
Note: If you disable **HTTP** in the **WWW** screen, then the NXC blocks all HTTP connection attempts.

## 28.7.4 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 189** Configuration > System > WWW > Service Control



The following table describes the labels in this screen.

Table 168 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. |
| 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.<br><br>**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.<br><br>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.<br><br>**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. |

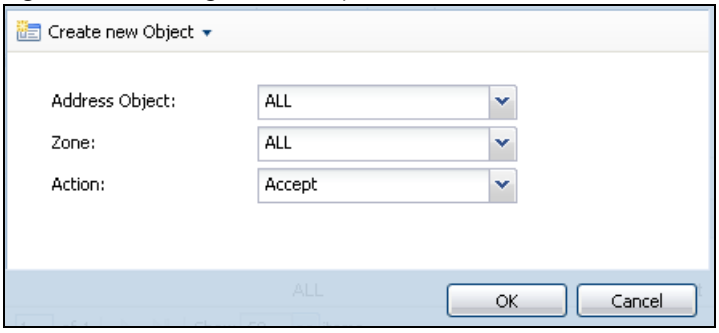
Table 168 Configuration > System > WWW > Service Control (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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**). |
| Authentication | |
| Client Authentication Method | Select a method the HTTPS or HTTP server uses to authenticate a client.<br>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. |

## 28.7.5 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 190** Configuration > System > Service Control Rule > Add/Edit



The following table describes the labels in this screen.

Table 169 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.<br>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.<br>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.<br>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 |

## 28.7.6 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.

### 28.7.6.1 Internet Explorer Warning Messages

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 191** Security Alert Dialog Box (Internet Explorer)

### 28.7.6.2 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 422 for details.

### 28.7.6.3 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 192** Login Screen (Internet Explorer)

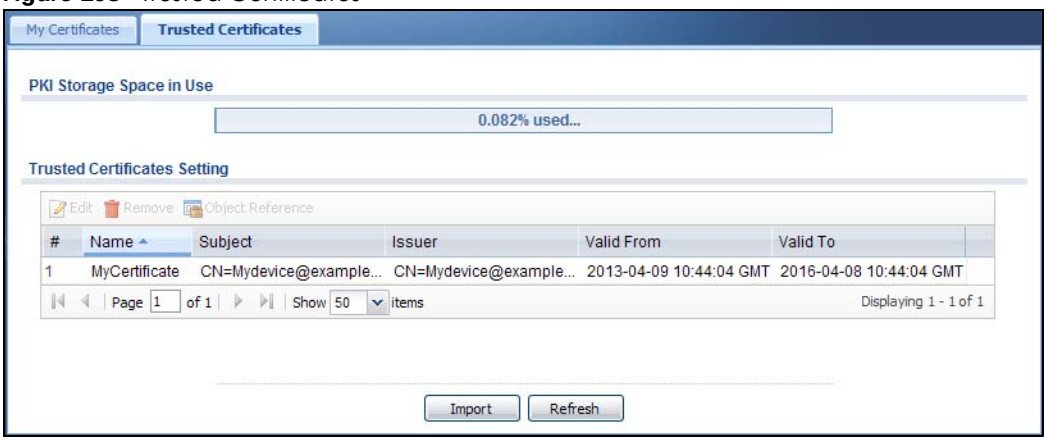

### 28.7.6.4 Enrolling and Importing SSL Client Certificates

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).

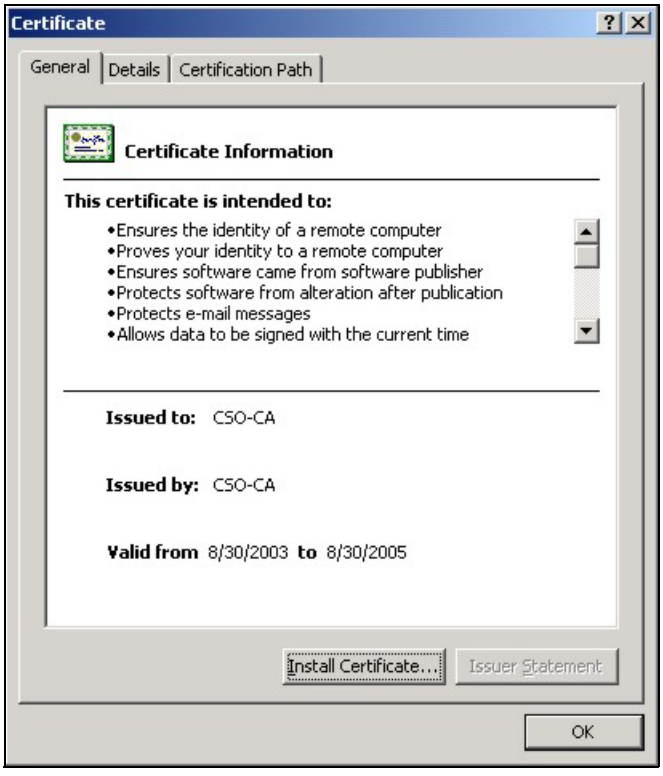
**Figure 193** Trusted Certificates




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).

### 28.7.6.5 Installing the CA's Certificate

1 Double click the CA's trusted certificate to produce a screen similar to the one shown next.



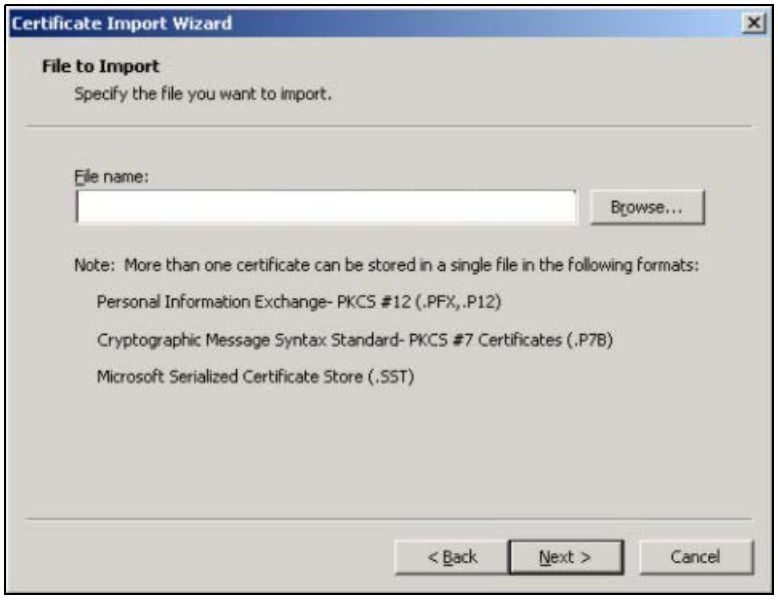

2 Click **Install Certificate** and follow the wizard as shown earlier in this appendix.

### 28.7.6.6 Installing a Personal Certificate

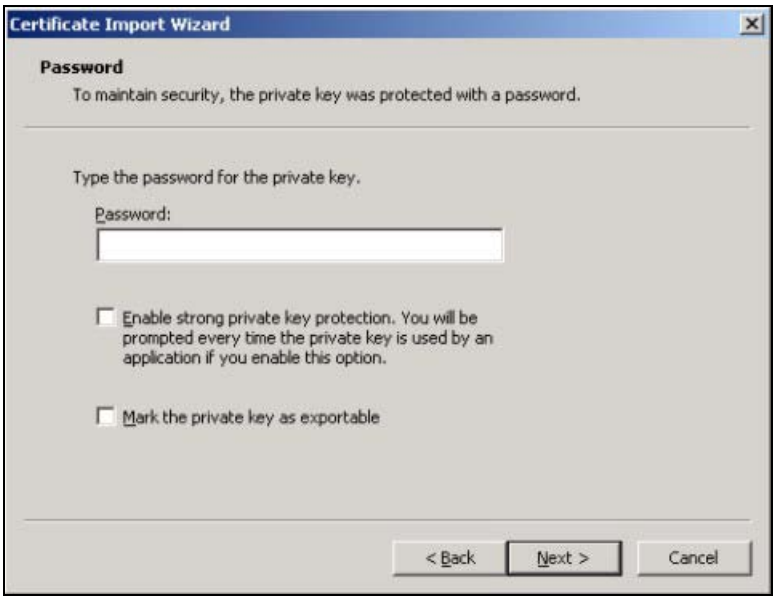
You need a password in advance. The CA may issue the password or you may have to specify it during the enrollment. Double-click the personal certificate given to you by the CA to produce a screen similar to the one shown next

1 Click **Next** to begin the wizard.

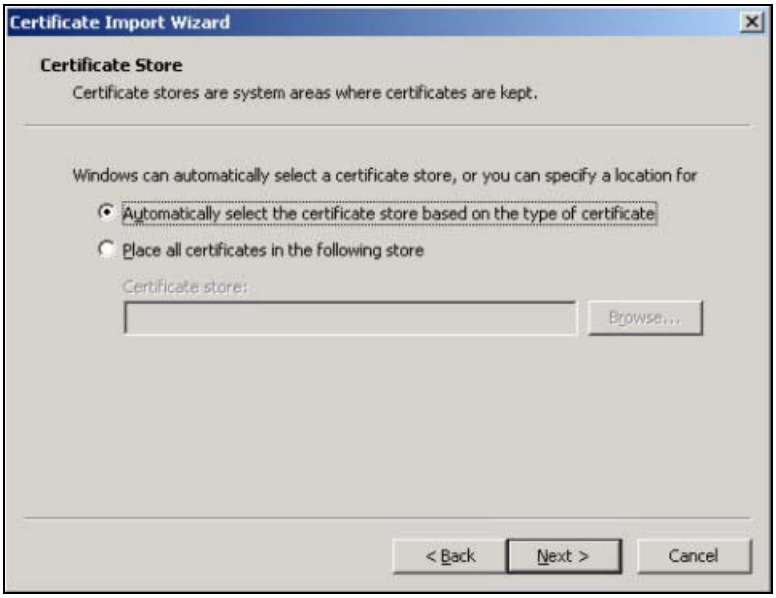

2 The file name and path of the certificate you double-clicked should automatically appear in the **File name** text box. Click **Browse** if you wish to import a different certificate.



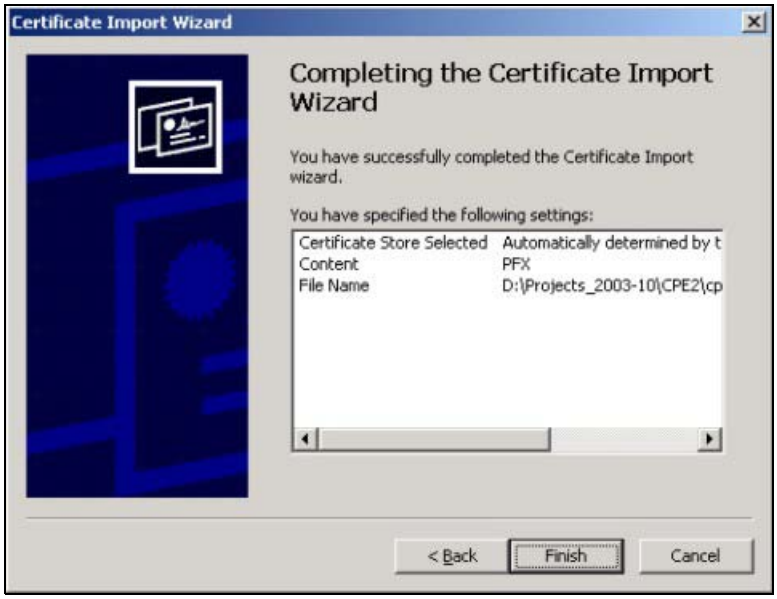
3 Enter the password given to you by the CA.




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.



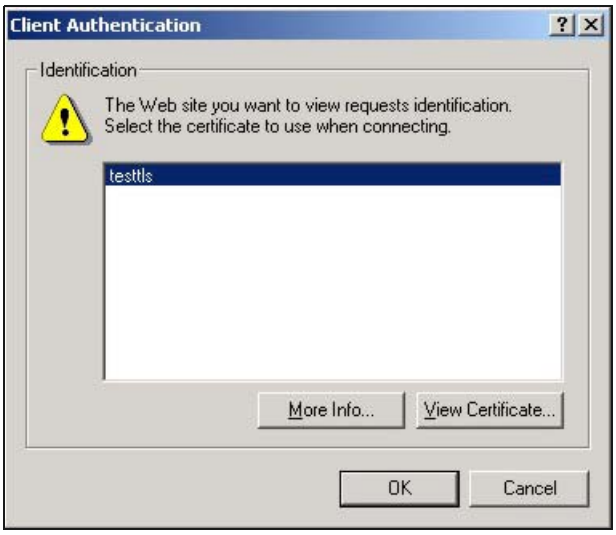

6 You should see the following screen when the certificate is correctly installed on your computer.


### 28.7.6.7 Using a Certificate When Accessing the NXC

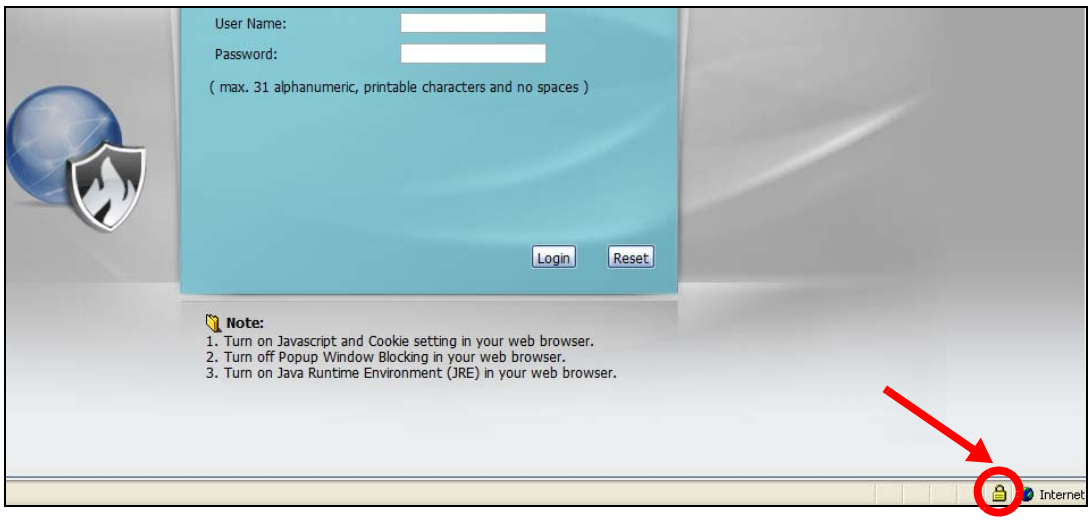
To access the NXC via HTTPS:

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.




# 28.8 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.

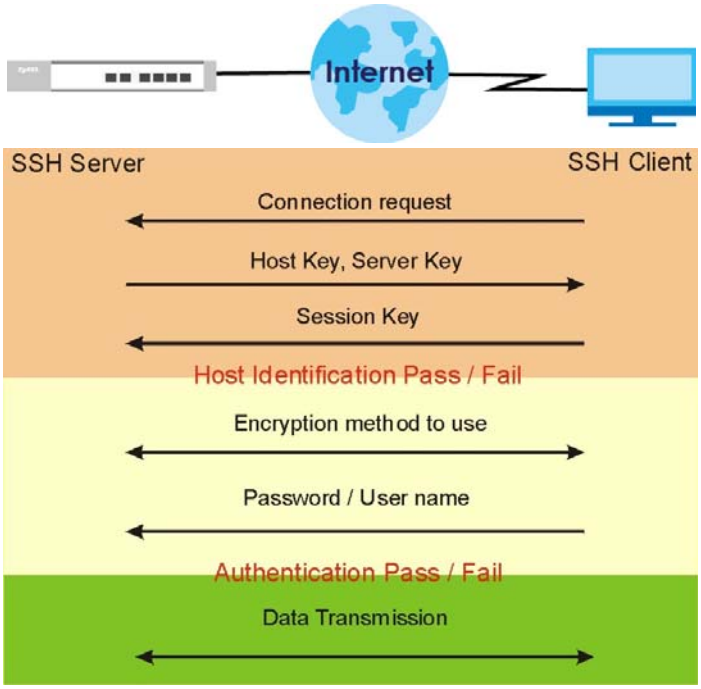
SSH is a secure communication protocol that combines authentication and data encryption to provide secure encrypted communication between two hosts over an unsecured network. In the following figure, computer **A** on the Internet uses SSH to securely connect to the WAN port of the NXC for a management session.

**Figure 194** SSH Communication Over the WAN Example


## 28.8.1 How SSH Works

The following figure is an example of how a secure connection is established between two remote hosts using SSH v1.

**Figure 195** 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.

## 28.8.2 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).

## 28.8.3 Requirements for Using SSH

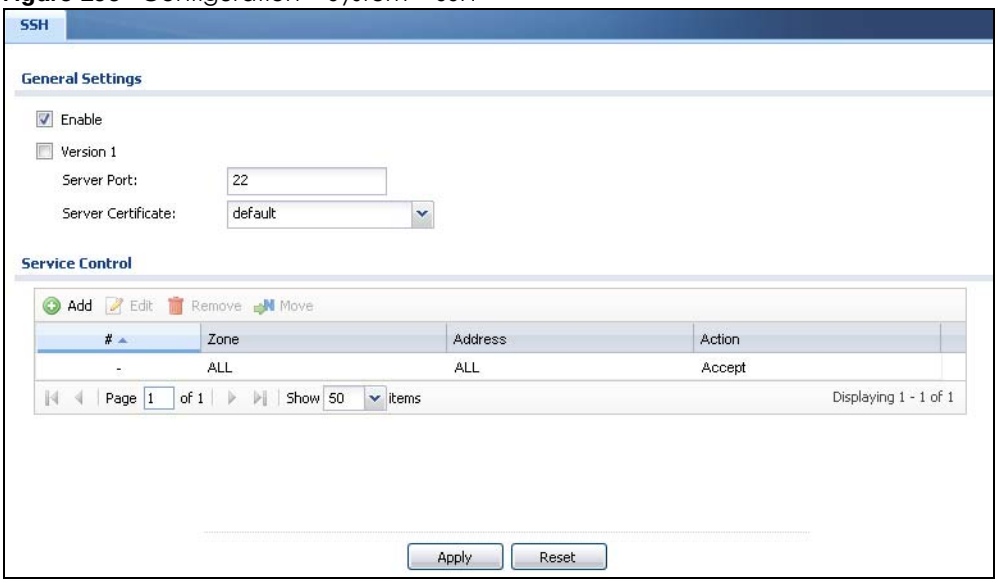
You must install an SSH client program on a client computer (Windows or Linux operating system) that is used to connect to the NXC over SSH.

## 28.8.4 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 196** Configuration > System > SSH




The following table describes the labels in this screen.

Table 170 Configuration > System > SSH

| LABEL | DESCRIPTION |
|---|---|
| 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 170 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. |

## 28.8.5 Examples of Secure Telnet Using SSH

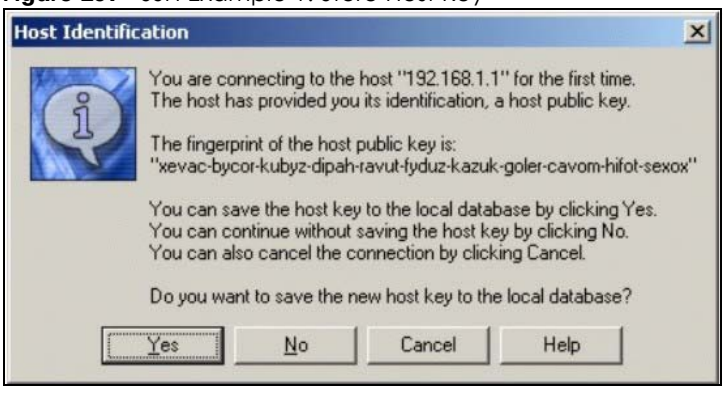
This section shows two examples using a command interface and a graphical interface SSH client program to remotely access the NXC. The configuration and connection steps are similar for most SSH client programs. Refer to your SSH client program user's guide.

### 28.8.5.1 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 197** SSH Example 1: Store Host Key




Enter the password to log in to the NXC. The CLI screen displays next.

### 28.8.5.2 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 198** 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 199** SSH Example 2: Log in

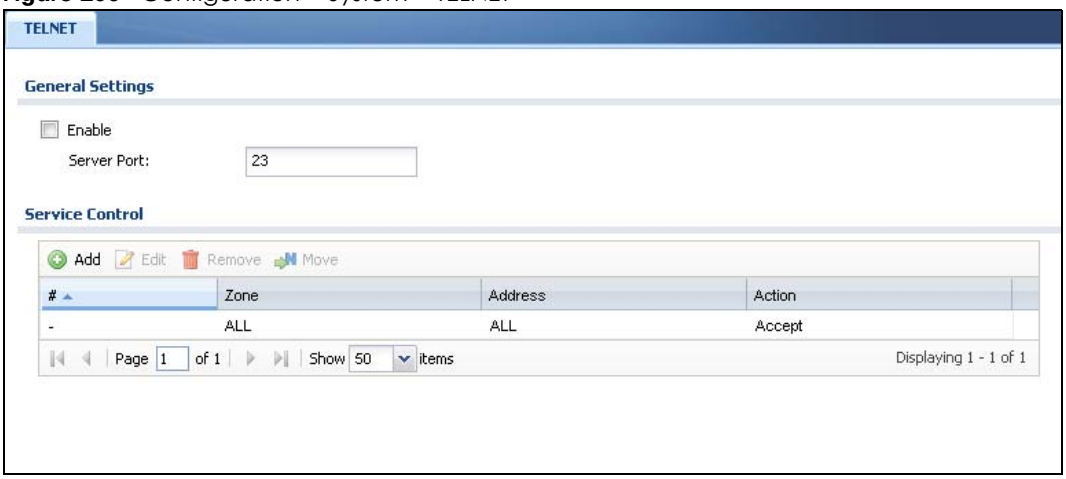
```
$ ssh -1 192.168.1.1
The authenticity of host '192.168.1.1 (192.168.1.1)' can't be established.
RSA1 key fingerprint is 21:6c:07:25:7e:f4:75:80:ec:af:bd:d4:3d:80:53:d1.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.1' (RSA1) to the list of known hosts.
Administrator@192.168.1.1's password:
```

3 The CLI screen displays next.

# 28.9 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 200** Configuration > System > TELNET




The following table describes the labels in this screen.

Table 171 Configuration > System > TELNET

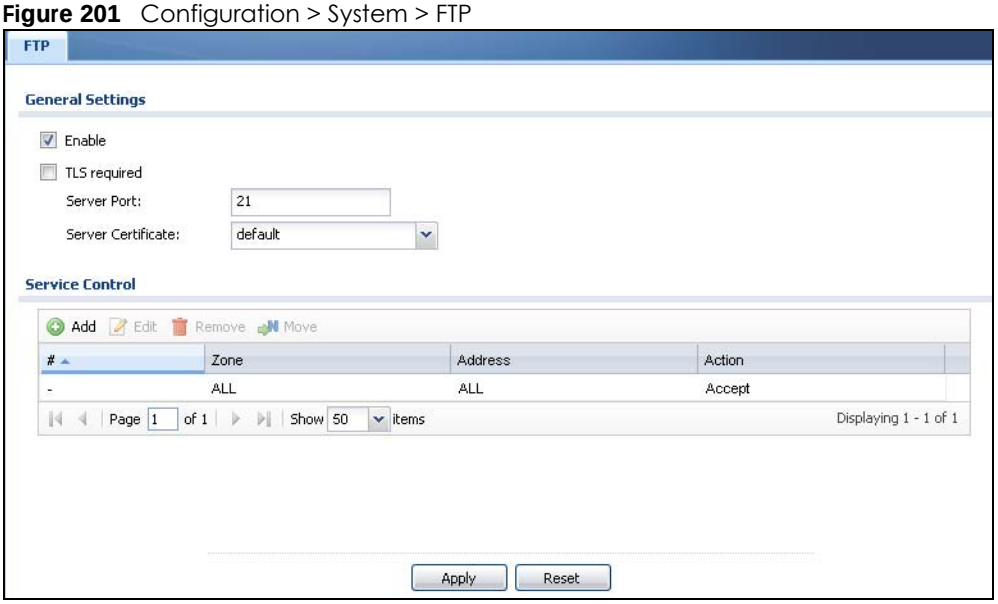
| LABEL | DESCRIPTION |
|---|---|
| Enable | Select the check box to allow or disallow the computer with the IP address that matches the IP address(es) in the **Service Control** table to access the NXC CLI using this service. |
| Server Port | You may change the server port number for a service if needed, 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.<br><br>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. |

# 28.10 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 30 on page 352 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 201** Configuration > System > FTP




The following table describes the labels in this screen.

Table 172 Configuration > System > FTP

| LABEL | DESCRIPTION |
|---|---|
| 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.<br>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. |

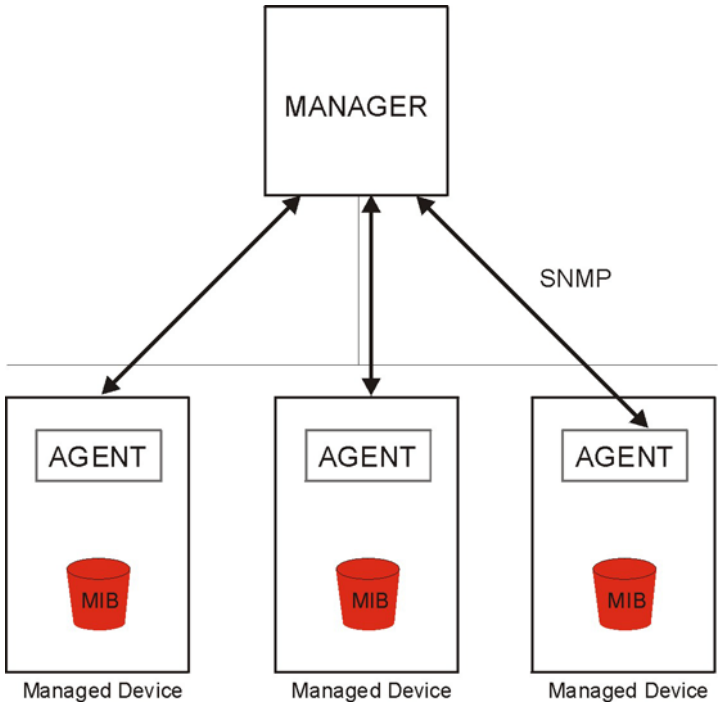
Table 172 Configuration > System > FTP (continued)

| LABEL | DESCRIPTION |
|---|---|
| # | This the index number of the service control rule.<br><br>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. |

# 28.11 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 202** 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.

## 28.11.1 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.

## 28.11.2 SNMP Traps

The NXC will send traps to the SNMP manager when any one of the following events occurs.

Table 173 SNMP Traps

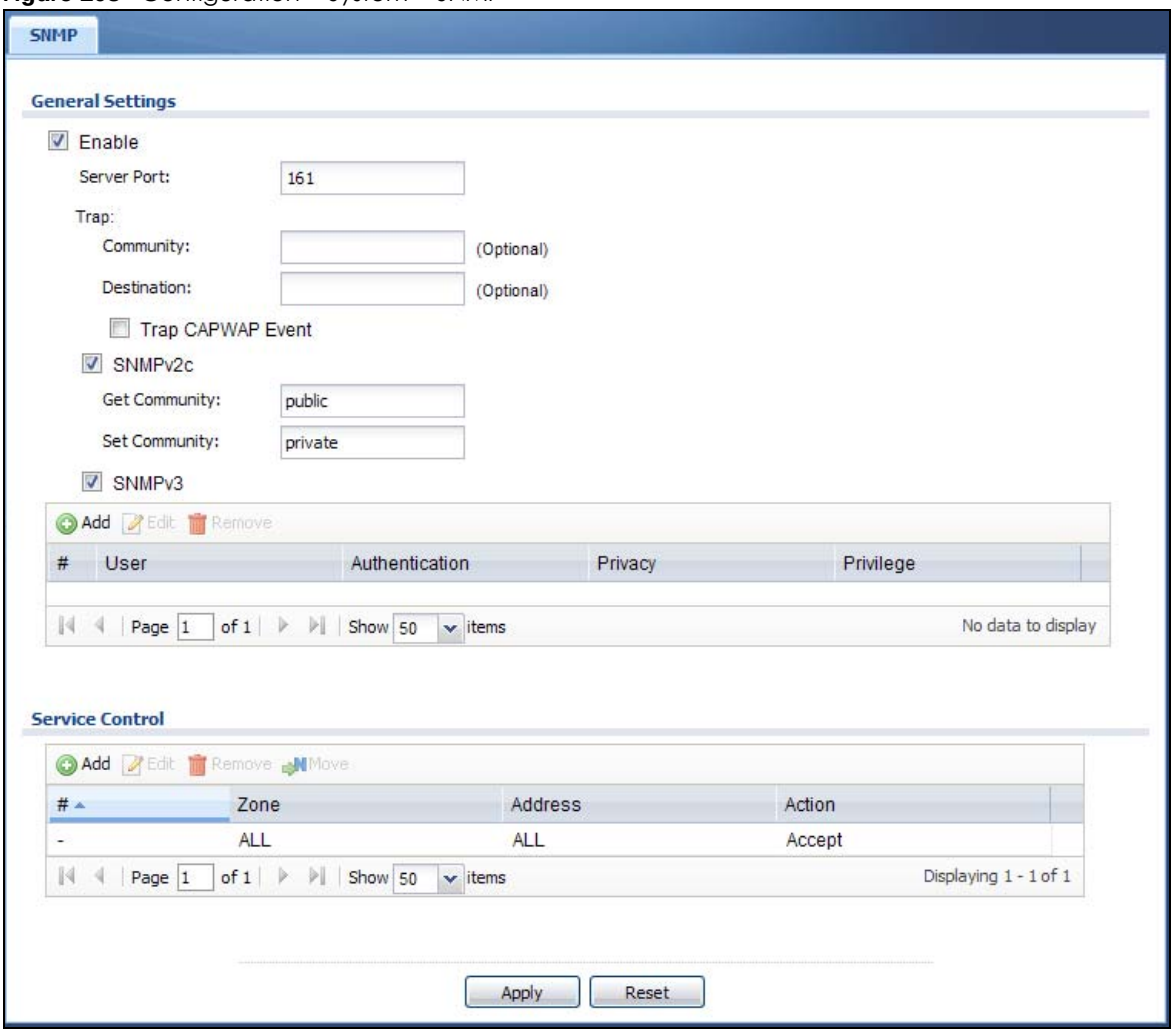
| OBJECT LABEL | OBJECT ID | DESCRIPTION |
|---|---|---|
| Cold Start | 1.3.6.1.6.3.1.1.5.1 | This trap is sent when an agent reinitialized or its configuration tables have been changed. |
| linkDown | 1.3.6.1.6.3.1.1.5.3 | This trap is sent when the Ethernet link is down. |
| linkUp | 1.3.6.1.6.3.1.1.5.4 | 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. |

## 28.11.3 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 203** Configuration > System > SNMP




The following table describes the labels in this screen.

Table 174 Configuration > System > SNMP

| LABEL | DESCRIPTION |
|---|---|
| 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 | |

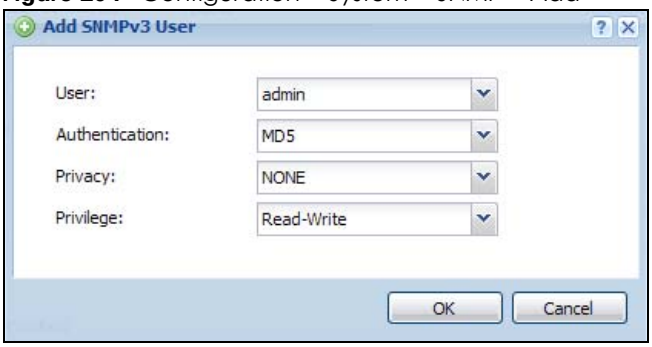
Table 174 Configuration > System > SNMP (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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.<br>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. |

### 28.11.4 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 204** Configuration > System > SNMP > Add




The following table describes the labels in this screen.

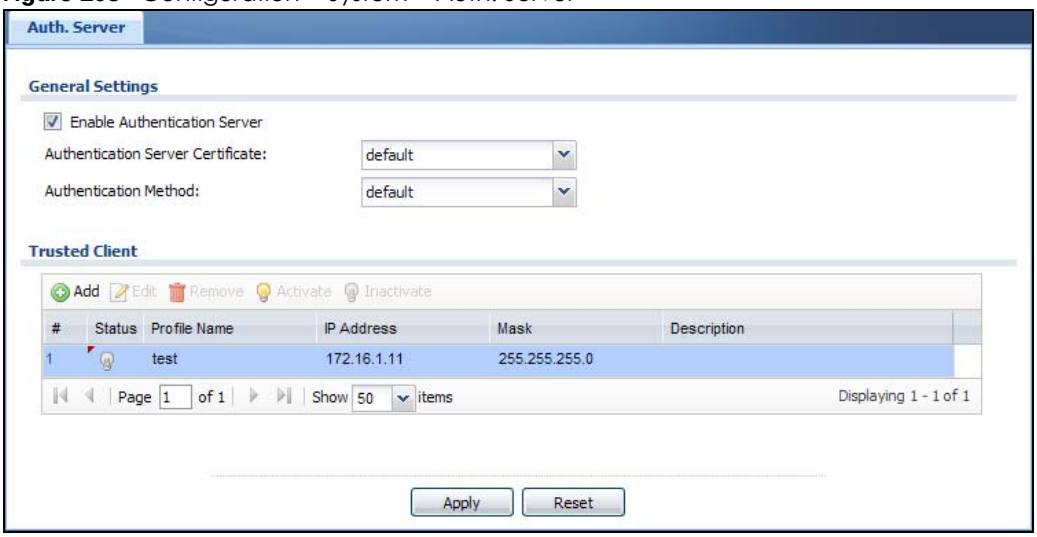
Table 175 Configuration > System > SNMP

| LABEL | DESCRIPTION |
|---|---|
| User Name | 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.<br>Select **MD5** to require the SNMPv3 user's password be encrypted by MD5 for authentication.<br>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.<br>Select **NONE** to not encrypt the SNMPv3 communications.<br>Select **DES** to use DES to encrypt the SNMPv3 communications.<br>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. |

## 28.12 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 205** Configuration > System > Auth. Server




The following table describes the labels in this screen.

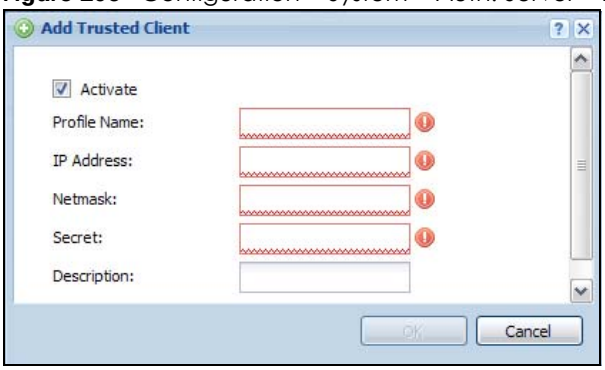
Table 176 Configuration > System > Auth. Server

| LABEL | DESCRIPTION |
|---|---|
| Enable | 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. |
| 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. |
| 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. |

## 28.12.1 Add/Edit Trusted RADIUS 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 206** Configuration > System > Auth. Server > Add/Edit




The following table describes the labels in this screen.

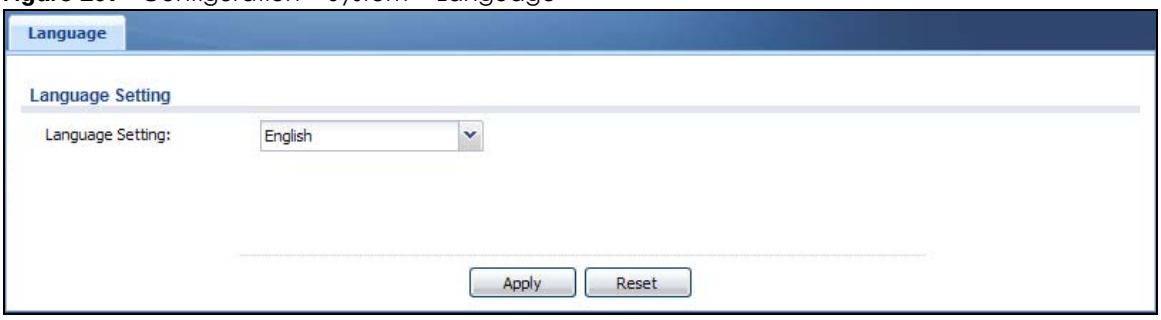
Table 177 Configuration > System > Auth. Server > Add/Edit

| 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.<br>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. |

# 28.13 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 207** Configuration > System > Language



The following table describes the labels in this screen.

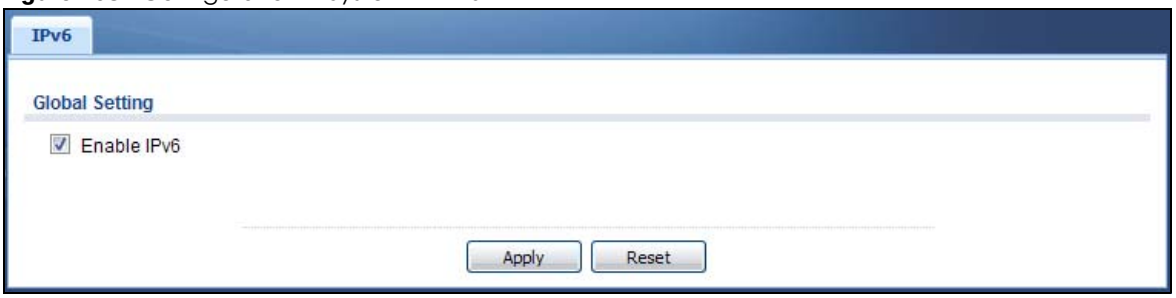
Table 178 Configuration > System > Language

| 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. |

# 28.14 IPv6

Click **Configuration > System > IPv6** to open the following screen. Use this screen to enable IPv6 support on the NXC.

**Figure 208** Configuration > System > IPv6




The following table describes the labels in this screen.

Table 179 Configuration > System > IPv6

| LABEL | DESCRIPTION |
|---|---|
| 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 29
# Log and Report

## 29.1 Overview

Use the system screens to configure daily reporting and log settings.

### 29.1.1 What You Can Do In this Chapter

- The **Email Daily Report** screen (Section 29.2 on page 337) configures how and where to send daily reports and what reports to send.
- The **Log Settings** screens (Section 29.3 on page 339) specify which logs are e-mailed, where they are e-mailed, and how often they are e-mailed.

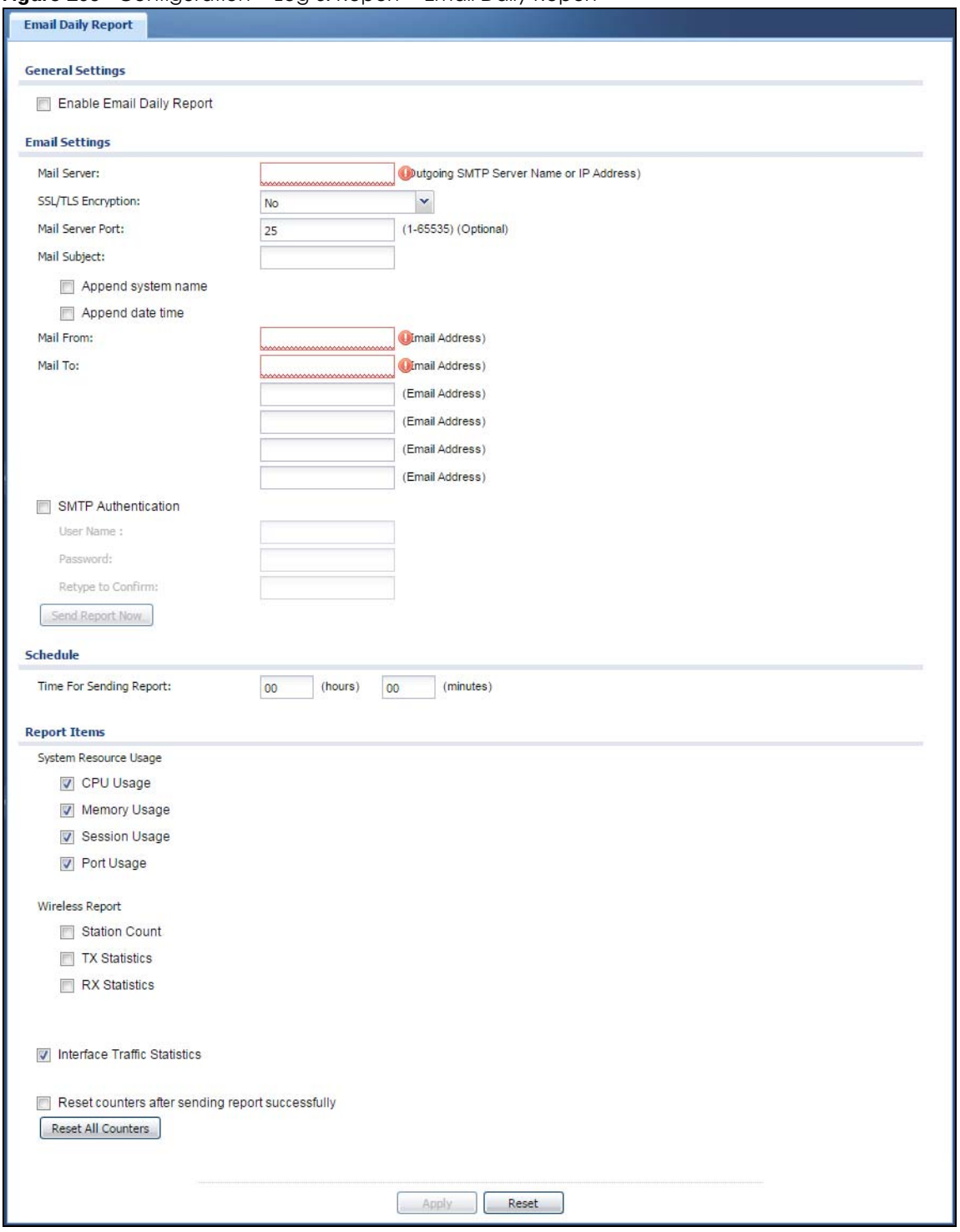
## 29.2 Email Daily Report

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 209** Configuration > Log & Report > Email Daily Report



The following table describes the labels in this screen.

Table 180 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.<br>Select **STARTTLS** to upgrade a plain text connection to a secure connection using SSL/TLS.<br>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. Select **Reset counters after sending report successfully** 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. |

# 29.3 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.

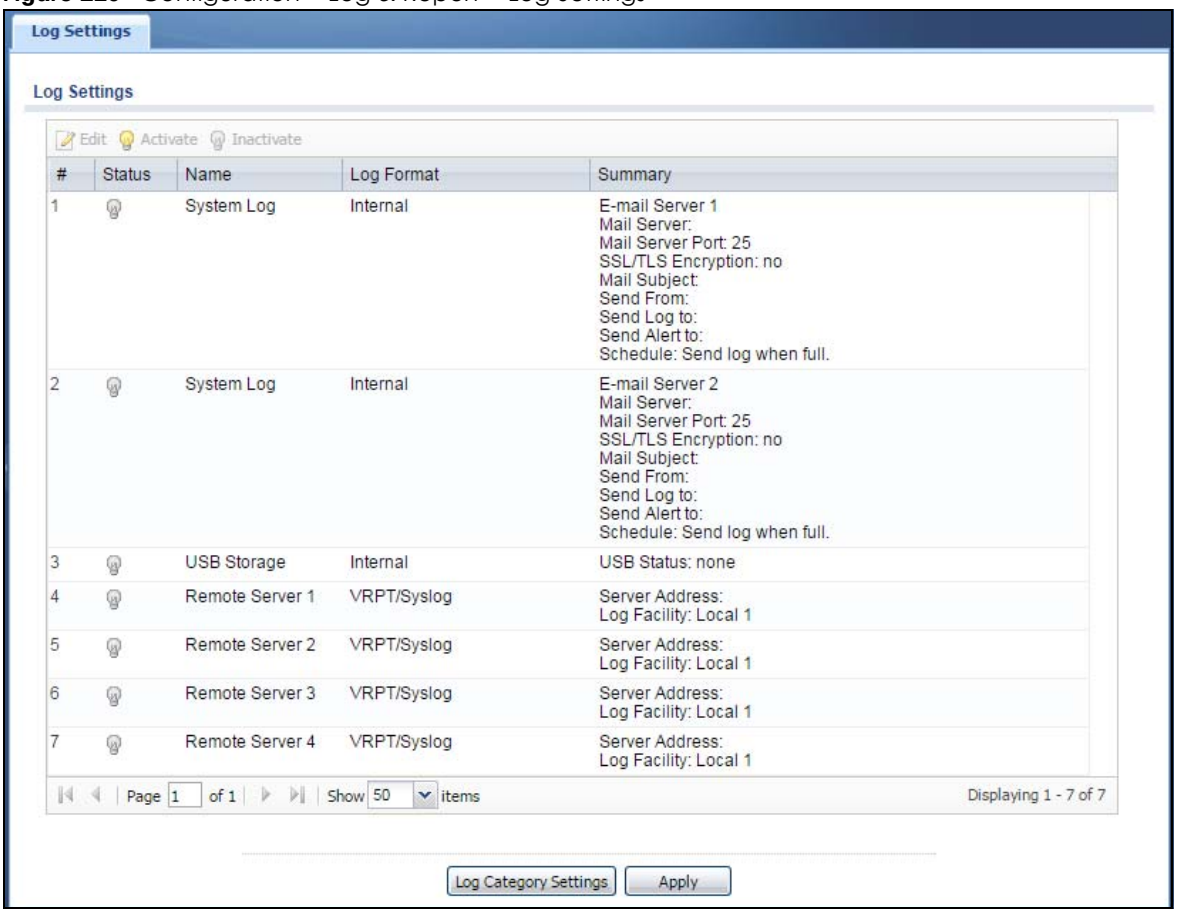
For alerts, the **Log Settings** tab controls which events generate alerts and where alerts are e-mailed.

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.

## 29.3.1 Log Settings Summary

To access this screen, click **Configuration > Log & Report > Log Settings**.

**Figure 210** Configuration > Log & Report > Log Settings




The following table describes the labels in this screen.

Table 181 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**. |

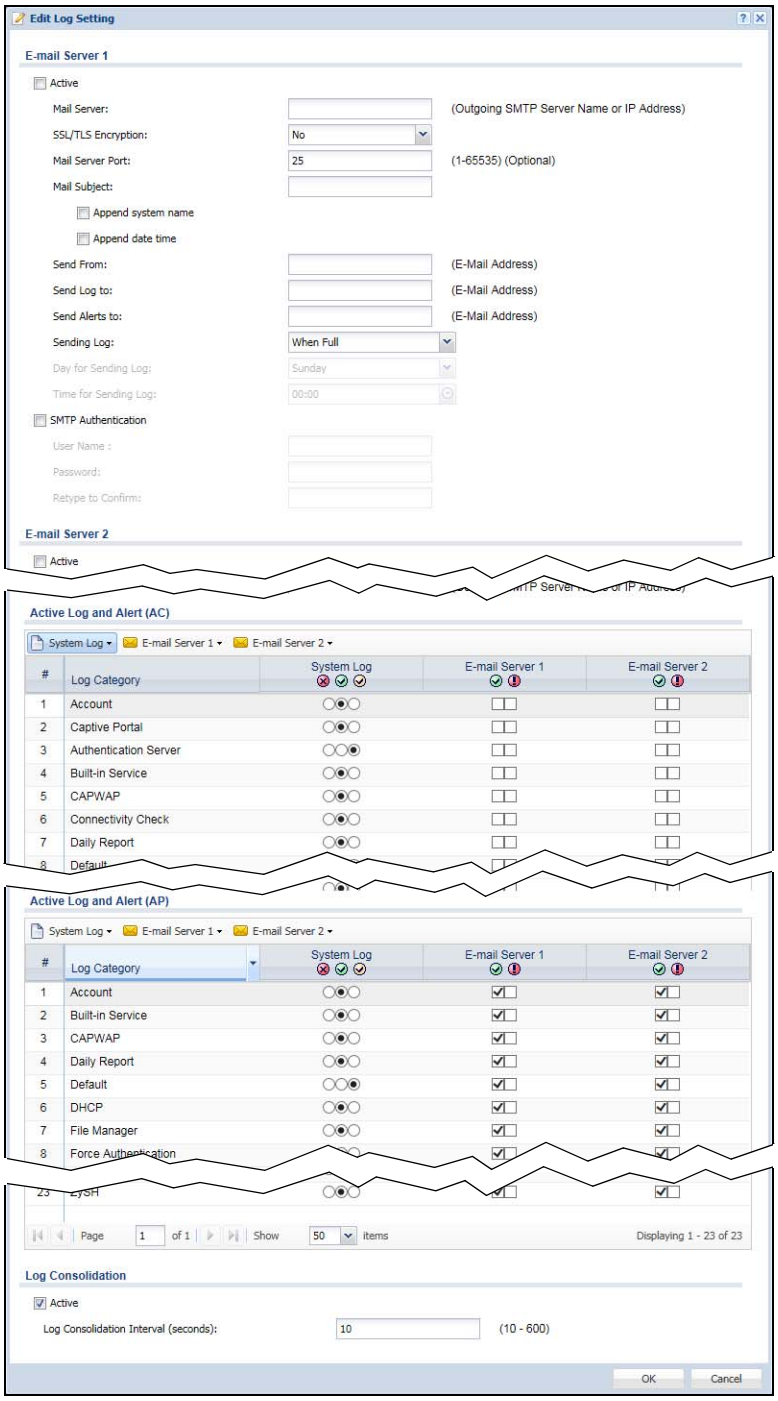
Table 181 Configuration > Log & Report > Log Settings (continued)

| LABEL | DESCRIPTION |
|---|---|
| # | 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.<br>**Internal** - system log; you can view the log on the **View Log** tab.<br>**VRPT/Syslog** - Zyxel's Vantage Report, syslog-compatible format.<br>**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. |

## 29.3.2 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 211** Configuration > Log & Report > Log Settings > Edit (System Log)



The following table describes the labels in this screen.

Table 182 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.<br>Select **STARTTLS** to upgrade a plain text connection to a secure connection using SSL/TLS.<br>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.<br>**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.<br>**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.<br>**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. |

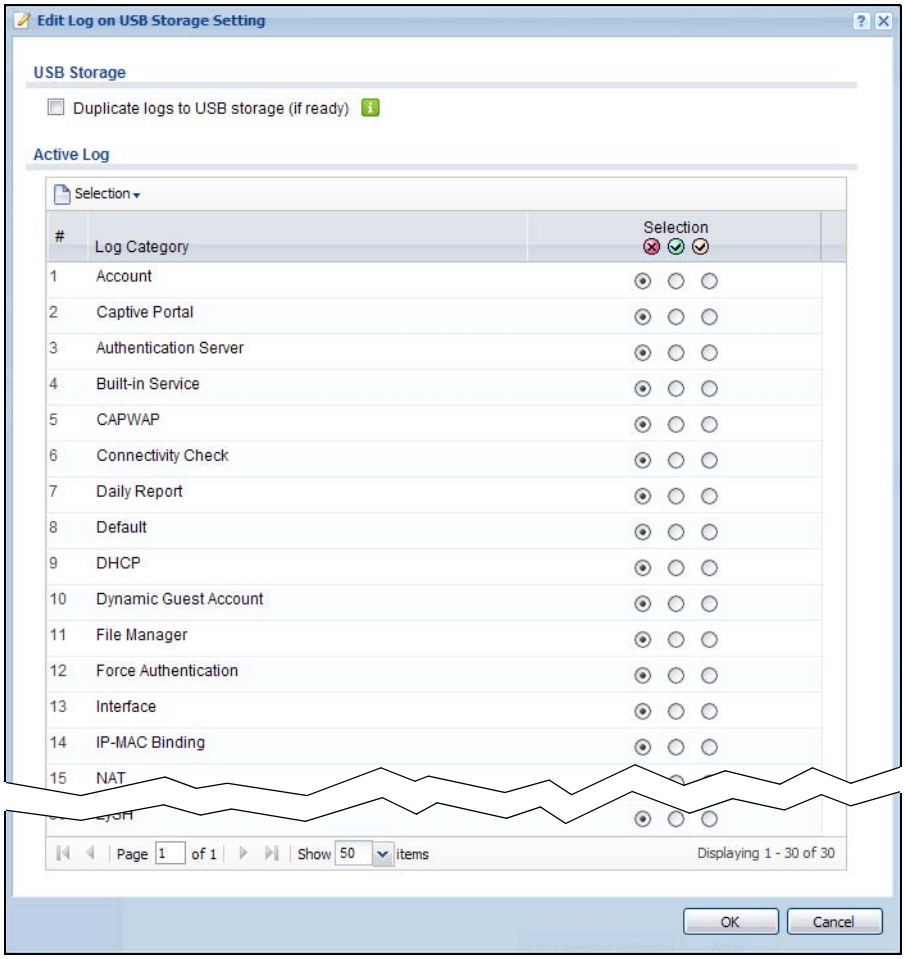
Table 182 Configuration > Log & Report > Log Settings > Edit (System Log) (continued)

| 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.<br>Using the **System Log** drop-down list to disable all logs overrides your e-mail server 1 settings.<br>**enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 1.<br>**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.<br>Using the **System Log** drop-down list to disable all logs overrides your e-mail server 2 settings.<br>**enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 2.<br>**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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - create log messages and alerts from this category<br>**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. |

## 29.3.3 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 212** Configuration > Log & Report > Log Settings > Edit (USB Storage)




The following table describes the labels in this screen.

Table 183 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.<br>**disable all logs** (red X) - do not send the remote server logs for any log category.<br>**enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories.<br>**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. |

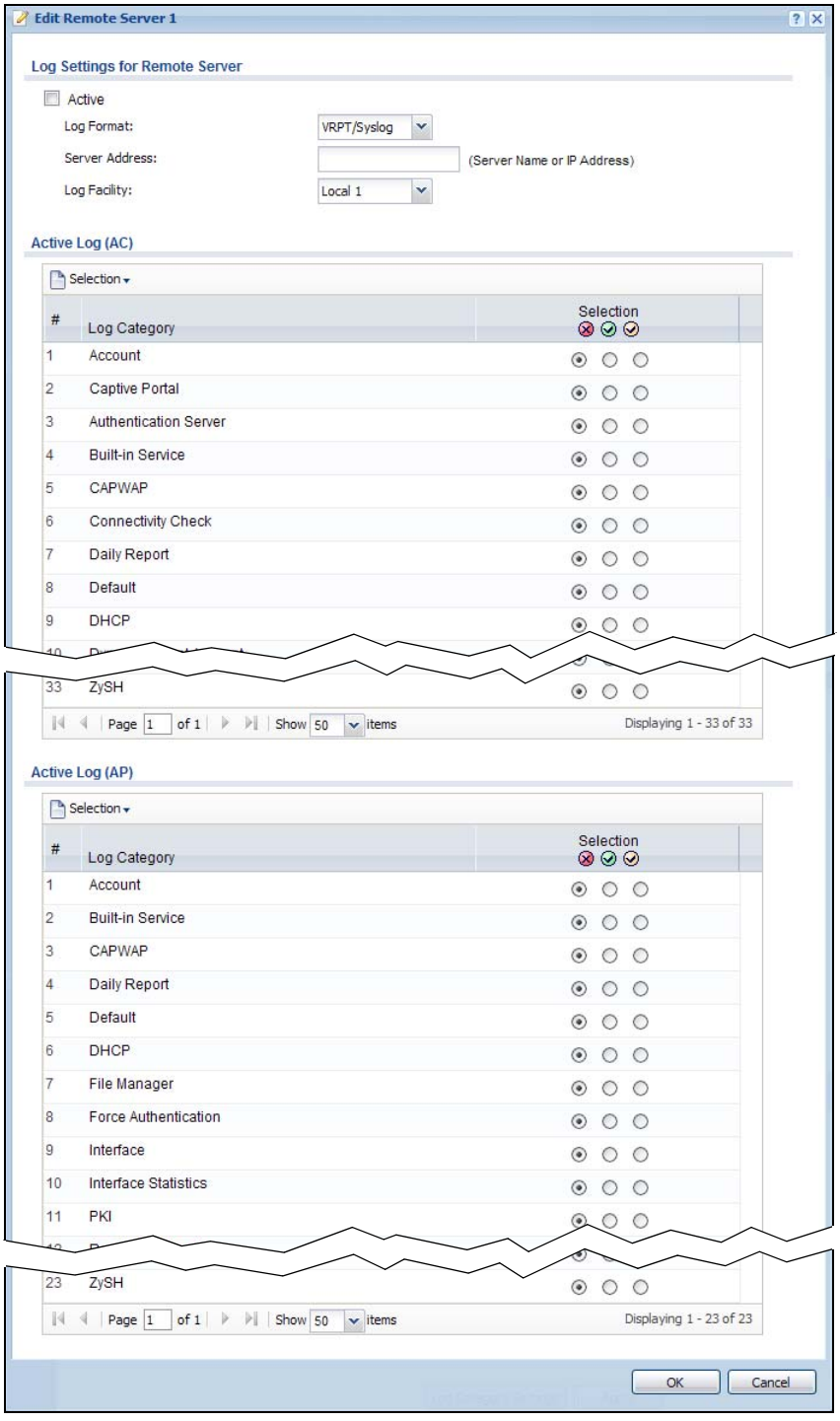
Table 183 Configuration > Log & Report > Log Settings > Edit (USB Storage) (continued)

| 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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - log regular information and alerts from this category<br>**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. |

## 29.3.4 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 213** Configuration > Log & Report > Log Settings > Edit (Remote Server)



The following table describes the labels in this screen.

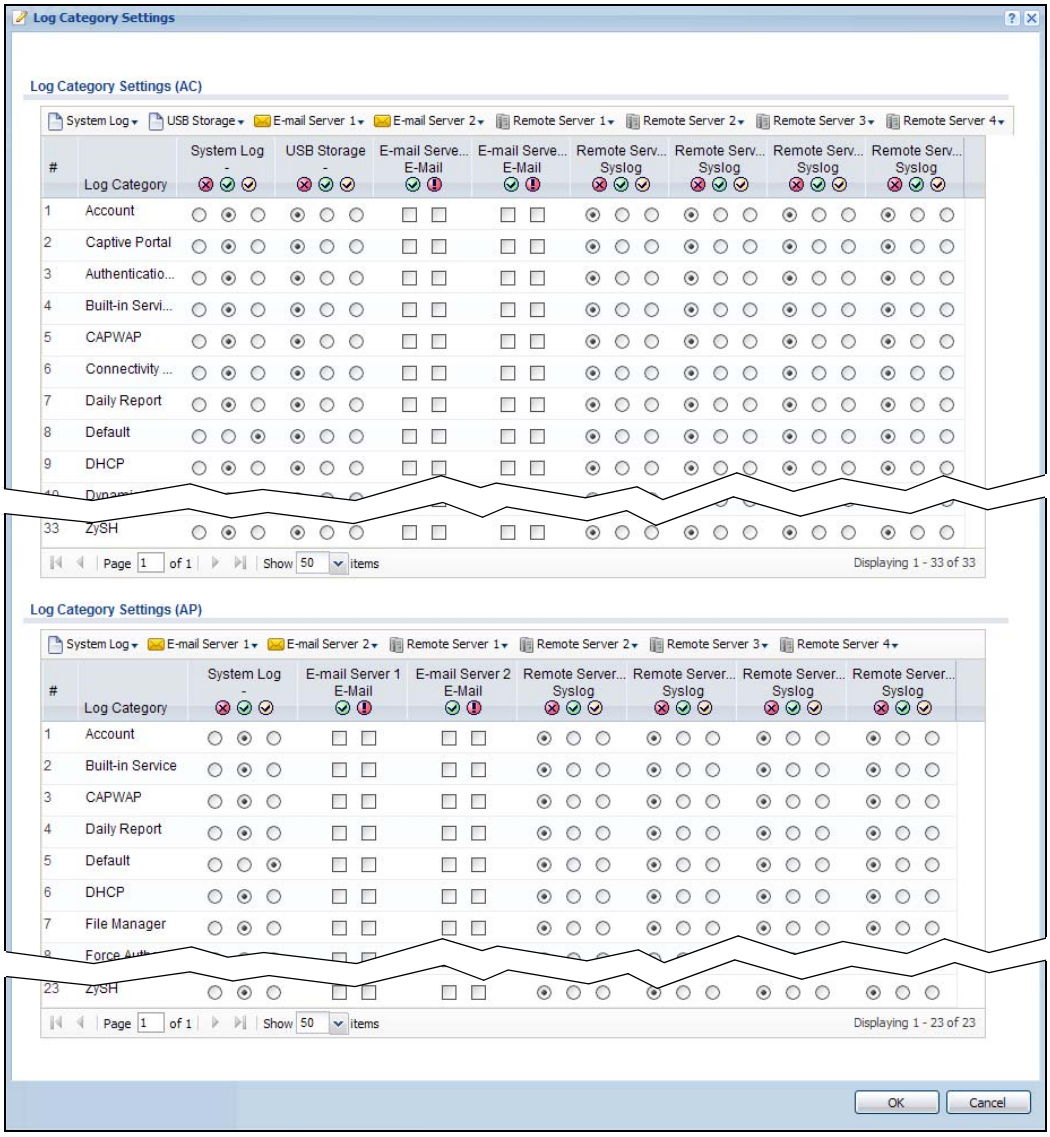
Table 184 Configuration > Log & Report > Log Settings > Edit (Remote Server)

| 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. |
| Log Format | This field displays the format of the log information. It is read-only.<br>**VRPT/Syslog** - Zyxel's Vantage Report, syslog-compatible format.<br>**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.<br>**disable all logs** (red X) - do not send the remote server logs for any log category.<br>**enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories.<br>**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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - log regular information and alerts from this category<br>**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. |

## 29.3.5 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 214** 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 185 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.<br>**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.<br>**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.<br>**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.<br>**disable all logs** (red X) - do not log any information for any category to a connected USB storage device.<br>**enable normal logs** (green check mark) - create log messages and alerts for all categories and save them to a connected USB storage device.<br>**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.<br>Using the **System Log** drop-down list to disable all logs overrides your e-mail server 1 settings.<br>**enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 1.<br>**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.<br>Using the **System Log** drop-down list to disable all logs overrides your e-mail server 2 settings.<br>**enable normal logs** (green check mark) - e-mail log messages for all categories to e-mail server 2.<br>**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.<br>**disable all logs** (red X) - do not send the remote server logs for any log category.<br>**enable normal logs** (green check mark) - send the remote server log messages and alerts for all log categories.<br>**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 185 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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - create log messages and alerts from this category<br>**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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - save log messages and alerts from this category<br>**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:<br>**disable all logs** (red X) - do not log any information from this category<br>**enable normal logs** (green check mark) - log regular information and alerts from this category<br>**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 30
# File Manager

## 30.1 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.

### 30.1.1 What You Can Do in this Chapter

- The **Configuration File** screen (Section 30.2 on page 354) stores and names configuration files. You can also download and upload configuration files.
- The **Firmware Package** screen (Section 30.3 on page 358) checks your current firmware version and uploads firmware to the NXC.
- The **Shell Script** screen (Section 30.4 on page 360) stores, names, downloads, uploads and runs shell script files.

### 30.1.2 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 215** 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 186 Configuration Files and Shell Scripts in the NXC

| Configuration Files (.conf) | Shell Scripts (.zysh) |
|---|---|
| • Resets to default configuration.<br>• Goes into CLI **Configuration** mode.<br>• Runs the commands in the configuration file. | • Goes into CLI **Privilege** mode.<br>• 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.

## 30.2 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.

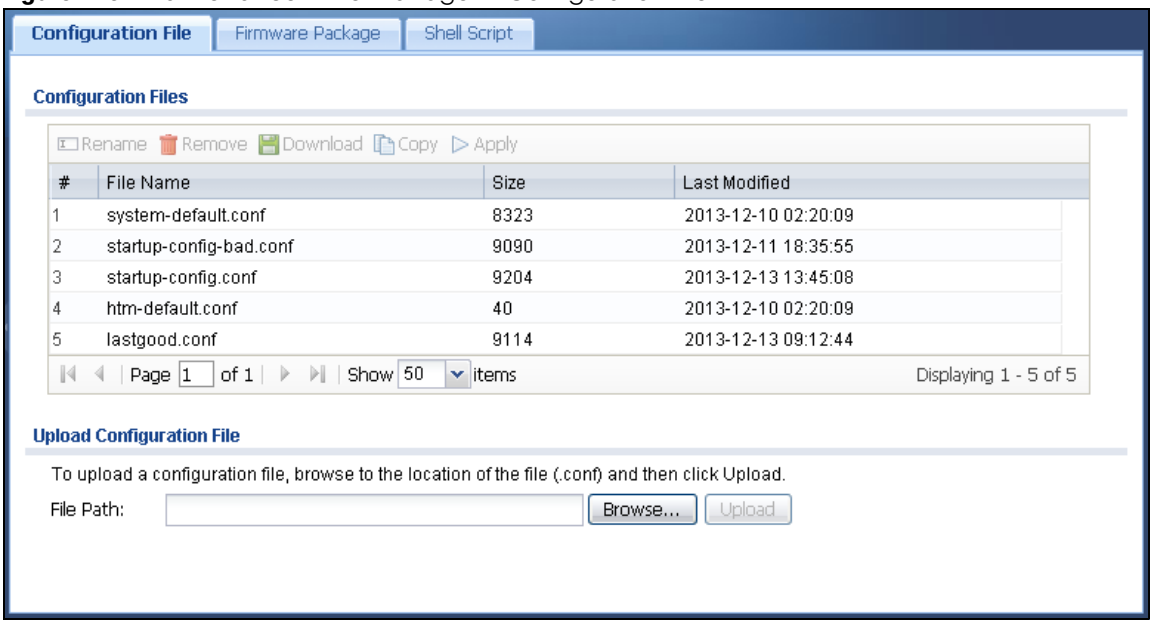
Once your NXC is configured and functioning properly, it is highly recommended that you back up your configuration file before making further configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

### 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 216** 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 187 Maintenance > File Manager > Configuration File

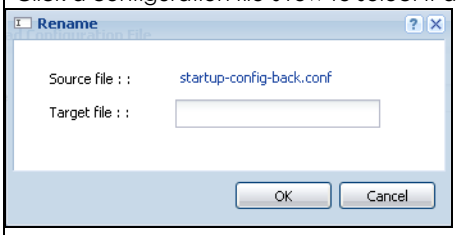
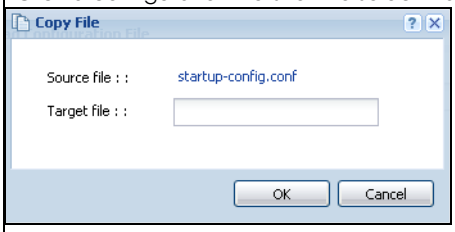
| LABEL | DESCRIPTION |
|---|---|
| Rename | Use this button to change the label of a configuration file on the NXC. You can only rename manually saved configuration files. You cannot rename the **lastgood.conf**, **system-default.conf** and **startup-config.conf** files.<br><br>You cannot rename a configuration file to the name of another configuration file in the NXC.<br><br>Click a configuration file's row to select it and click **Rename** to open the **Rename File** screen.<br>  <br><br>Specify the new name for the configuration file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-).<br><br>Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file. |
| Remove | Click a configuration file's row to select it and click **Remove** to delete it from the NXC. You can only delete manually saved configuration files. You cannot delete the **system-default.conf**, **startup-config.conf** and **lastgood.conf** files.<br><br>A pop-up window asks you to confirm that you want to delete the configuration file. Click **OK** to delete the configuration file or click **Cancel** to close the screen without deleting the configuration file. |
| Download | Click a configuration file's row to select it and click **Download** to save the configuration to your computer. |
| Copy | Use this button to save a duplicate of a configuration file on the NXC.<br><br>Click a configuration file's row to select it and click **Copy** to open the **Copy File** screen.<br>  <br><br>Specify a name for the duplicate configuration file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-).<br><br>Click **OK** to save the duplicate or click **Cancel** to close the screen without saving a duplicate of the configuration file. |

Table 187 Maintenance > File Manager > Configuration File (continued)

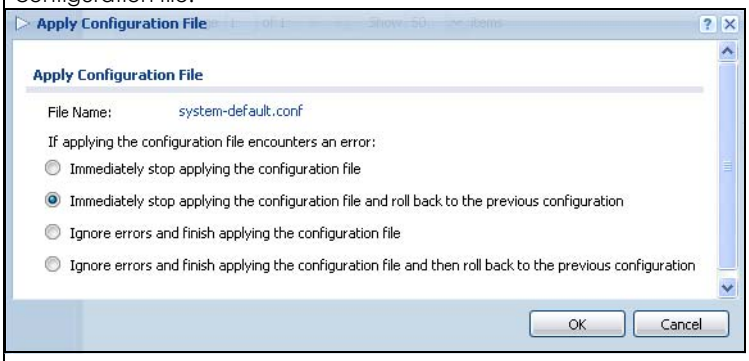
| LABEL | DESCRIPTION |
|---|---|
| Apply | Use this button to have the NXC use a specific configuration file.<br><br>Click a configuration file's row to select it and click **Apply** to have the NXC use that configuration file. The NXC does not have to restart in order to use a different configuration file, although you will need to wait for a few minutes while the system reconfigures.<br><br>The following screen gives you options for what the NXC is to do if it encounters an error in the configuration file.<br>  <br><br><br>**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.<br><br>**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.<br><br>**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.<br><br>**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.<br><br>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.<br><br>You cannot delete the following configuration files or change their file names.<br><br>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.<br><br>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.<br><br>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. |
| Last Modified | This column displays the date and time that the individual configuration files were last changed or saved. |

Table 187 Maintenance > File Manager > Configuration File (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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<br><br>You cannot upload a configuration file named **system-default.conf** or **lastgood.conf**.<br><br>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. |

# 30.3 Firmware Package

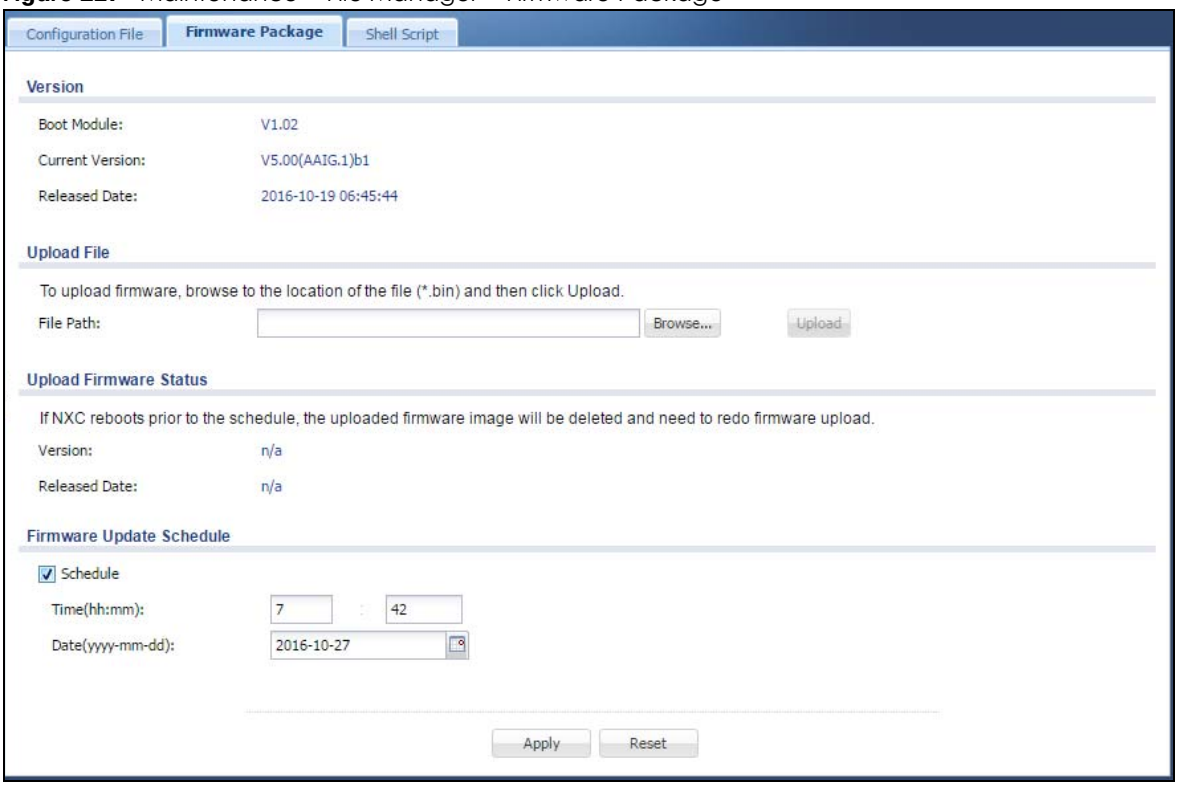
Click **Maintenance > File Manager > Firmware Package** to open this screen. Use the **Firmware Package** screen to check your current firmware version and upload firmware to the NXC.

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 217** Maintenance > File Manager > Firmware Package




The following table describes the labels in this screen.

Table 188 Maintenance > File Manager > Firmware Package

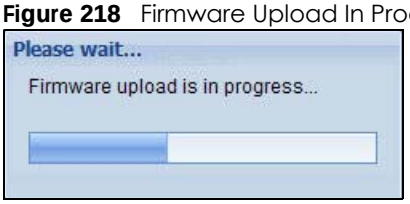
| LABEL | DESCRIPTION |
|---|---|
| Version | |
| Boot Module | This is the version of the boot module that is currently on the NXC. |
| Current Version | This is the version of the firmware that is currently installed on the NXC.<br><br>The firmware version conists of the trunk version number, model 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. |
| Upload File | |
| 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 .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. |
| Firmware Update Schedule | The NXC can be scheduled to install the firmware you uploaded at the specified date and time. |

Table 188 Maintenance > File Manager > Firmware Package (continued)

| LABEL | DESCRIPTION |
|---|---|
| Schedule | Select this option to turn on the firmware update scheduling feature.<br><br>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. |
| 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 218** Firmware Upload In Process




Note: The NXC automatically reboots after a successful firmware update.

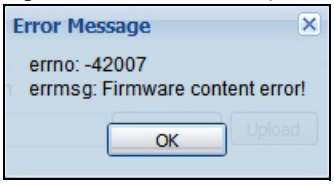
The NXC automatically restarts causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

**Figure 219** 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 220** Firmware Upload Error



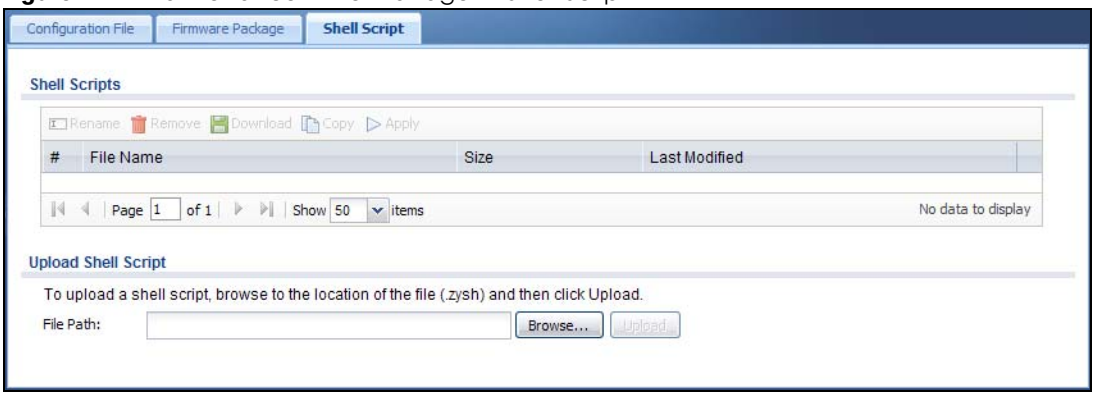

# 30.4 Shell Script

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 221** Maintenance > File Manager > Shell Script




Each field is described in the following table.

Table 189 Maintenance > File Manager > Shell Script

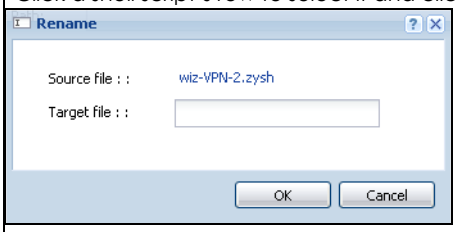
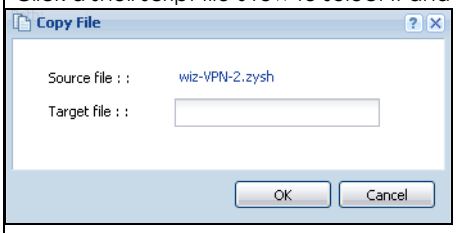
| LABEL | DESCRIPTION |
|---|---|
| Rename | Use this button to change the label of a shell script file on the NXC.<br>You cannot rename a shell script to the name of another shell script in the NXC.<br>Click a shell script's row to select it and click **Rename** to open the **Rename File** screen.<br>  <br>Specify the new name for the shell script file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-).<br>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.<br>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 189 Maintenance > File Manager > Shell Script (continued)

| LABEL | DESCRIPTION |
|---|---|
| Copy | Use this button to save a duplicate of a shell script file on the NXC.<br>Click a shell script file's row to select it and click **Copy** to open the **Copy File** screen.<br>  <br>Specify a name for the duplicate file. Use up to 25 characters (including a-zA-Z0-9;'~!@#$%^&()_+[]{}',.=-).<br>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.<br>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 31
# Diagnostics

## 31.1 Overview

Use the diagnostics screens for troubleshooting.

### 31.1.1 What You Can Do in this Chapter

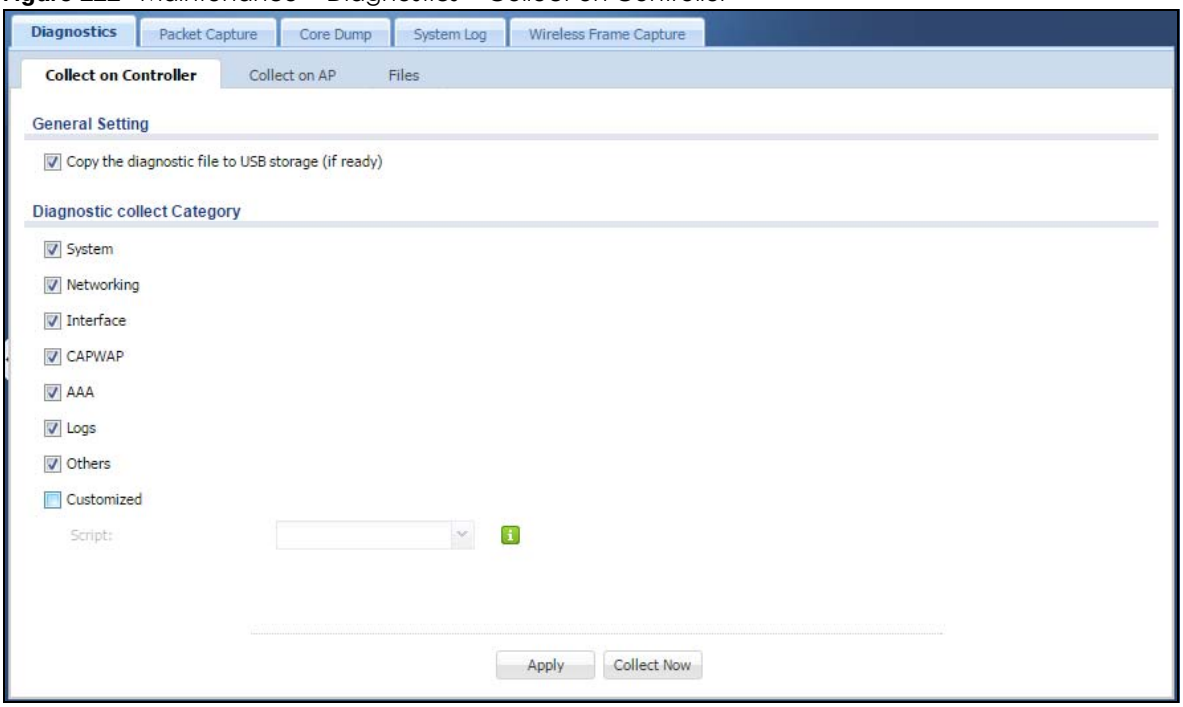
- The **Diagnostics** screen (Section 31.2 on page 363) generates a file containing the NXC's configuration and diagnostic information if you need to provide it to customer support during troubleshooting.
- The **Packet Capture** screen (Section 31.3 on page 366) captures data packets going through the NXC.
- The **Core Dump** screens (Section 31.4 on page 370) 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 31.5 on page 372) download files of system logs from a connected USB storage device to your computer.
- The **Wireless Frame Capture** screens (Section 31.6 on page 373) capture network traffic going through the AP interfaces connected to your NXC.

## 31.2 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 **Diagnostic** screen.

**Figure 222** Maintenance > Diagnostics > Collect on Controller




The following table describes the labels in this screen.

Table 190 Maintenance > Diagnostics > Collect on Controller

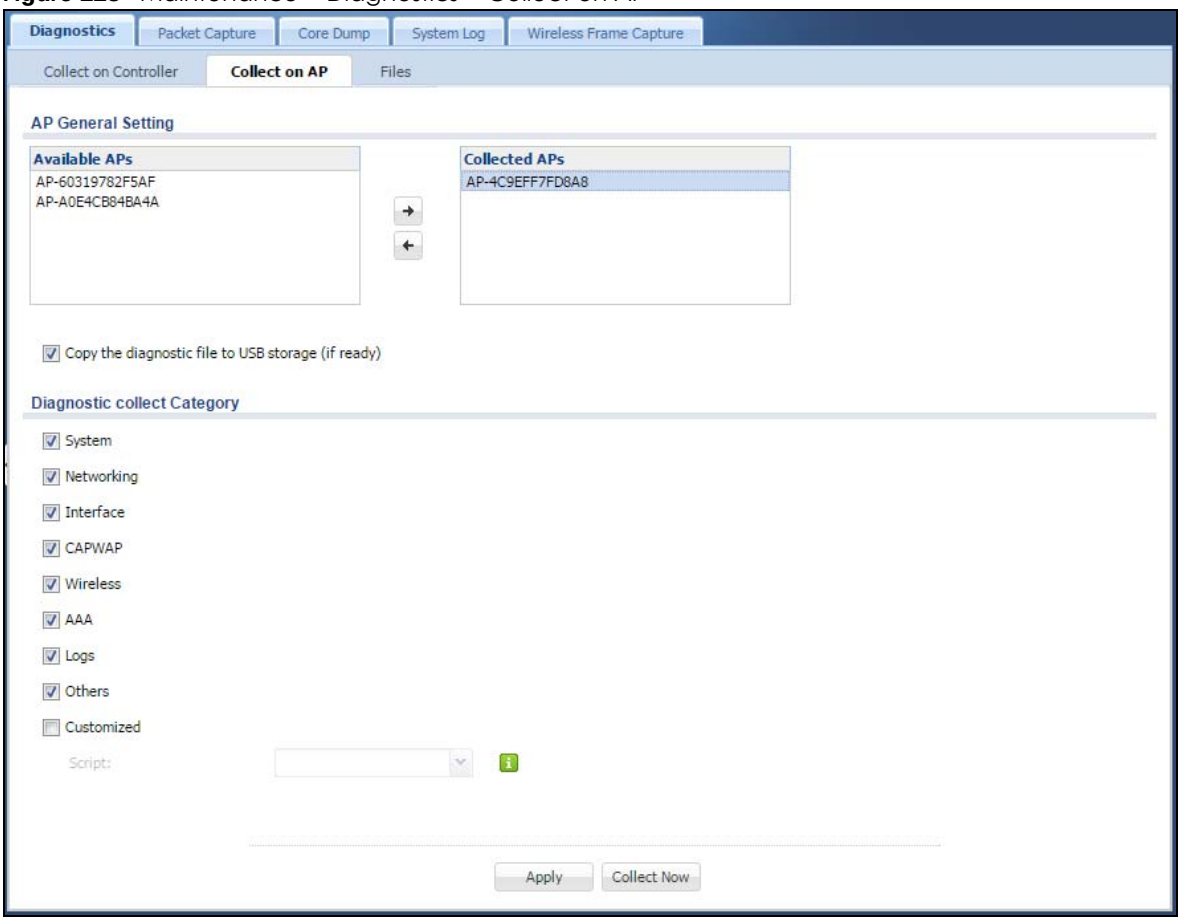
| LABEL | DESCRIPTION |
|---|---|
| General Setting | |
| Copy the diagnostic file to USB storage (if ready) | Select this to have the NXC create an extra copy of the diagnostic file to a connected USB storage device. |
| Diagnostic Collect Category | This field displays each category of settings. Select 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. |

## 31.2.1 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 223** Maintenance > Diagnostics > Collect on AP




The following table describes the labels in this screen.

Table 191 Maintenance > Diagnostics > Collect on AP

| LABEL | DESCRIPTION |
|---|---|
| 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. |
| 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. |
| 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. |

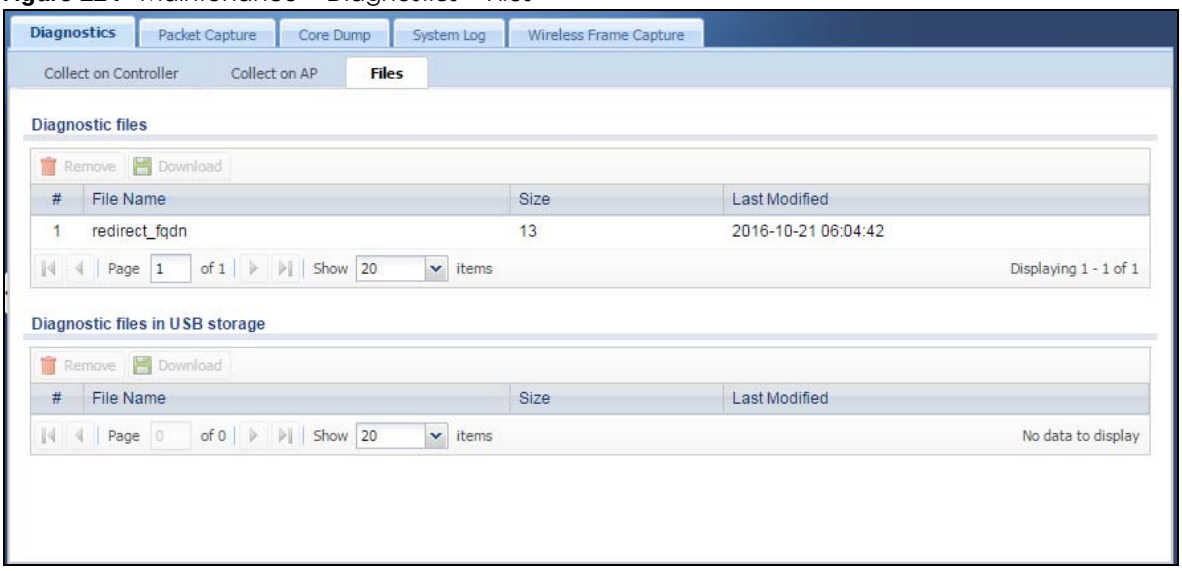
Table 191 Maintenance > Diagnostics > Collect on AP

| LABEL | DESCRIPTION |
|---|---|
| Apply | Click **Apply** to save your changes. |
| Collect Now | Click this to have the NXC create a new diagnostic file. |

## 31.2.2 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 224** Maintenance > Diagnostics > Files




The following table describes the labels in this screen.

Table 192 Maintenance > Diagnostics > 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 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. |

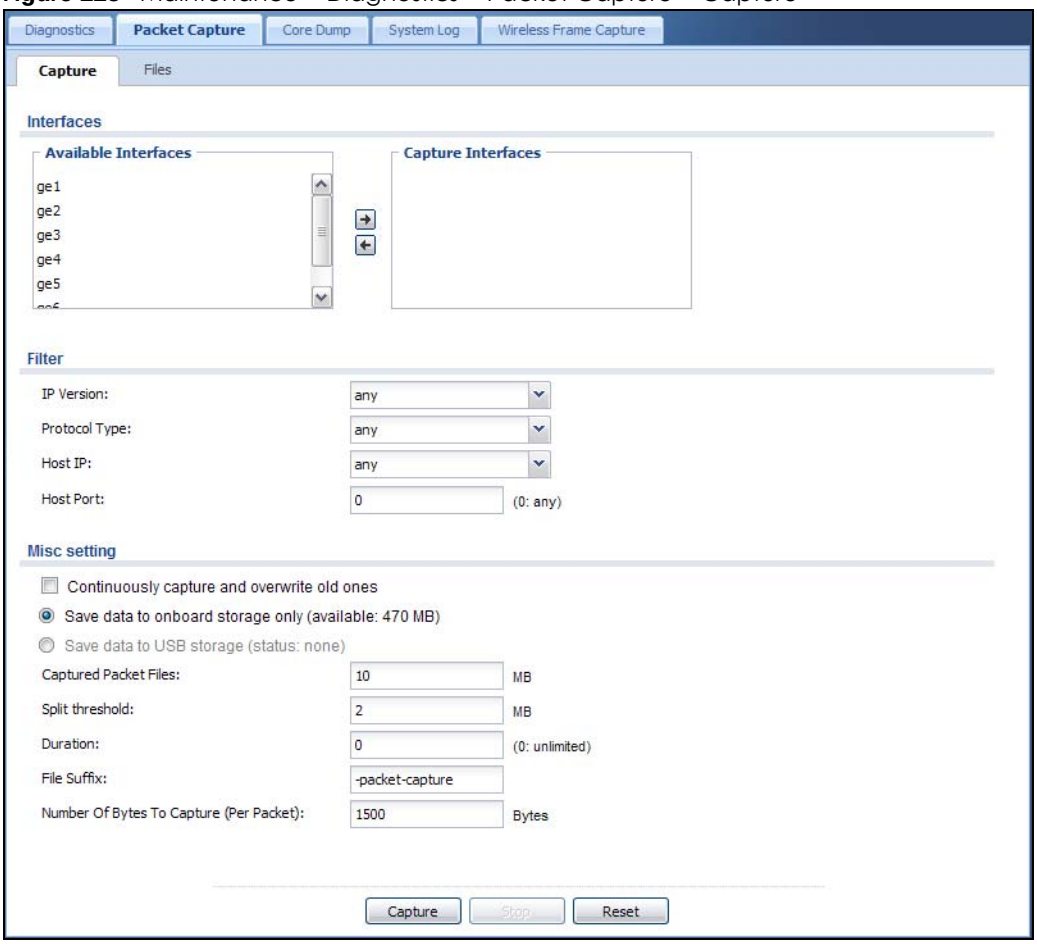
# 31.3 Packet Capture

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 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 225** Maintenance > Diagnostics > Packet Capture > Capture




The following table describes the labels in this screen.

Table 193 Maintenance > Diagnostics > Packet Capture

| 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. |
| 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. |
| 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 193 Maintenance > Diagnostics > Packet Capture (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.<br><br>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.<br><br>Status:<br><br>**Unused** - the connected USB storage device was manually unmounted by using the **Remove Now** button or for some reason the NXC cannot mount it.<br><br>**none** - no USB storage device is connected.<br><br>**available** - you can have the NXC use the USB storage device. The available storage capacity also displays.<br><br>**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.<br><br>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.<br><br>When saving packet captures to a connected USB storage device, specify a maximum limit in megabytes for each capture file.<br><br>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.<br><br>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.<br><br>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. |

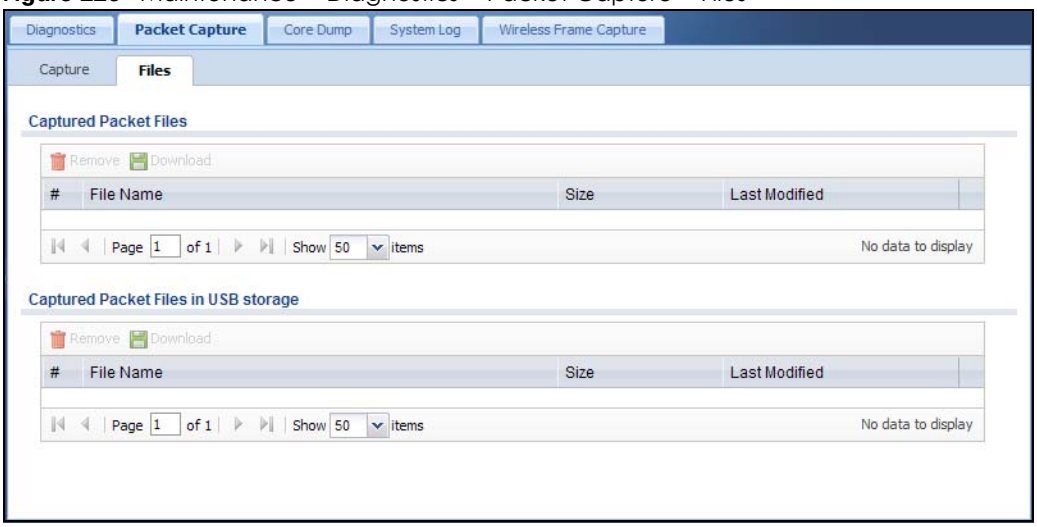
Table 193 Maintenance > Diagnostics > Packet Capture (continued)

| LABEL | DESCRIPTION |
|---|---|
| Capture | Click this button to have the NXC capture packets according to the settings configured in this screen.<br><br>You can configure the NXC while a packet capture is in progress although you cannot modify the packet capture settings.<br><br>The NXC's throughput or performance may be affected while a packet capture is in progress.<br><br>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. |

## 31.3.1 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 226** Maintenance > Diagnostics > Packet Capture > Files




The following table describes the labels in this screen.

Table 194 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. |

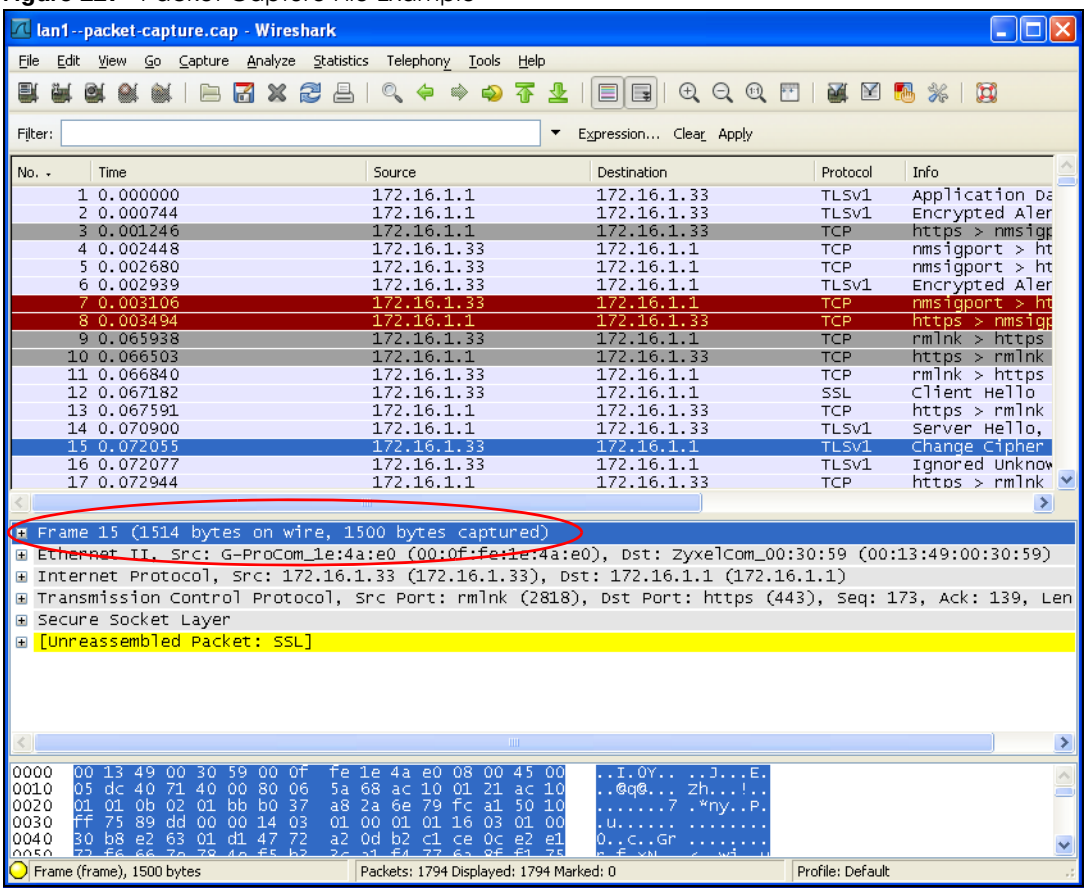
Table 194 Maintenance > Diagnostics > Packet Capture > Files (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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. |

## 31.3.2 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 227** Packet Capture File Example

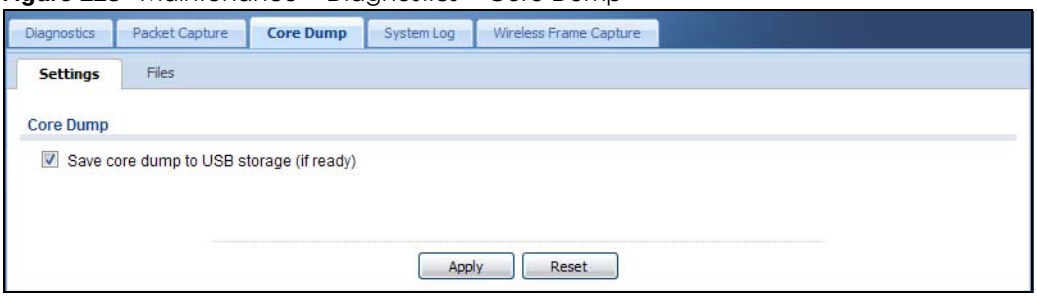



# 31.4 Core Dump

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 228** Maintenance > Diagnostics > Core Dump




The following table describes the labels in this screen.

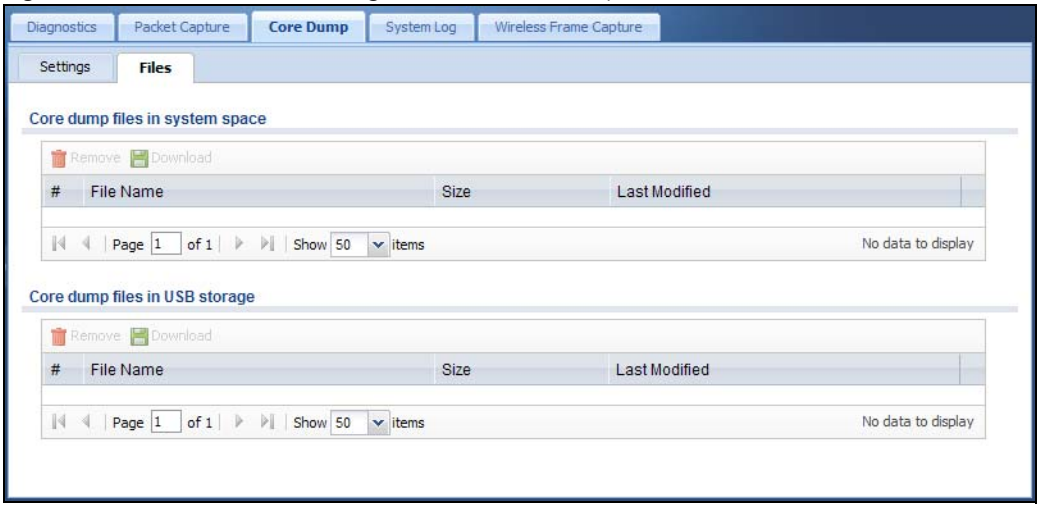
Table 195 Maintenance > Diagnostics > Core Dump

| 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. |

## 31.4.1 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 229** Maintenance > Diagnostics > Core Dump > Files



The following table describes the labels in this screen.

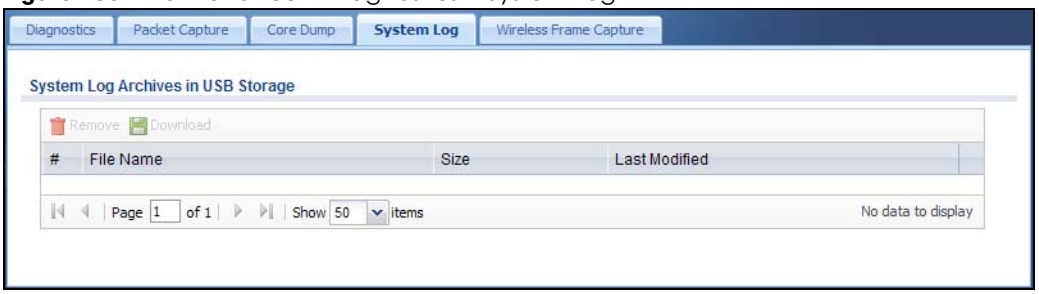
Table 196 Maintenance > Diagnostics > Core Dump > Files

| 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. |

# 31.5 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 230** Maintenance > Diagnostics > System Log




The following table describes the labels in this screen.

Table 197 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. |

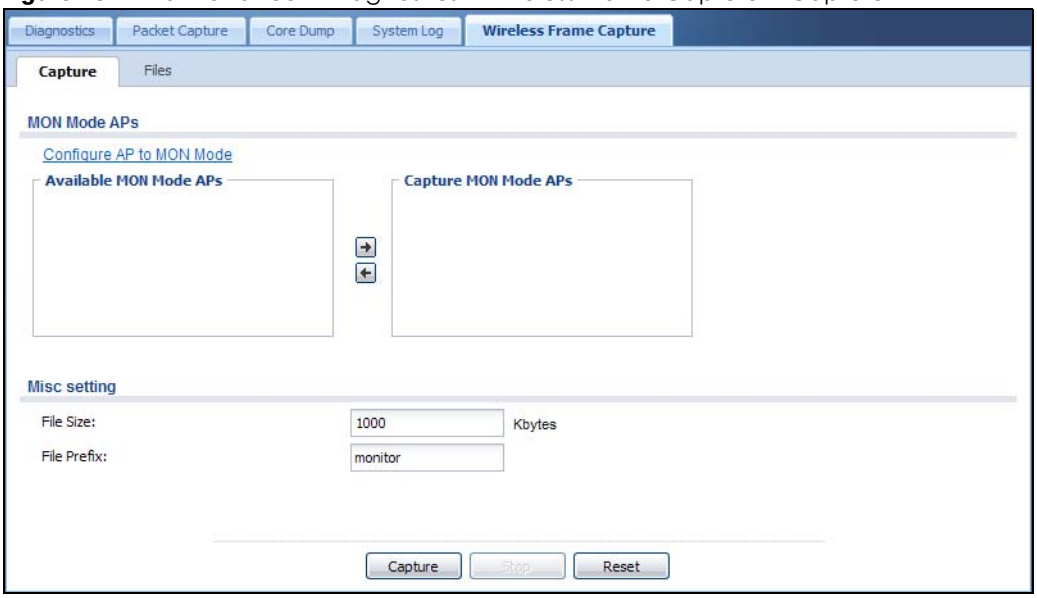
# 31.6 Wireless Frame Capture

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 231** Maintenance > Diagnostics > Wireless Frame Capture > Capture




The following table describes the labels in this screen.

Table 198 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.<br>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.<br>Note: If you have existing capture files you may need to set this size larger or delete existing capture files.<br>The valid range is 1 to 50000. The NXC stops the capture and generates the capture file when either the file reaches this size. |

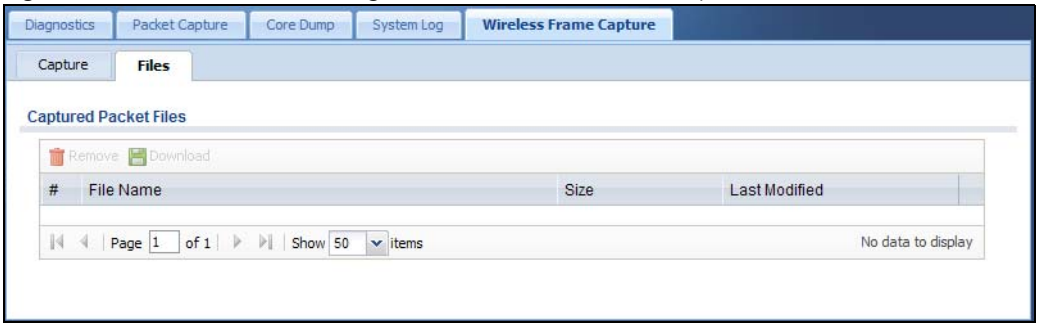
Table 198 Maintenance > Diagnostics > Wireless Frame Capture > Capture (continued)

| LABEL | DESCRIPTION |
|---|---|
| File Prefix | Specify text to add to the front of the file name in order to help you identify frame capture files.<br>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.<br>The file format is: [file prefix].cap. For example, "monitor.cap". |
| Capture | Click this button to have the NXC capture frames according to the settings configured in this screen.<br>You can configure the NXC while a frame capture is in progress although you cannot modify the frame capture settings.<br>The NXC's throughput or performance may be affected while a frame capture is in progress.<br>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. |

## 31.6.1 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 232** Maintenance > Diagnostics > Wireless Frame Capture > Files




The following table describes the labels in this screen.

Table 199 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. |

Table 199 Maintenance > Diagnostics > Wireless Frame Capture > Files (continued)

| LABEL | DESCRIPTION |
|---|---|
| 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 32
# Packet Flow Explore

## 32.1 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.

### 32.1.1 What You Can Do in this Chapter

- The **Routing Status** screen (Section 32.2 on page 376) displays the overall routing flow and each routing function's settings.
- The **SNAT Status** screen (Section 32.3 on page 379) displays the overall source IP address conversion (SNAT) flow and each SNAT function's settings.

## 32.2 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 233** Maintenance > Packet Flow Explore > Routing Status (Direct Route)

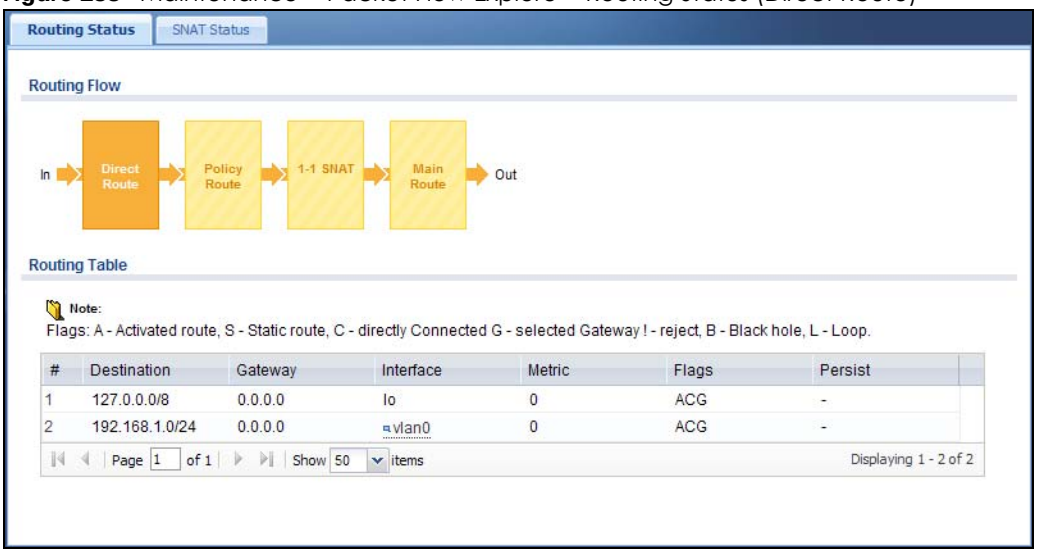



**Figure 234** Maintenance > Packet Flow Explore > Routing Status (Policy Route)

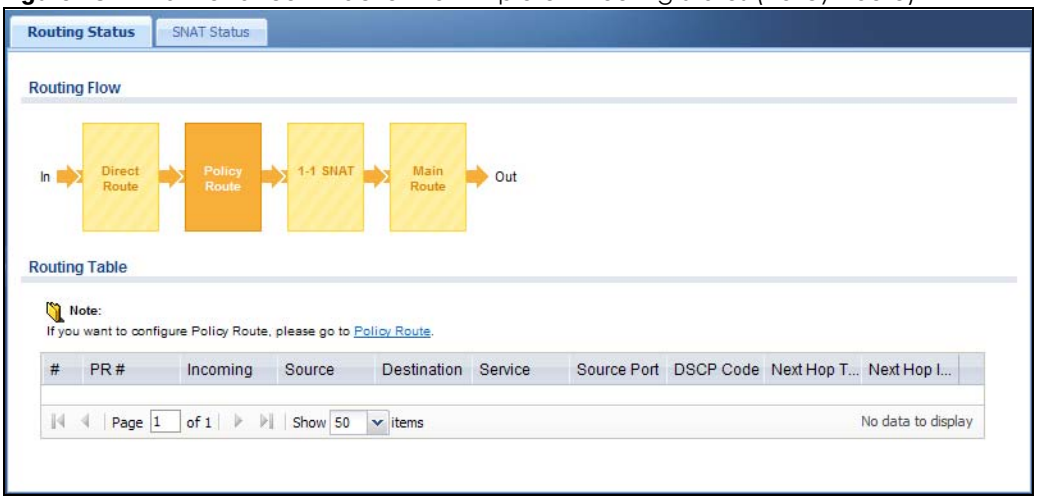



**Figure 235** Maintenance > Packet Flow Explore > Routing Status (1-1 SNAT)

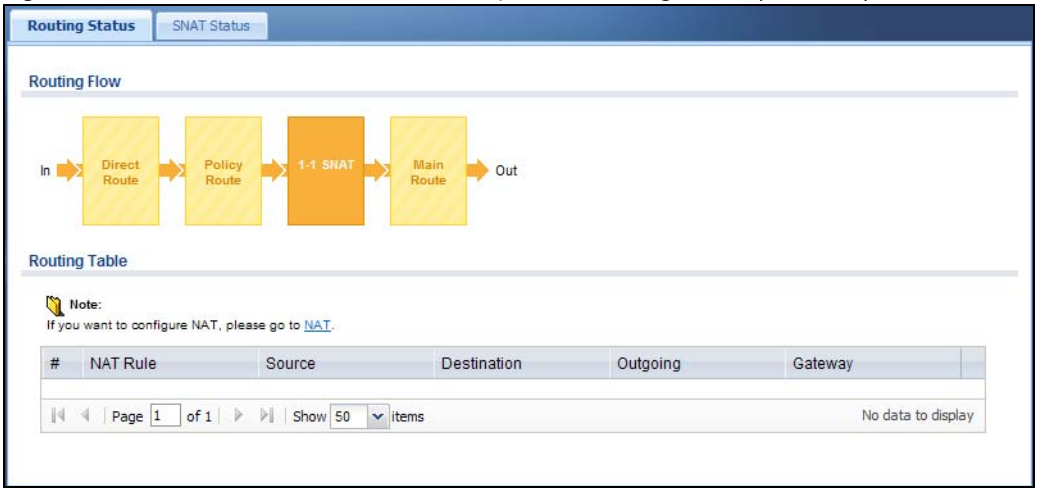
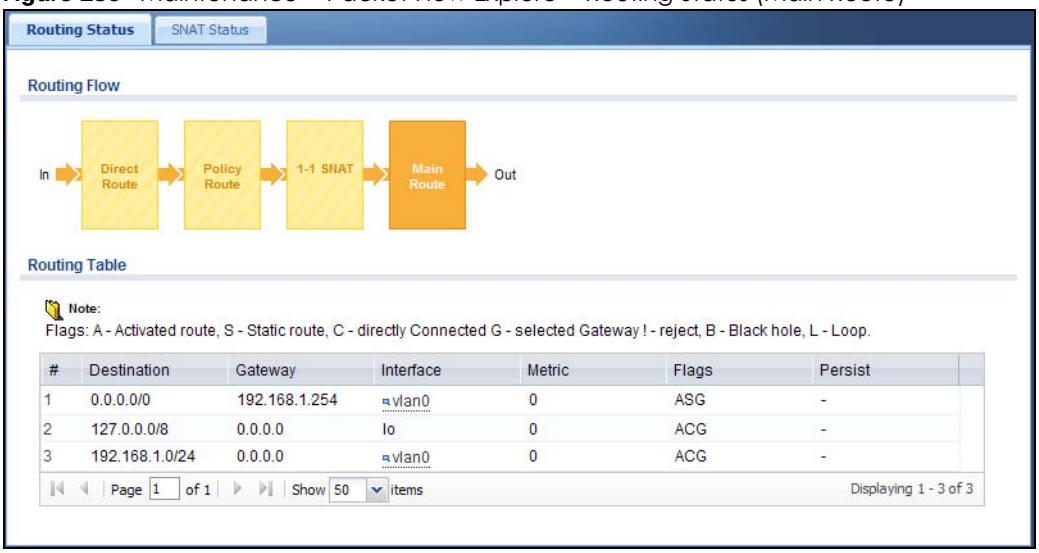


**Figure 236** Maintenance > Packet Flow Explore > Routing Status (Main Route)




The following table describes the labels in this screen.

Table 200 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:<br>• **A** - this route is currently activated.<br>• **S** - this is a static route.<br>• **C** - this is a direct connected route.<br>• **O** - this is a dynamic route learned through OSPF.<br>• **R** - this is a dynamic route learned through RIP.<br>• **G** - the route is to a gateway (router) in the same network.<br>• **!** - this is a route which forces a route lookup to fail.<br>• **B** - this is a route which discards packets.<br>• **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 200 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**.<br>• 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. |

# 32.3 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 237** Maintenance > Packet Flow Explore > SNAT Status (Policy Route SNAT)

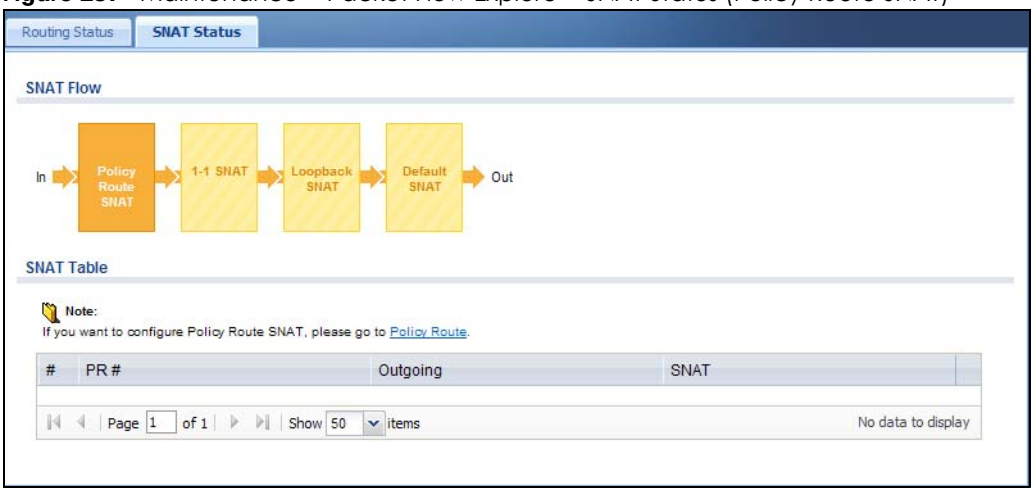


**Figure 238** Maintenance > Packet Flow Explore > SNAT Status (1-1 SNAT)

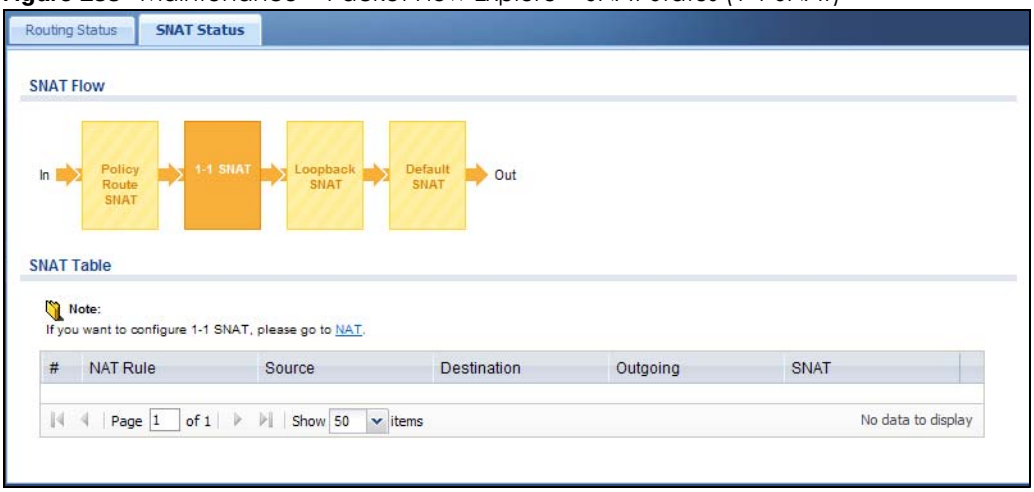



**Figure 239** Maintenance > Packet Flow Explore > SNAT Status (Loopback SNAT)

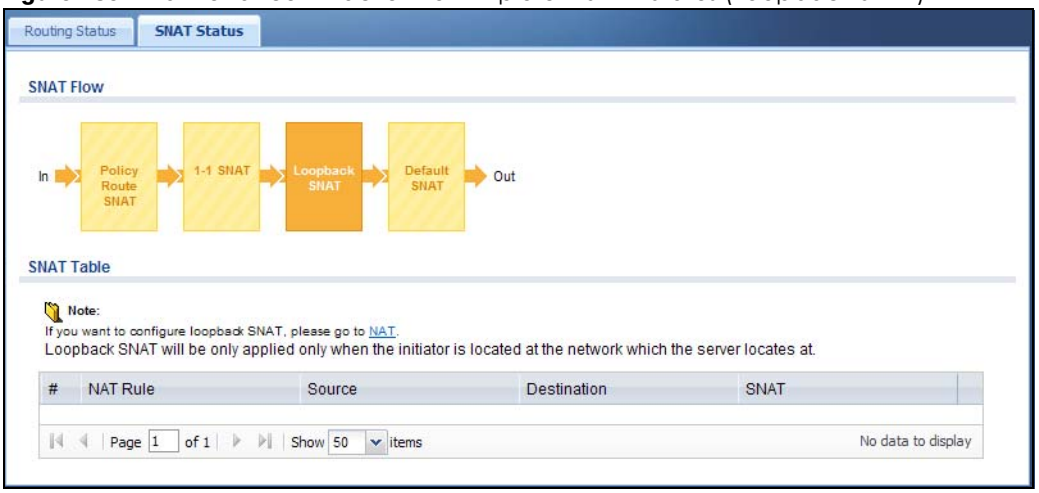
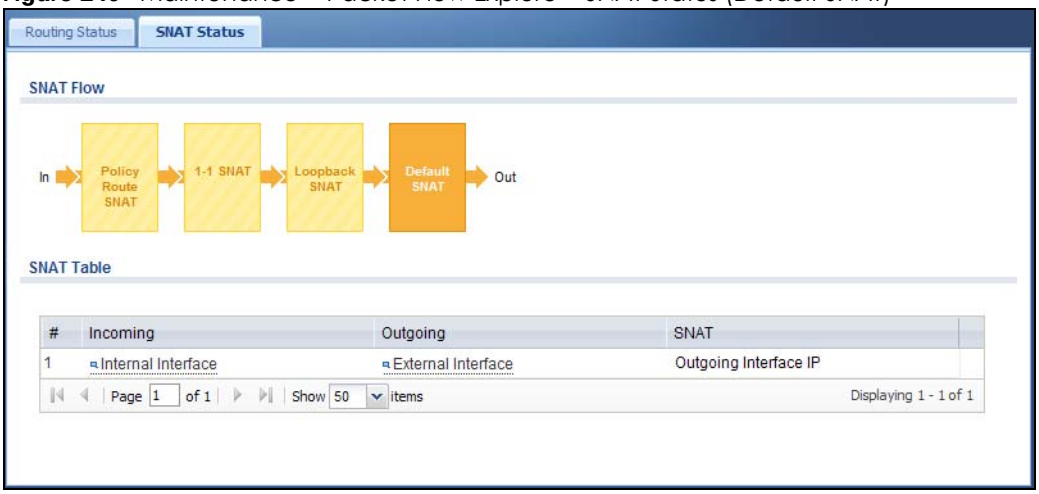



**Figure 240** Maintenance > Packet Flow Explore > SNAT Status (Default SNAT)



The following table describes the labels in this screen.

Table 201 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 33
# Reboot

## 33.1 Overview

Use this screen to restart the device.

### 33.1.1 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.

## 33.2 Reboot

This screen allows remote users to restart the device. To access this screen, click **Maintenance** > **Reboot**.

**Figure 241** 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 34
# Shutdown

## 34.1 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.**

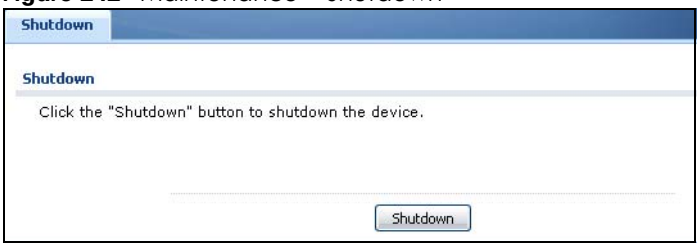
### 34.1.1 What You Need To Know

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.

## 34.2 Shutdown

To access this screen, click **Maintenance** > **Shutdown**.

**Figure 242** 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.

# CHAPTER 35
# Troubleshooting

## 35.1 Overview

This chapter offers some suggestions to solve problems you might encounter.

### 35.1.1 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.

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.

## 35.1.2 Wireless

This section provides troubleshooting for wireless devices connected the NXC.

Wireless clients cannot connect to an AP.

- 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, and so on.

  See Section 5.11 on page 75 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 5.11.1 on page 77 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 18.3.3 on page 238 for details on managing the NXC MAC Filter.
- 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 18 on page 222 and Chapter 7 on page 98 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 18.3.2.1 on page 234).
- Enable the AP **Wireless LAN** logs (see Section 29.3.2 on page 342).
- Check the AP log **Wireless LAN** logs (Section 5.18 on page 92) for WTP logs. WTP stands for Wireless 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 31 on page 363) 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 7 on page 98).

## 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 28 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 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.

## 35.2 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 files or shell scripts 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.

## 35.3 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 202 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 202 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 203 User Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| %s %s from %s has logged in EnterpriseWLAN | A user logged into the NXC.<br>1st %s: The type of user account.<br>2nd %s: The user's user name.<br>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.<br>1st %s: The type of user account.<br>2nd %s: The user's user name.<br>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.<br>1st %s: The type of user account.<br>2nd %s: The user's user name.<br>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.<br>1st %s: The type of user account.<br>2nd %s: The user's user name.<br>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.<br>1st %s: The type of user account.<br>2nd %s: The user's user name.<br>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.<br>%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.<br>%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.<br>%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.<br>%s: service name |

Table 203 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.<br>%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.<br>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 204 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.<br>%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.<br>1st %s: service name<br>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.<br>%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 204 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.<br>%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.<br>%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 204 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 204 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.<br>%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 204 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.<br>1st %d: certificate chain level<br>2nd %d: error number<br>%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 205 Sessions Limit Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| Maximum sessions per host (%d) was exceeded. | %d is maximum sessions per host. |

Table 206 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.<br>%d: the policy route rule number |
| The policy route %d uses empty user group! | Use an empty object group.<br>%d: the policy route rule number |

Table 206 Policy Route Logs (continued)

| LOG MESSAGE | DESCRIPTION |
|---|---|
| The policy route %d uses empty source address group! | Use an empty object group.<br>%d: the policy route rule number |
| The policy route %d uses empty destination address group! | Use an empty object group.<br>%d: the policy route rule number |
| The policy route %d uses empty service group | Use an empty object group.<br>%d: the policy route rule number |
| Policy-route rule %d was inserted. | Rules is inserted into system.<br>%d: the policy route rule number |
| Policy-route rule %d was appended. | Rules is appended into system.<br>%d: the policy route rule number |
| Policy-route rule %d was modified. | Rule is modified.<br>%d: the policy route rule number |
| Policy-route rule %d was moved to %d. | Rule is moved.<br>1st %d: the original policy route rule number<br>2nd %d: the new policy route rule number |
| Policy-route rule %d was deleted. | Rule is deleted.<br>%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 207 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.<br>%u.%u.%u.%u is IP address<br>%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.<br>%s is certificate name assigned by user |
| HTTPS port has been changed to port %s. | An administrator changed the port number for HTTPS.<br>%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.<br>%s is port number assigned by user |

Table 207 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.<br>%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.<br>%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.<br>%s is certificate name assigned by user |
| TELNET port has been changed to port %s. | An administrator changed the port number for TELNET.<br>%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.<br>%s is certificate name assigned by user |
| FTP port has been changed to port %s. | An administrator changed the port number for FTP.<br>%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.<br>%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.<br>%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).<br>%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.<br>%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.<br>%s is interface name |

Table 207 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.<br>%s is interface name. The DNS option of DHCP pool has retrieved from it |
| Set timezone to %s. | An administrator changed the time zone.<br>%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.<br>%u is rule number |
| DNS access control rule %u has been inserted. | An administrator inserted a new rule.<br>%u is rule number |
| DNS access control rule %u has been appended | An administrator appended a new rule.<br>%u is rule number |
| DNS access control rule %u has been modified | An administrator modified the rule %u.<br>%u is rule number |
| DNS access control rule %u has been deleted. | An administrator removed the rule %u.<br>%u is rule number |
| DNS access control rule %u has been moved to %d. | An administrator moved the rule %u to index %d.<br>%u is previous index<br>%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.<br>%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.<br>%s is interface name |

Table 207 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.<br>%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.<br>%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.<br>%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.<br>%s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.<br>%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.<br>%u is the index of the access control rule.<br>%s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET. |
| Access control rule %u of %s was inserted. | An access control rule was inserted successfully.<br>%u is the index of the access control rule.<br>%s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET. |
| Access control rule %u of %s was modified. | An access control rule was modified successfully.<br>%u is the index of the access control rule.<br>%s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET. |
| Access control rule %u of %s was deleted. | An access control rule was removed successfully.<br>%u is the index of the access control rule.<br>%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.<br>1st %d is the previous index .<br>%s is HTTP/HTTPS/SSH/SNMP/FTP/TELNET.<br>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 208 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).<br>1st %s: Daemon Name, 2nd %s: date and time |
| %s process count is incorrect at %s | The count of the listed process is incorrect.<br>1st %s: Daemon Name, 2nd %s: date and time |
| %s becomes Zombie at %s | A process is present but not functioning.<br>1st %s: Daemon Name, 2nd %s: date and time<br>When memory usage exceed threshold-max, memory usage reaches %d%% :mem-threshold-max.<br>When local storage usage exceeds threshold-max, %s: Partition name file system usage reaches %d%%: disk-threshold-max.<br>When memory usage drops below threshold-min, System Memory usage drops below the threshold of %d%%: mem-threshold-min.<br>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 208 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.<br>%s is the date and time. |
| NTP update successful, current time is %s | The device successfully synchronized with a NTP time server .<br>%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 209 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.<br>%s: interface name |
| Can not open %s.arg | Cannot open configuration file for connectivity check process.<br>%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.<br>%s: interface name |
| The connectivity-check is fail for %s interface | The link status of interface is fail after check of connectivity check process.<br>%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.<br>%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.<br>%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.<br>%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.<br>%s: interface name. |
| Can't get flags of %s interface | The connectivity check process can't get interface configuration.<br>%s: interface name |
| Can't get NETMASK address of %s interface | The connectivity check process can't get netmask address of interface.<br>%s: interface name |
| Can't get BROADCAST address of %s interface | The connectivity check process can't get broadcast address of interface<br>%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.<br>%s: interface name |
| To send ARP REQUEST error! | The connectivity check process can't send ARP request packet. |

Table 209 Connectivity Check Logs (continued)

| LOG MESSAGE | DESCRIPTION |
|---|---|
| The %s routing status seted to DEAD by connectivity-check | The interface routing can't forward packet.<br>%s: interface name |
| The %s routing status seted ACTIVATE by connectivity-check | The interface routing can forward packet.<br>%s: interface name |
| The link status of %s interface is inactive | The specified interface failed a connectivity check. |

Table 210 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.<br>%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.<br>%d: Port number |
| Register SIP ALG signal port=%d failed. | SIP ALG apply signal port failed.<br>%d: Port number |
| Register H.323 ALG extra port=%d failed. | H323 ALG apply additional signal port failed.<br>%d: Port number |
| Register H.323 ALG signal port=%d failed. | H323 ALG apply signal port failed.<br>%d: Port number |

Table 210 NAT Logs (continued)

| LOG MESSAGE | DESCRIPTION |
|---|---|
| Register FTP ALG extra port=%d failed. | FTP ALG apply additional signal port failed.<br>%d: Port number |
| Register FTP ALG signal port=%d failed. | FTP ALG apply signal port failed.<br>%d: Port number |

Table 211 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 212 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.<br>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.<br>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 213 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 213 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 214 Account Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| Account %s %s has been deleted. | A user deleted an ISP account profile.<br>1st %s: profile type, 2nd %se: profile name. |
| Account %s %s has been changed. | A user changed an ISP account profile's options.<br>1st %s: profile type, 2nd %s: profile name. |
| Account %s %s has been added. | A user added a new ISP account profile.<br>1st %s: profile type, 2nd %s: profile name. |

Table 215 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 216 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.<br>1st %s is CLI command.<br>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.<br>1st %s is CLI command.<br>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.<br>1st %s is CLI command.<br>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.<br>1st %s is CLI command.<br>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.<br>%s is configuration file name. |
| Running %s... | An administrator ran the listed shell script.<br>%s is script file name. |

Table 217 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 218 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 219 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 220 CAPWAP Server Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| WLAN Controller Start. Registration Type:%s | Start the AP management service.<br>1st %s: Registration Type.<br>{Always Accept \| Manual} |
| WLAN Controller Reset. Registration Type:%s | Reset the AP management service.<br>1st %s: Registration Type.<br>{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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>8th %s: Managed AP Disconnect Reason.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Model Name. |
| AP Delete. MAC:%02x%02x%02x%02x%02x%02x, Model:%s | Delete an AP from managed list.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Model Name. |

Table 220 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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Model Name.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>8th %s: Managed AP Model Name.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>7th: %d: Managed AP's Radio Number.<br>8th: %s: Managed AP Stop SSID Name. |

Table 220 CAPWAP Server Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| VLAN setting is conflict.MAC:%02x:%02x:%02x:%02x:%02x:%02x,Model:%s, Mgnt. VID(AC):%d, %s, Mgnt. VID(AP):%d,%s | The VLAN ID of the AC is not the same as the VLAN ID of the AP.<br>1st %02x~6th%02x: Managed AP MAC Address.<br>7th %s: Managed AP Description.<br>8th %d: VID , 9th %s: tag or untag<br>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.<br>1st %s: feature name<br>2st %02x~7th%02x: Managed AP MAC Address.<br>8th %s: Managed AP Description. |

Table 221 CAPWAP Client Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| AP Start. Discovery Type:%s | Start the CAPWAP Client service.<br>1st %s: Discovery type {Static \| DHCP \| DNS \| Broadcast} |
| AP Reset. Discovery Type:%s | Reset the CAPWAP Client service.<br>1st %s: Discovery type {Static \| DHCP \| DNS \| Broadcast} |
| Connect to WLAN Controller. IP:%s | CAPWAP Client connected to the WLAN Controller.<br>1st %s: WLAN Controller IP Address. |
| Disconnect from WLAN Controller. IP:%s | CAPWAP Client disconnected from to the WLAN Controller.<br>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.<br>1st %s: WLAN Controller IP Address. |
| Firmware Upgraded by WLAN Controller. IP:%s | Firmware upgraded by WLAN Controller.<br>1st %s: WLAN Controller IP Address. |
| Apply Configuration by a WLAN Controller Success.%s | Configuration apply success by WLAN Controller.<br>1st %s: Complete Update |
| WLAN Controller IP Changed. New Discovery Type:%s, WLAN Controller IP: %s | Changed WTP's AC IP.<br>1st %s: Discovery type {Static \| DHCP \| DNS \| Broadcast}<br>2nd %s: WLAN Controller IP Address |

Table 221 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.<br>1st %s: WTP's description. |
| DNS Query result is NULL. | A DNS query failed. |

Table 222 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 223 Rogue AP Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| rogue ap detection is enabled. | Indicates that rogue AP detection is enabled. |

Table 224 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.<br>1st %d: total files size of directory.<br>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 225 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 225 DCS Logs

| LOG MESSAGE | DESCRIPTION |
|---|---|
| channel changed: %s %d -> %d\n | DCS has changed the wireless interface %s channel from %d to channel %d.<br>1st %s: interface name<br>1st %d: current channel<br>2nd %d: new channel |
| dcs is terminated! | DCS was terminated for an unknown reason. |

Table 226 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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>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.<br>1st %02x ~ 6th %02x: Managed AP MAC Address.<br>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.<br>1st %02x~6th%02x: Station MAC Address.<br>7th %s: Source WTP's description.<br>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.<br>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.<br>1st %s: Disassociation reason.<br>2nd %02x~7th%02x: Wireless client's MAC Address.<br>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.<br>1st %02x~6th%02x: AP's MAC Address.<br>7th %02x~12th%02x: Wireless client's MAC Address.<br>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 227 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<br>UDP | 7648<br>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<br>TCP | 20<br>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 227 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 227 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.

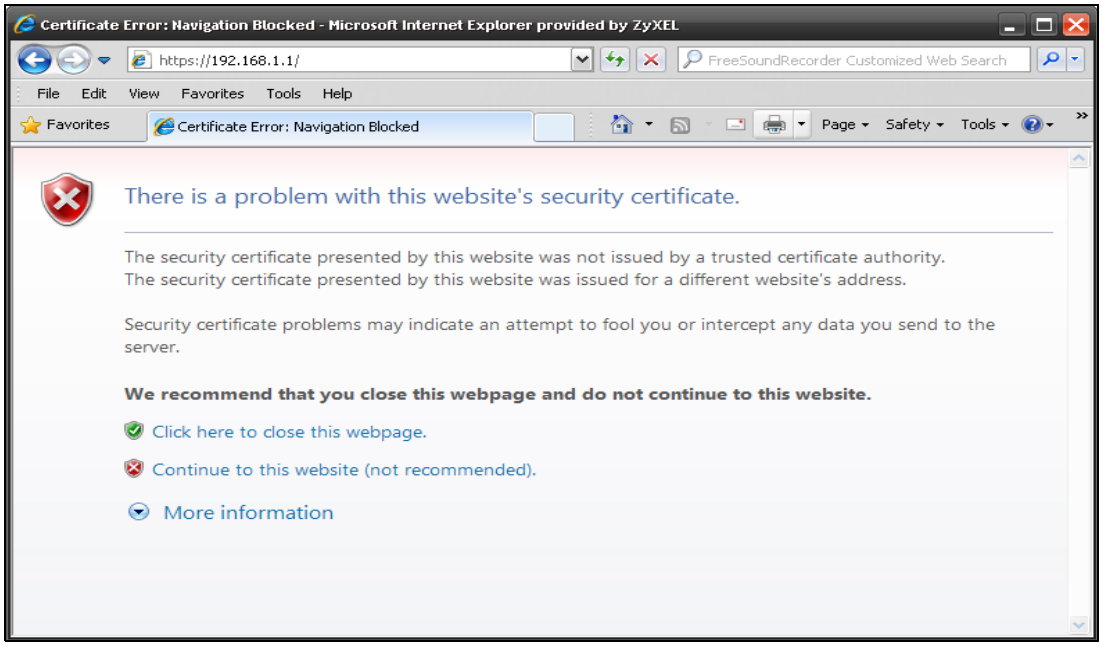
Many Zyxel products, such as the NXC, issue their own public key certificates. These can be used by web browsers on a LAN or WAN to verify that they are in fact connecting to the legitimate device and not one masquerading as it. However, because the certificates were not issued by one of the several 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.)

## Internet Explorer

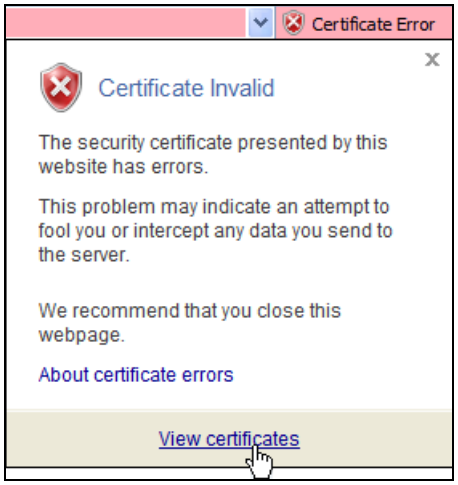
The following example uses Microsoft Internet Explorer 7 on Windows XP Professional; however, they can also apply to Internet Explorer on Windows Vista.

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.

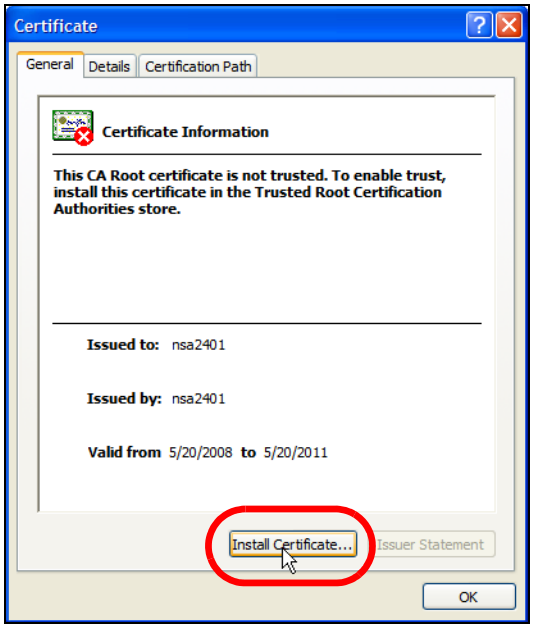



2 Click **Continue to this website (not recommended)**.

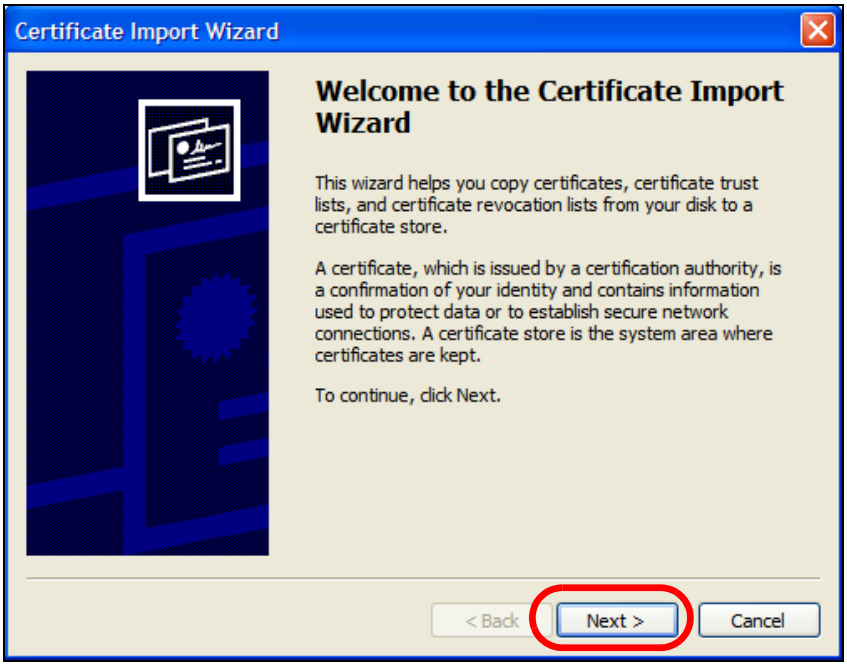
3 In the **Address Bar**, click **Certificate Error** > **View certificates**.



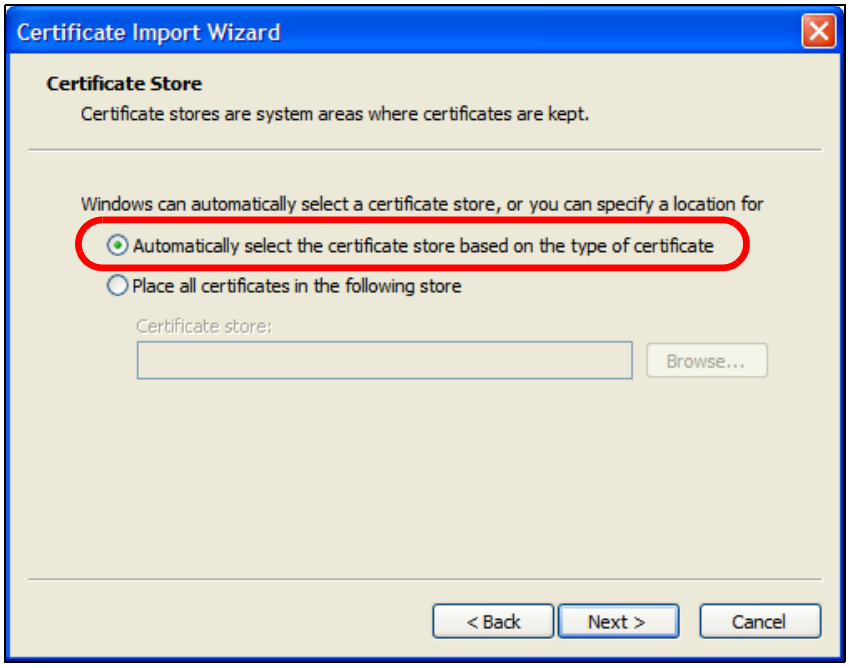
4 In the **Certificate** dialog box, click **Install Certificate**.



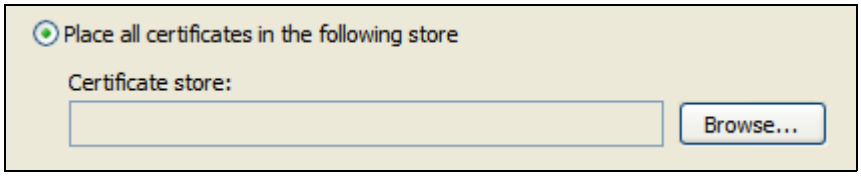

5 In the **Certificate Import Wizard**, click **Next**.



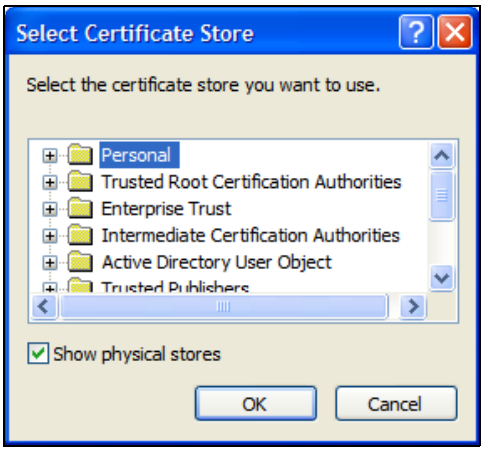
6 If you want Internet Explorer to **Automatically select certificate store based on the type of certificate**, click **Next** again and then go to step 9.



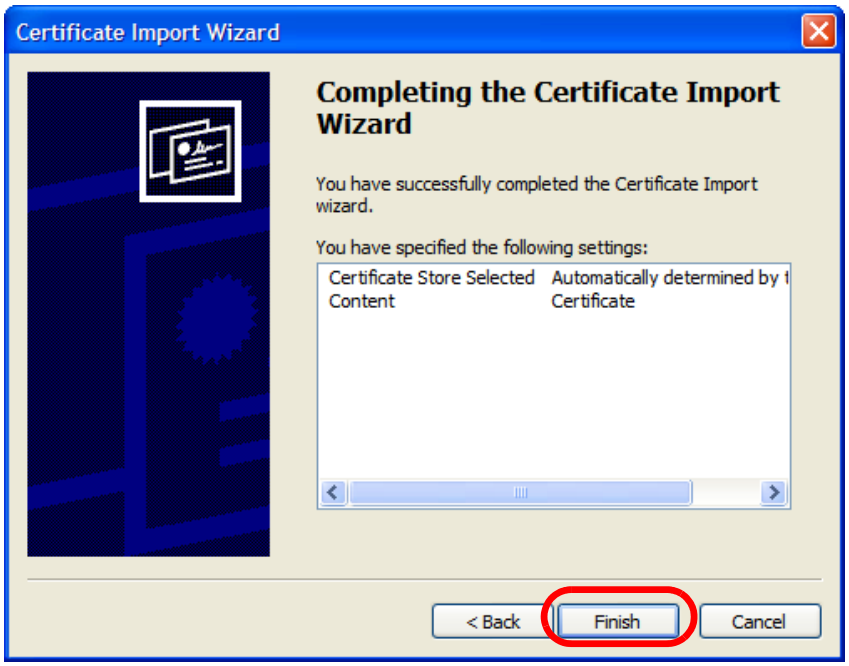

7 Otherwise, select **Place all certificates in the following store** and then click **Browse**.



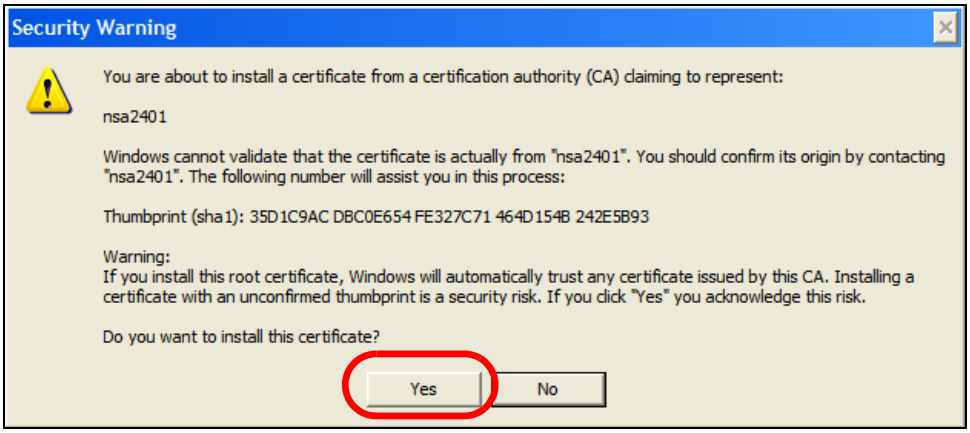

8 In the **Select Certificate Store** dialog box, choose a location in which to save the certificate and then click **OK**.



9 In the **Completing the Certificate Import Wizard** screen, click **Finish**.

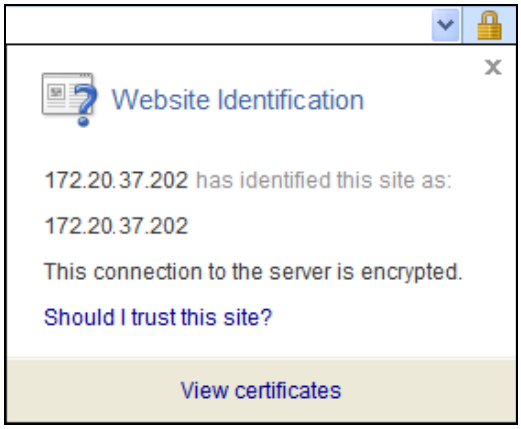



10 If you are presented with another **Security Warning**, click **Yes**.




11 Finally, click **OK** when presented with the successful certificate installation message.

12 The next time you start Internet Explorer and go to a Zyxel Web Configurator page, a sealed padlock icon appears in the address bar. Click it to view the page's **Website Identification** information.

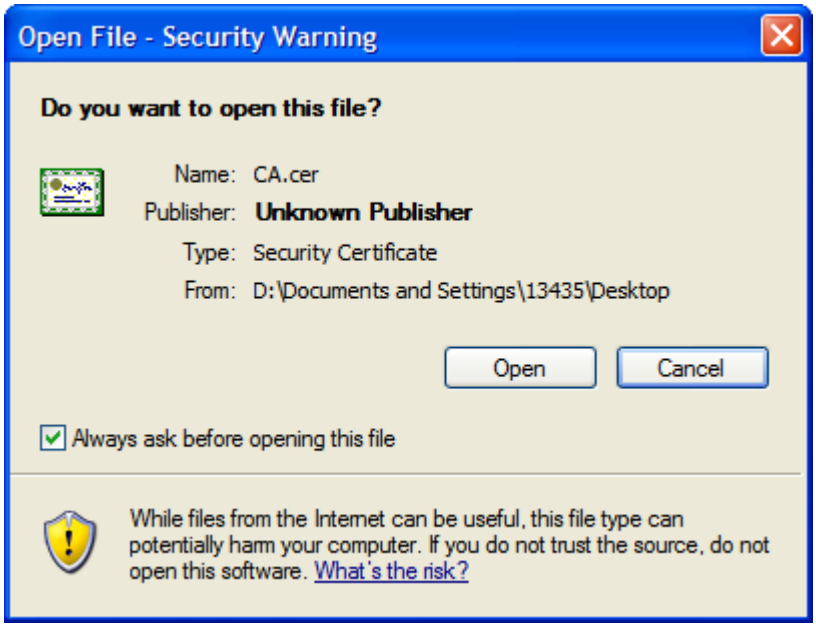



## Installing a Stand-Alone Certificate File in Internet Explorer

Rather than browsing to a Zyxel Web Configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.


2 In the security warning dialog box, click **Open**.

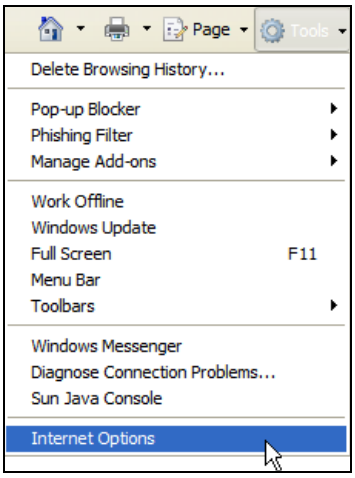



3 Refer to steps 4-12 in the Internet Explorer procedure beginning on page 423 to complete the installation process.

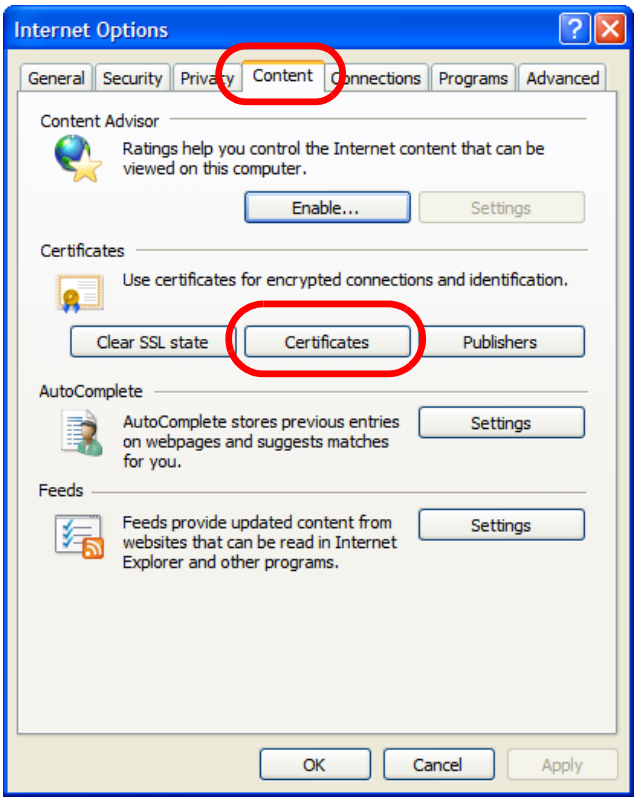
## Removing a Certificate in Internet Explorer

This section shows you how to remove a public key certificate in Internet Explorer 7 on Windows XP.

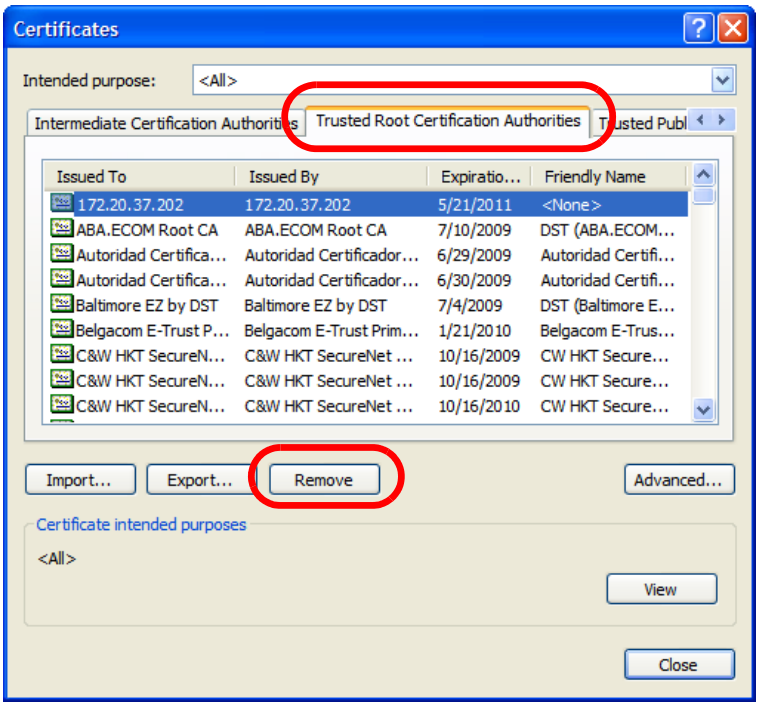
1 Open **Internet Explorer** and click **Tools > Internet Options**.



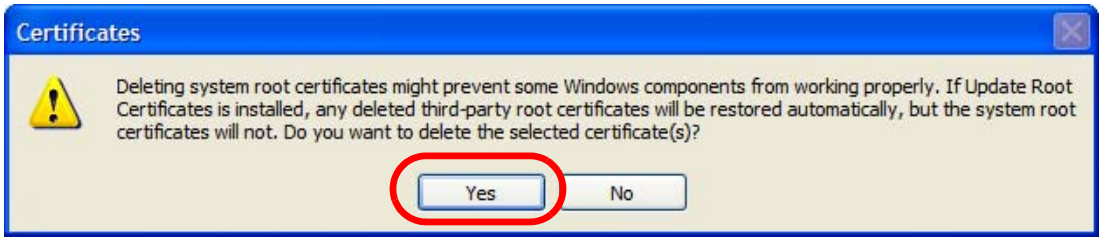

2 In the **Internet Options** dialog box, click **Content** > **Certificates**.



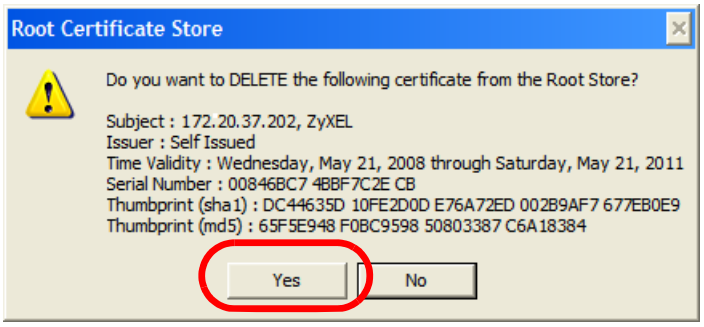
3 In the **Certificates** dialog box, click the **Trusted Root Certificates Authorities** tab, select the certificate that you want to delete, and then click **Remove**.




4 In the **Certificates** confirmation, click **Yes**.




5 In the **Root Certificate Store** dialog box, click **Yes**.



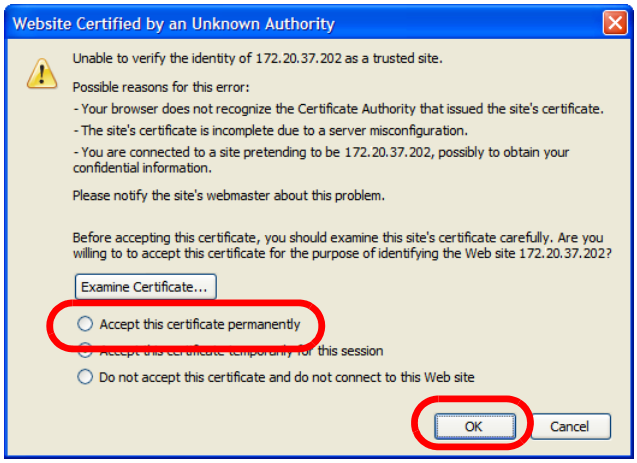

6 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

## Firefox

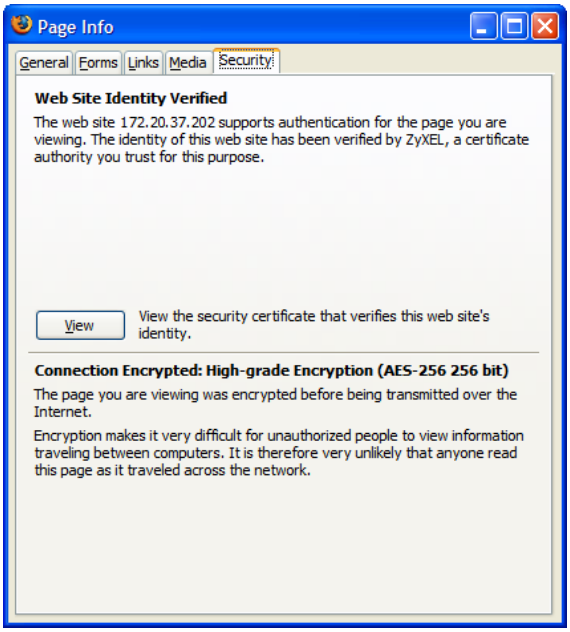
The following example uses Mozilla Firefox 2 on Windows XP Professional; however, the screens can also apply to Firefox 2 on all platforms.

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.

2 Select **Accept this certificate permanently** and click **OK.**



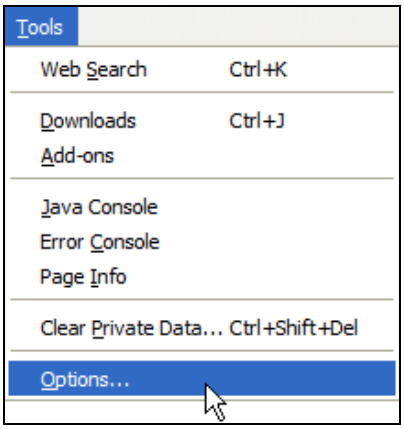

3 The certificate is stored and you can now connect securely to the Web Configurator. A sealed padlock appears in the address bar, which you can click to open the **Page Info > Security** window to view the web page's security information.



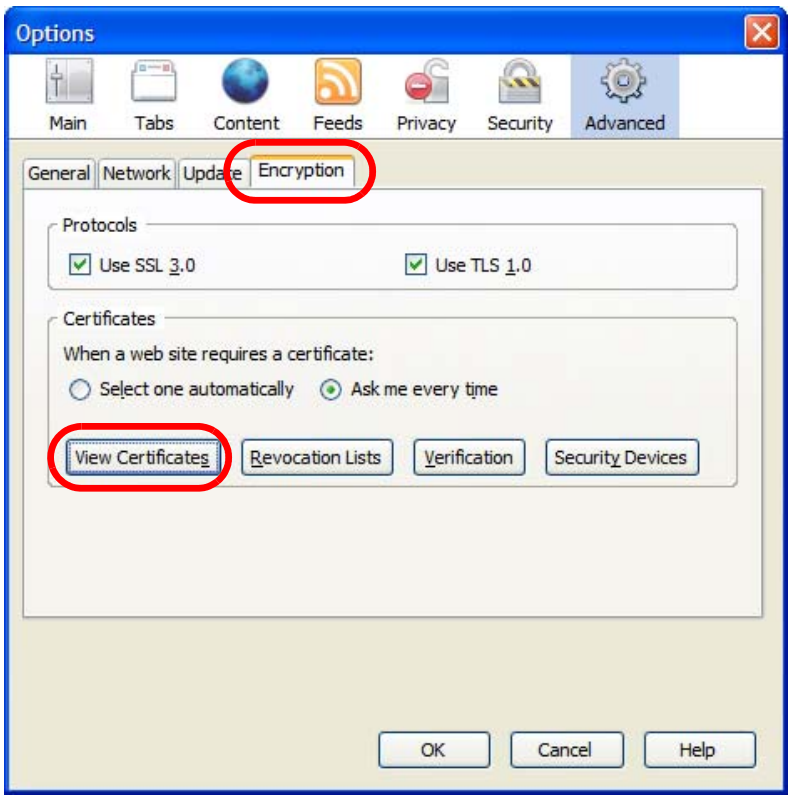
## Installing a Stand-Alone Certificate File in Firefox

Rather than browsing to a Zyxel Web Configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

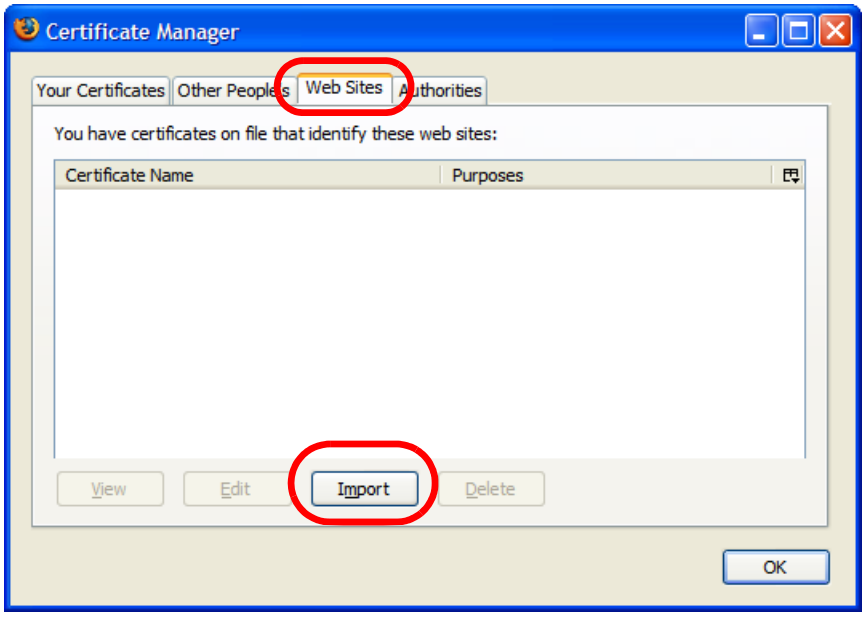
1 Open **Firefox** and click **Tools > Options**.



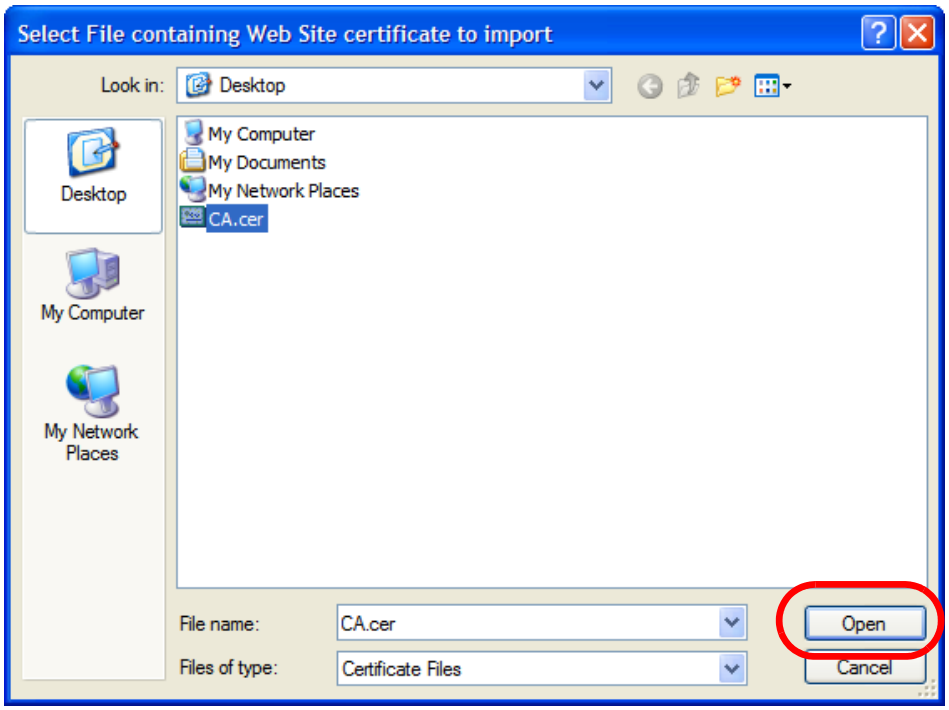

2 In the **Options** dialog box, click **Advanced** > **Encryption** > **View Certificates**.



3 In the **Certificate Manager** dialog box, click **Web Sites** > **Import**.




4 Use the **Select File** dialog box to locate the certificate and then click **Open**.

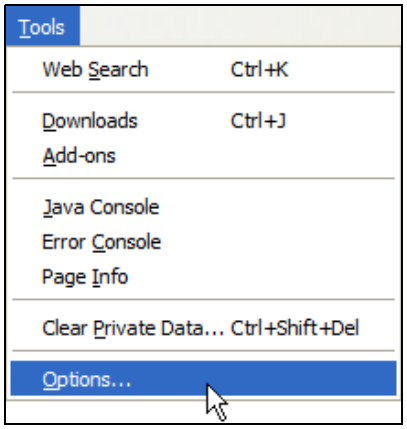



5 The next time you visit the web site, click the padlock in the address bar to open the **Page Info > Security** window to see the web page's security information.

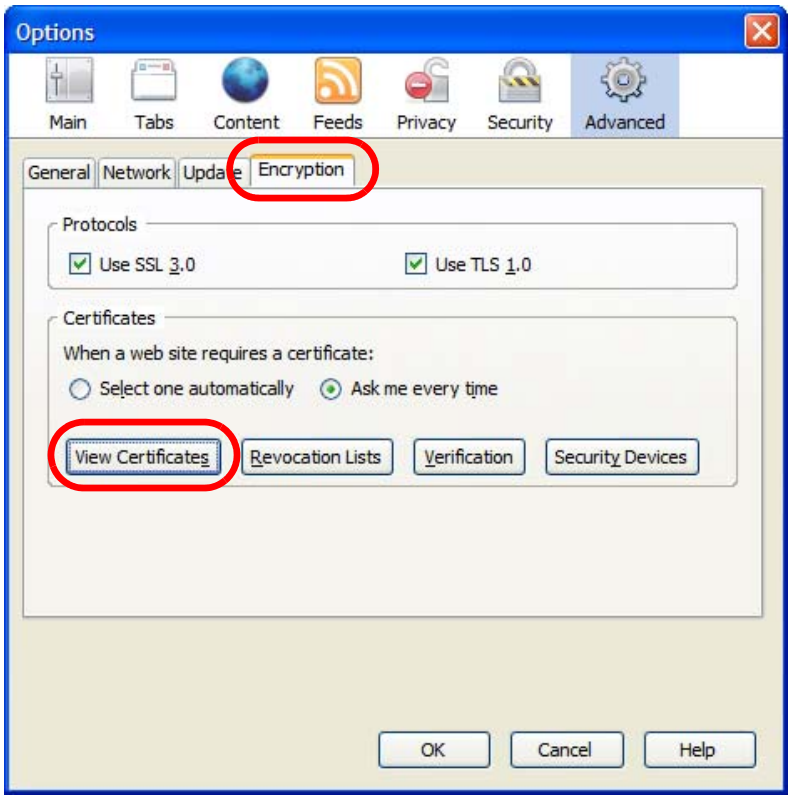
## Removing a Certificate in Firefox

This section shows you how to remove a public key certificate in Firefox 2.

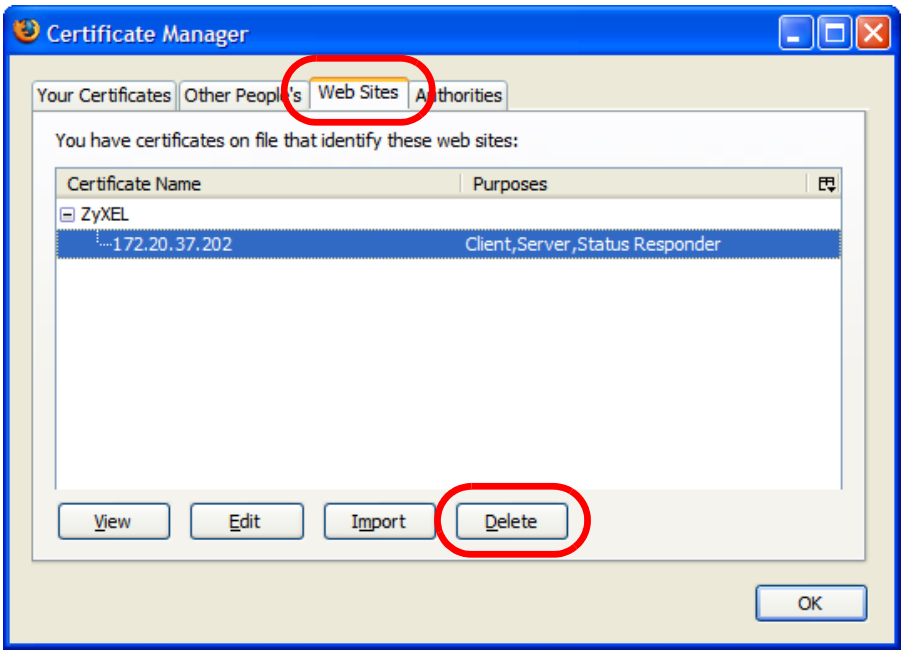
1 Open **Firefox** and click **Tools** > **Options**.



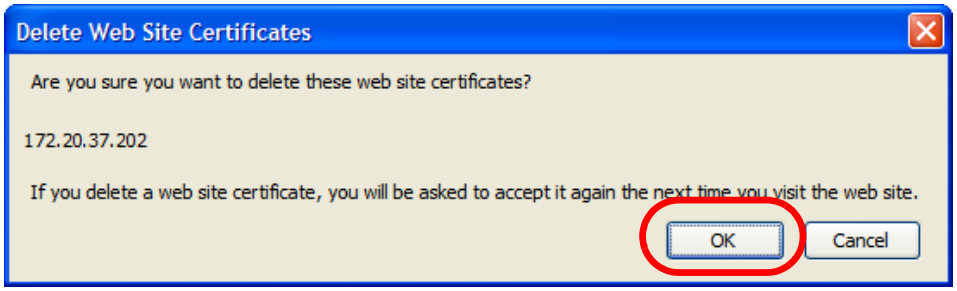

2 In the **Options** dialog box, click **Advanced** > **Encryption** > **View Certificates**.



3 In the **Certificate Manager** dialog box, select the **Web Sites** tab, select the certificate that you want to remove, and then click **Delete**.




4 In the **Delete Web Site Certificates** 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

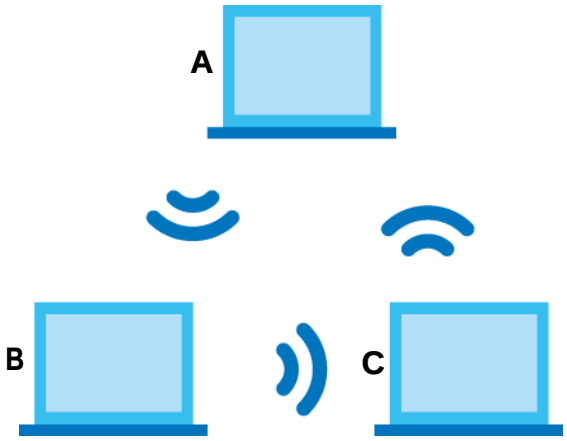
## Wireless LAN Topologies

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 243** Peer-to-Peer Communication in an Ad-hoc Network

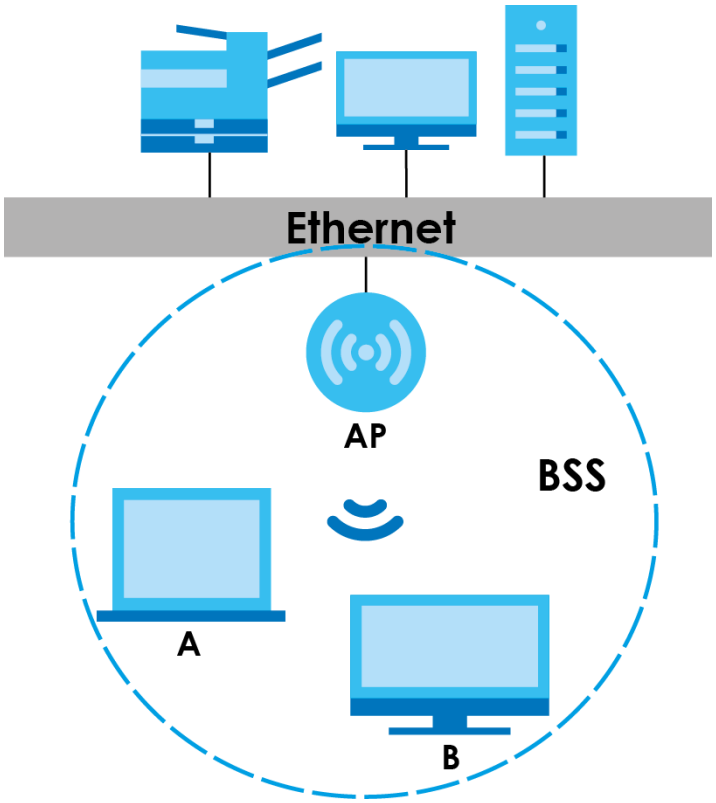



## BSS

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 244** Basic Service Set



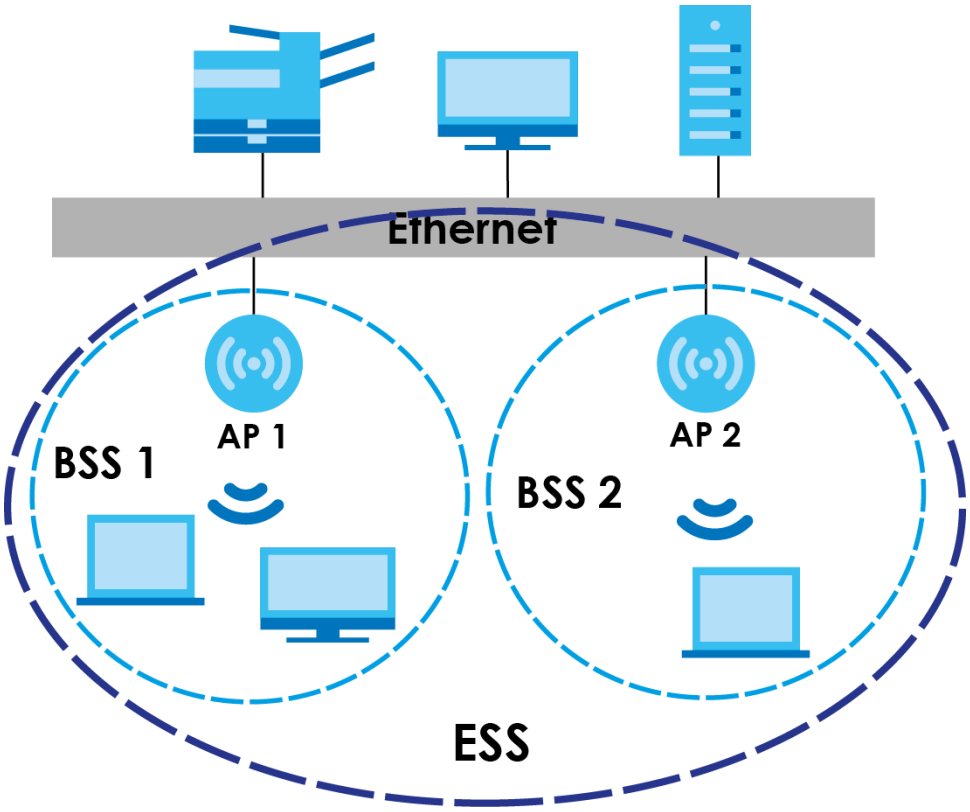

## ESS

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 245** Infrastructure WLAN




## Channel

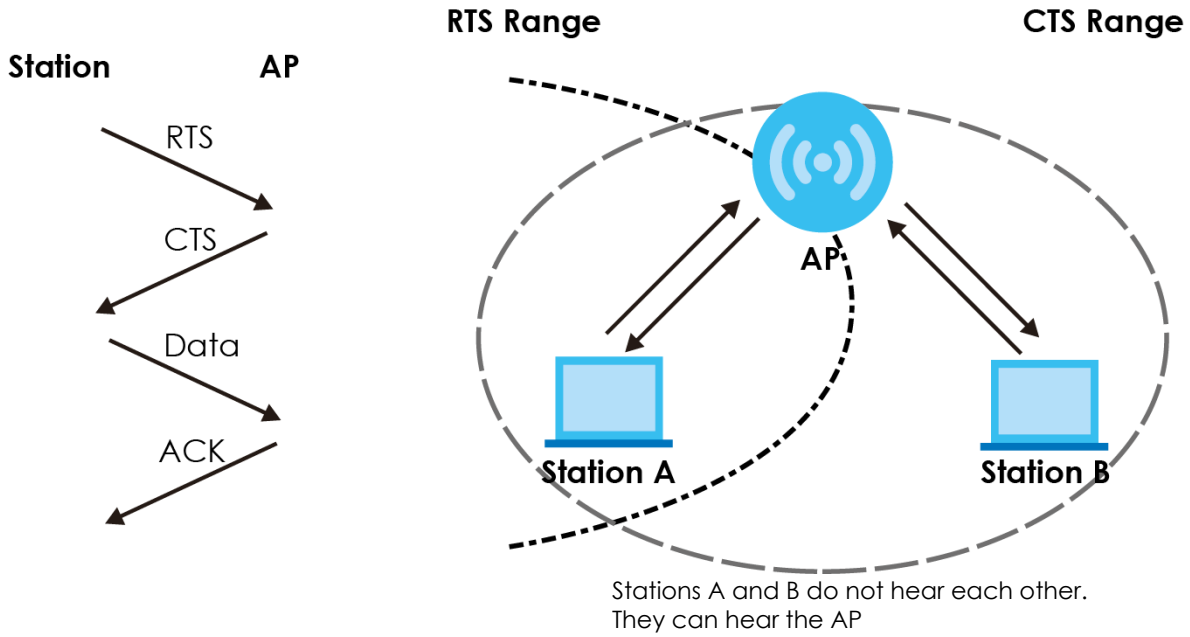
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference 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 246** 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 228 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 229 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 |
| | Wi-Fi 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 230 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

Wi-Fi 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 Wi-Fi 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.

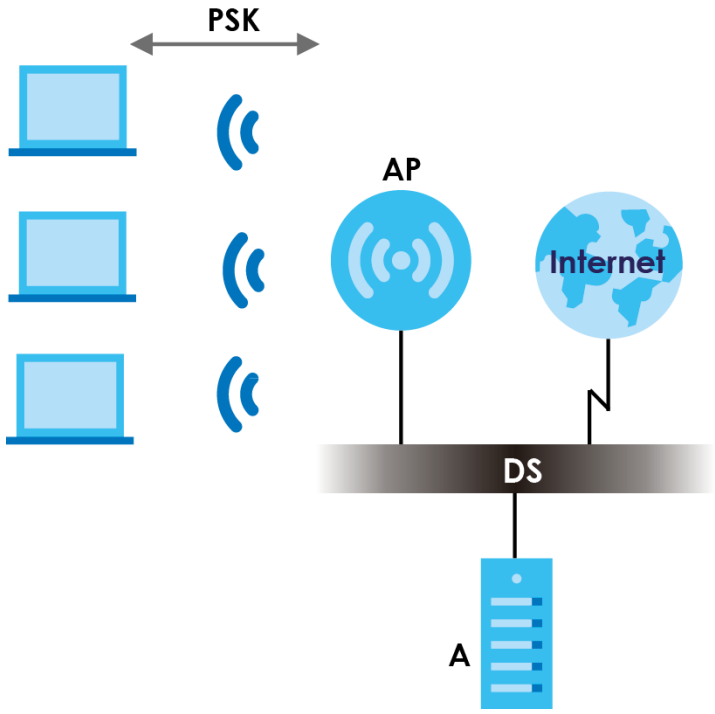
1 The AP passes the wireless client's authentication request to the RADIUS server.

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 247** WPA(2) with RADIUS Application Example




## WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

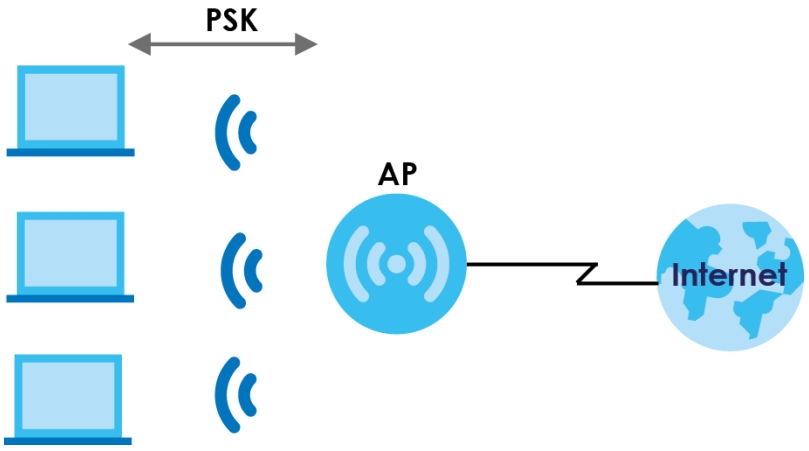
1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).

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 248** 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 231 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 232 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 233 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 234 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 235

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MAC** | 00 | : | 13 | : | 49 | : 12 | : | 34 | : | 56 | |

Table 236

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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

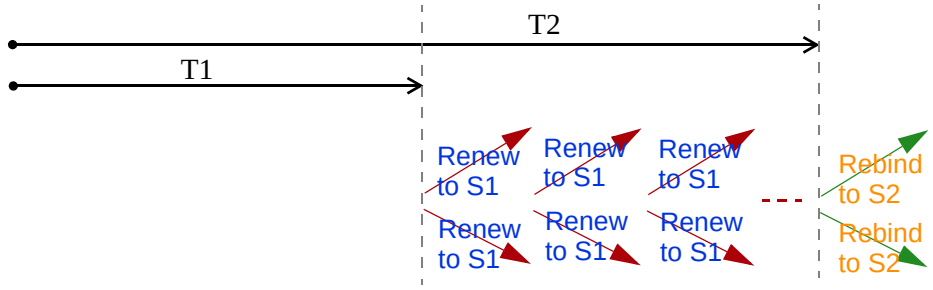
The Dynamic Host Configuration Protocol for IPv6 (DHCPv6, RFC 3315) is a server-client protocol that allows a DHCP server to assign and pass IPv6 network addresses, prefixes and other configuration information to DHCP clients. DHCPv6 servers and clients exchange DHCP messages using UDP.

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.)

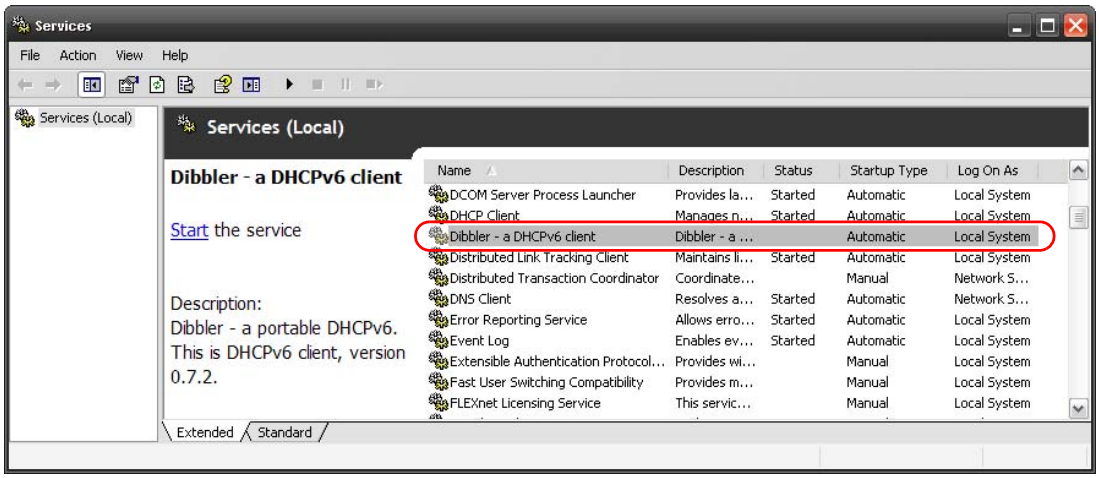
This example uses Dibbler as the DHCPv6 client. To enable DHCPv6 client on your computer:

1 Install Dibbler and select the DHCPv6 client option on your computer.

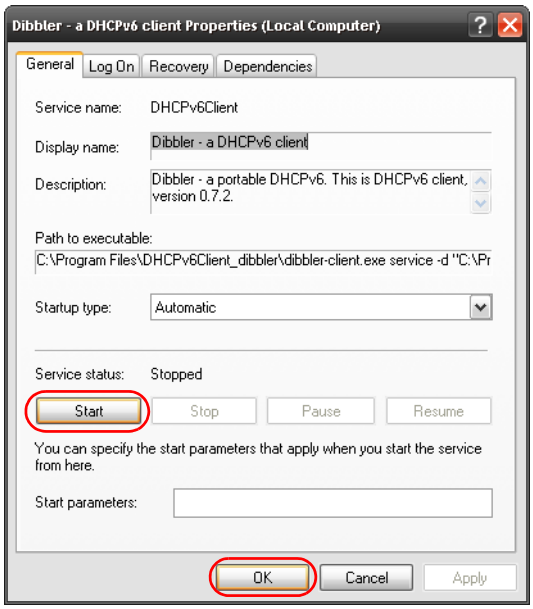
2 After the installation is complete, select **Start** > **All Programs** > **Dibbler-DHCPv6** > **Client Install as service**.

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

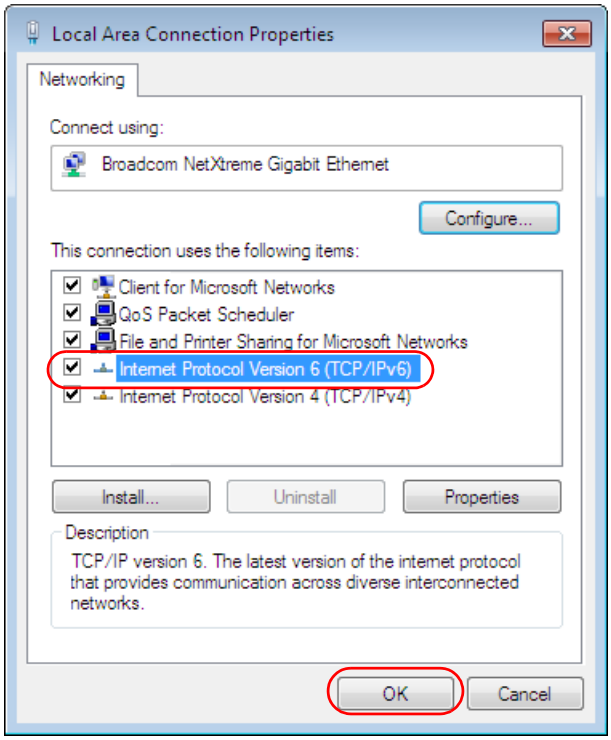
Windows 7 supports IPv6 by default. DHCPv6 is also enabled when you enable IPv6 on a Windows 7 computer.

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 *http://www.zyxel.com/homepage.shtml* and also *http://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.
- http://www.zyxel.cn

### India

- Zyxel Technology India Pvt Ltd
- http://www.zyxel.in

### Kazakhstan

- Zyxel Kazakhstan
- http://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
- http://www.zyxel.com/tw/zh/

### Thailand

- Zyxel Thailand Co., Ltd
- http://www.zyxel.co.th

### Vietnam

- Zyxel Communications Corporation-Vietnam Office
- http://www.zyxel.com/vn/vi

## Europe

### Austria

- Zyxel Deutschland GmbH
- http://www.zyxel.de

### Belarus

- Zyxel BY
- http://www.zyxel.by

### Belgium

- Zyxel Communications B.V.
- http://www.zyxel.com/be/nl/
- http://www.zyxel.com/be/fr/

### Bulgaria

- Zyxel България
- http://www.zyxel.com/bg/bg/

### Czech Republic

- Zyxel Communications Czech s.r.o
- http://www.zyxel.cz

### Denmark

- Zyxel Communications A/S
- http://www.zyxel.dk

### Estonia

- Zyxel Estonia
- http://www.zyxel.com/ee/et/

### Finland

- Zyxel Communications
- http://www.zyxel.fi

### France

- Zyxel France
- http://www.zyxel.fr

### Germany

- Zyxel Deutschland GmbH
- http://www.zyxel.de

### Hungary

- Zyxel Hungary & SEE
- http://www.zyxel.hu

### Italy

- Zyxel Communications Italy
- http://www.zyxel.it/

### Latvia

- Zyxel Latvia
- http://www.zyxel.com/lv/lv/homepage.shtml

### Lithuania

- Zyxel Lithuania
- http://www.zyxel.com/lt/lt/homepage.shtml

### Netherlands

- Zyxel Benelux
- http://www.zyxel.nl

### Norway

- Zyxel Communications
- http://www.zyxel.no

### Poland

- Zyxel Communications Poland
- http://www.zyxel.pl

### Romania

- Zyxel Romania
- http://www.zyxel.com/ro/ro

### Russia

- Zyxel Russia
- http://www.zyxel.ru

### Slovakia

- Zyxel Communications Czech s.r.o. organizacna zlozka
- http://www.zyxel.sk

### Spain

- Zyxel Communications ES Ltd
- http://www.zyxel.es

### Sweden

- Zyxel Communications
- http://www.zyxel.se

### Switzerland

- Studerus AG

- http://www.zyxel.ch/

### Turkey

- Zyxel Turkey A.S.
- http://www.zyxel.com.tr

### UK

- Zyxel Communications UK Ltd.
- http://www.zyxel.co.uk

### Ukraine

- Zyxel Ukraine
- http://www.ua.zyxel.com

## Latin America

### Argentina

- Zyxel Communication Corporation
- http://www.zyxel.com/ec/es/

### Brazil

- Zyxel Communications Brasil Ltda.
- https://www.zyxel.com/br/pt/

### Ecuador

- Zyxel Communication Corporation
- http://www.zyxel.com/ec/es/

## Middle East

### Israel

- Zyxel Communication Corporation
- http://il.zyxel.com/homepage.shtml

### Middle East

- Zyxel Communication Corporation
- http://www.zyxel.com/me/en/

## North America

### USA

- Zyxel Communications, Inc. - North America Headquarters
- http://www.zyxel.com/us/en/

## Oceania

### Australia

- Zyxel Communications Corporation
- http://www.zyxel.com/au/en/

## Africa

### South Africa

- Nology (Pty) Ltd.
- http://www.zyxel.co.za

# APPENDIX G
# Legal Information

## Copyright



### Disclaimers

Zyxel does not assume any liability arising out of the application or use of any products, or software described herein. Neither does it convey any license under its patent rights nor the patent rights of others. Zyxel further reserves the right to make changes in any products described herein without notice. This publication is subject to change without notice.

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.

### Industry 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 | CR | 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 | Sweden | SE |
| Ireland | IE | Switzerland | CH |
| 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. 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.

## 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.

Wireless setting, please refer to "Wireless" chapter for more detail.

### 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.

## Environmental Product Declaration

**Български (Bulgarian)**

Екологична продуктова декларация

| | |
|---|---|
| RoHS | Директива 2011/65/EC |
| WEEE | Директива 2012/19/EC |
| PPW | Директива 94/62/ЕО |
| REACH | РЕГЛАМЕНТ (ЕО) № 1907/2006 |
| ErP | Директива 2009/125/ЕО |

Име/ титла : Richard Hsu / Quality Management Division Senior Manager

Подпис : Дата (дд/мм/гггг): 01/10/2014

**Čeština (Czech)**

Environmentální prohlášení o produktu

| | |
|---|---|
| RoHS | Směrnice 2011/65/EU |
| WEEE | Směrnice 2012/19/EU |
| PPW | Směrnice 94/62/ES |
| REACH | Nařízení (ES) č. 1907/2006 |
| ErP | Směrnice 2009/125/ES |

Jméno/ titul : Richard Hsu / Quality Management Division Senior Manager

Podpis : Datum (dd/mm/rrrr): 01/10/2014

**Dansk (Danish)**

Miljøvaredeklaration

| | |
|---|---|
| RoHS | Direktiv 2011/65/EU |
| WEEE | Direktiv 2012/19/EU |
| PPW | Direktiv 94/62/EF |
| REACH | Forordning (EF) nr. 1907/2006 |
| ErP | Direktiv 2009/125/EF |

Navn/ titel : Richard Hsu / Quality Management Division Senior Manager

Underskrift : Dato (dd/mm/åååå): 01/10/2014

**Deutsch (German)**

Produkt-Umweltdeklaration

| | |
|---|---|
| RoHS | Richtlinie 2011/65/EU |
| WEEE | Richtlinie 2012/19/EU |
| PPW | Richtlinie 94/62/EG |
| REACH | VERORDNUNG (EG) Nr. 1907/2006 |
| ErP | Richtlinie 2009/125/EG |

Name/ titel : Richard Hsu / Quality Management Division Senior Manager

Unterschrift : Datum (tt.mm.jjjj): 2014/10/01

**Eesti keel (Estonian)**

Toote keskkonnadeklaratsiooni

| | |
|---|---|
| RoHS | Direktiiv 2011/65/EL |
| WEEE | Direktiiv 2012/19/EL |
| PPW | Direktiiv 94/62/EÜ |
| REACH | MÄÄRUS (EÜ) nr 1907/2006 |
| ErP | Direktiiv 2009/125/EÜ |

Nimi/ peakiri : Richard Hsu / Quality Management Division Senior Manager

Allkiri : Kuupäev (pp/kk/aaaa): 01/10/2014

**English**

Environmental product declaration

| | |
|---|---|
| RoHS | Directive 2011/65/EU |
| WEEE | Directive 2012/19/EU |
| PPW | Directive 94/62/EC |
| REACH | Regulation (EC) No 1907/2006 |
| ErP | Directive 2009/125/EC |

Name/ title : Richard Hsu / Quality Management Division Senior Manager

Signature : Date (dd/mm/yyyy) : 01/10/2014

**Español (Spanish)**

Declaraciones Ambientales de Producto

| | |
|---|---|
| RoHS | Directiva 2011/65/UE |
| WEEE | Directiva 2012/19/UE |
| PPW | Directiva 94/62/CE |
| REACH | REGLAMENTO (CE) nº 1907/2006 |
| ErP | Directiva 2009/125/CE |

Nombre/ título : Richard Hsu / Quality Management Division Senior Manager

Firma : Fecha (aaaa/mm/dd): 2014/10/01

**Français (French)**

Profil environnemental de produit

| | |
|---|---|
| RoHS | Directive 2011/65/UE |
| WEEE | Directive 2012/19/UE |
| PPW | Directive 94/62/CE |
| REACH | REGLEMENT (CE) N° 1907/2006 |
| ErP | Directive 2009/125/CE |

Nom/ titre : Richard Hsu / Quality Management Division Senior Manager

Signature : Date (aaaa/mm/jj): 2014/10/01

**Hrvatski (Croatian)**

Deklaraciju o zbrinjavanju proizvoda

| | |
|---|---|
| RoHS | Direktiva 2011/65/EU |
| WEEE | Direktiva 2012/19/EU |
| PPW | Direktiva 94/62/EZ |
| REACH | Uredbe (EZ) br. 1907/2006 |
| ErP | Direktiva 2009/125/EZ |

Ime/ naslov : Richard Hsu / Quality Management Division Senior Manager

Potpis : Datum (dd/mm/yyyy): 01/10/2014

**Italiano (Italian)**

Dichiarazione ambientale di prodotto

| | |
|---|---|
| RoHS | Direttiva 2011/65/UE |
| WEEE | Direttiva 2012/19/UE |
| PPW | Direttiva 94/62/CE |
| REACH | REGOLAMENTO (CE) n. 1907/2006 |
| ErP | Direttiva 2009/125/CE |

Nome/ titolo : Richard Hsu / Quality Management Division Senior Manager

Firma : Data (aaaa/mm/gg): 2014/10/01

**Latviešu valoda (Latvian)**

Produkta vides ietekmējuma deklarācija

| | |
|---|---|
| RoHS | Direktīva 2011/65/ES |
| WEEE | Direktīva 2012/19/ES |
| PPW | Direktīva 94/62/EK |
| REACH | Regula (EK) Nr. 1907/2006 |
| ErP | Direktīva 2009/125/EK |

Nosaukums/ tituls : Richard Hsu / Quality Management Division Senior Manager

Paraksts : Datums (dd/mm/gggg): 01/10/2014

**Lietuvių kalba (Lithuanian)**

Aplinkosauginę gaminio deklaraciją

| | |
|---|---|
| RoHS | Direktyva 2011/65/ES |
| WEEE | Direktyva 2012/19/ES |
| PPW | Direktyva 94/62/EB |
| REACH | REGLAMENTAS (EB) Nr. 1907/2006 |
| ErP | Direktyva 2009/125/EB |

Vardas/ tituliaus : Richard Hsu / Quality Management Division Senior Manager

Parašas : Data (dd/mm/mmmm): 01/10/2014

**Magyar (Hungarian)**

Környezetvédelmi terméknyilatkozatot

| | |
|---|---|
| RoHS | 2011/65/EU irányelve |
| WEEE | 2012/19/EU irányelve |
| PPW | 94/62/EK irányelve |
| REACH | 1907/2006/EK Rendelete |
| ErP | 2009/125/EK irányelve |

Név/ cím : Richard Hsu / Quality Management Division Senior Manager

Aláírás : Dátum (éééé/hh/nn): 2014/10/01

**Malti (Maltese)**

Dikjarazzjoni Ambjentali dwar il-Prodott

| | |
|---|---|
| RoHS | Direttiva 2011/65/UE |
| WEEE | Direttiva 2012/19/UE |
| PPW | Direttiva 94/62/KE |
| REACH | REGOLAMENT (KE) NRU 1907/2006 |
| ErP | Direttiva 2009/125/KE |

Isem/ titolu : Richard Hsu / Quality Management Division Senior Manager

Firma : Data (ssss/xx/jj): 2014/10/01

**Nederlands (Dutch)**

Milieuproductverklaring

| | |
|---|---|
| RoHS | Richtlijn 2011/65/EU |
| WEEE | Richtlijn 2012/19/EU |
| PPW | Richtlijn 94/62/EG |
| REACH | Verordening (EG) nr. 1907/2006 |
| ErP | Richtlijn 2009/125/EG |

Naam/ titel : Richard Hsu / Quality Management Division Senior Manager

Handtekening : Datum (dd/mm/jaar): 01/10/2014

**Polski (Polish)**

Deklarację środowiskową produktu

| | |
|---|---|
| RoHS | Dyrektywa 2011/65/UE |
| WEEE | Dyrektywa 2012/19/UE |
| PPW | Dyrektywa 94/62/WE |
| REACH | Rozporządzenie (WE) nr 1907/2006 |
| ErP | Dyrektywa 2009/125/WE |

Nazwisko/ tytuł : Richard Hsu / Quality Management Division Senior Manager

Podpis : Data (rr/mm/dd): 2014/10/01

**Português (Portuguese)**

Declaração ambiental do produto

| | |
|---|---|
| RoHS | Directiva 2011/65/UE |
| WEEE | Directiva 2012/19/UE |
| PPW | Directiva 94/62/CE |
| REACH | Regulamento (CE) n.º 1907/2006 |
| ErP | Directiva 2009/125/CE |

Nome/ título : Richard Hsu / Quality Management Division Senior Manager

Assinatura : Data (dd/mm/aaaa): 01/10/2014

**Română (Romanian)**

Declarație de mediu privind produsele

| | |
|---|---|
| RoHS | Directiva 2011/65/UE |
| WEEE | Directiva 2012/19/UE |
| PPW | Directiva 94/62/CE |
| REACH | REGULAMENTUL (CE) NR. 1907/2006 |
| ErP | Directiva 2009/125/CE |

Numele/ titlu : Richard Hsu / Quality Management Division Senior Manager

Semnătura : Data (zz/ll/aaaa): 01/10/2014

**Slovenčina (Slovak)**

Vyhlásenie o environmentálnom výrobku

| | |
|---|---|
| RoHS | Smernica 2011/65/EÚ |
| WEEE | Smernica 2012/19/EÚ |
| PPW | Smernica 94/62/ES |
| REACH | Nariadenie (ES) č. 1907/2006 |
| ErP | Smernica 2009/125/ES |

Meno/ titul : Richard Hsu / Quality Management Division Senior Manager

Podpis : Dátum (dd/mm/rrrr): 01/10/2014

**Slovenščina (Slovene)**

Okoljsko deklaracijo izdelka

| | |
|---|---|
| RoHS | Direktiva 2011/65/EU |
| WEEE | Direktiva 2012/19/EU |
| PPW | Direktiva 94/62/ES |
| REACH | Uredba (ES) št. 1907/2006 |
| ErP | Direktiva 2009/125/ES |

Ime/ naziv : Richard Hsu / Quality Management Division Senior Manager

Podpis : Datum (dd/mm/llll): 01/10/2014

**Suomi (Finnish)**

Standardiin perustuva ympäristötuoteseloste

| | |
|---|---|
| RoHS | Direktiivi 2011/65/EU |
| WEEE | Direktiivi 2012/19/EU |
| PPW | Direktiivi 94/62/EY |
| REACH | ASETUS (EY) N:o 1907/2006 |
| ErP | Direktiivi 2009/125/EY |

Nimi/ otsikko : Richard Hsu / Quality Management Division Senior Manager

Allekirjoitus : Päivämäärä (pp/kk/vvvv): 01/10/2014

**Svenska (Swedish)**

Miljöproduktdeklaration

| | |
|---|---|
| RoHS | Direktiv 2011/65/EU |
| WEEE | Direktiv 2012/19/EU |
| PPW | Direktiv 94/62/EG |
| REACH | Förordning (EG) nr 1907/2006 |
| ErP | Direktiv 2009/125/EG |

Namn/ titel : Richard Hsu / Quality Management Division Senior Manager

Namnteckning : Datum (dd/mm/åååå): 01/10/2014

**Ελληνικά (Greek)**

Περιβαλλοντική δήλωση προϊόντος

| | |
|---|---|
| RoHS | Οδηγία 2011/65/ΕΕ |
| WEEE | Οδηγία 2012/19/ΕΕ |
| PPW | Οδηγία 94/62/ΕΚ |
| REACH | Κανονισμού (ΕΚ) αριθ. 1907/2006 |
| ErP | Οδηγία 2009/125/ΕΚ |

Όνομα/ τίτλος : Richard Hsu / Quality Management Division Senior Manager

Υπογραφή : Ημερομηνία (ηη/μμ/εεεε): 01/10/2014

**Norsk (Norwegian)**

Miljødeklarasjon

| | |
|---|---|
| RoHS | Direktiv 2011/65/EU |
| WEEE | Direktiv 2012/19/EU |
| PPW | Direktiv 94/62/EF |
| REACH | Forordning (EF) nr. 1907/2006 |
| ErP | Direktiv 2009/125/EF |

Navn/ tittel : Richard Hsu / Quality Management Division Senior Manager

Signatur : Dato (dd/mm/åååå) : 01/10/2014

## 台灣

以下訊息僅適用於產品銷售至台灣地區 **(Class A Products Only, NXC5500 for example)**

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。

## 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.

# Index

## A

## B



## C

## D



## E



## F

## G



## H



## I

## J



## K



## L



## M

## N



## O



## P

## Q



## R



## S

## T

## U



## V



## W

## Z